Freshwater Environment Study

Proposed Bay d'Espoir to Western Avalon Transmission Line (TL 267)

FINAL REPORT

Prepared for:

Newfoundland and Labrador Hydro
A Nalcor Energy Company
Hydro Place, 500 Columbus Drive
PO Box 12400
St. John's, Newfoundland and Labrador
A1B 4K7 Canada

Prepared by:

Amec Foster Wheeler Environment & Infrastructure
A Division of Amec Foster Wheeler Americas Limited
133 Crosbie Road, PO Box 13216
St. John's, Newfoundland and Labrador
A1B 4A5 Canada

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EXECUTIVE SUMMARY

Newfoundland and Labrador Hydro (Hydro) is proposing to construct and operate a new 230 kilovolt (kV) transmission line (TL 267, or the Project) in south-central and eastern Newfoundland, connecting the existing Bay d'Espoir and Western Avalon Terminal Stations. The new transmission line will be approximately 188 km in length, and will run parallel to existing transmission lines in the region.

The purpose and focus of this Freshwater Environment Study is to identify and describe each of the watercourses, waterbodies and larger watershed areas that occur within (and which are crossed by) the proposed TL 267. This analysis has been undertaken through the compilation and analysis of the available high resolution spatial imagery (LiDAR and air photos) within a Geographic Information System (GIS), which was subsequently used to identify all such water crossings and to describe their key physical and biological characteristics - particularly those attributes which have relevance to fish and fish habitat, and which are most relevant to Project environmental planning, mitigation and eventual permitting. The study also provides an overview of fish species that are known or likely to occur in the region, including their presence, distribution and abundance, habitat associations, important times, and other key aspects of the life history of each species based on a review of the existing and available literature.

A total of 359 potential watercourse and waterbody crossings were identified through the above described mapping and aerial photography analysis. Of these, 212 potential crossings were identified within the proposed transmission line right of way (ROW), which include both watercourses (88 streams and rivers) and waterbodies (124 lakes and ponds). A total of 147 watercourses and waterbodies were also identified and assessed along Hydro's existing access trail network from Bay d'Espoir to Come By Chance, which are used for the on-going maintenance of the existing transmission system. Of this total, 54 of the identified crossings have potential to be fish bearing habitat, with the majority of these being associated with the larger watersheds (1,000-10,000 km^2) within the Study Area. This study focused on the freshwater environment along the TL 267 ROW as far east as TL 203, near Come By Chance. The remaining 44 km of the TL 267 ROW, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a previous, similar study (AMEC 2010) which is also summarized in this report.

The identified water crossing locations for the Project include several Scheduled Salmon Rivers and a Canadian Heritage River. Scheduled Salmon Rivers are managed by Fisheries and Oceans Canada for recreational Atlantic salmon fishing in consultation with user groups and stakeholders. Management of these rivers includes potential closures for angling (depending on environmental conditions or population indicators), classification (tag limits) and fishing gear types. Canadian Heritage Rivers do not have any special legislation protecting them, but are identified as having high levels of associated natural, cultural and recreational heritage value. Of the 359 potential water crossings, eight crossings are associated with eight Scheduled Salmon Rivers from Bay d'Espoir to Come By Chance. Of those eight Scheduled Salmon Rivers, one is also classified as a Canadian Heritage River (Bay du Nord River). An additional Scheduled Salmon River occurs near Bellevue, with watercourses in that area having been previously described in AMEC (2010).

There are five Public Protected Water Supply Areas (PPWSAs) in the Study Area, two of which occur from Bay d'Espoir to Come By Chance. Of these two PPWSAs only one (Black Duck Pond at Swift Current), has a potential watercourse crossing associated with the TL 267 ROW. The other PPWSA near Come By Chance (Butcher's Brook) is within the Study Area but not within the TL 267 ROW. The other three PPWSAs are located between Come By Chance and Chapel Arm.

Fish species of special conservation concern may be legally protected under the Newfoundland and Labrador *Endangered Species Act* (*NL ESA*) and/or the Canadian *Species at Risk Act* (*SARA*). Within Newfoundland and Labrador, there are several fish species that are listed under one or both of these Acts. Banded killifish (*Fundulus diaphanous*) and fourhorn sculpin (*Myoxocephalus quadricornis*) are listed as species of "Special Concern" under the *SARA,* and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has also indicated that the American eel (*Anguilla rostrata*) is considered to be "Threatened" (although this COSEWIC designation does not afford legal protection). Banded killifish and American eel are also listed as "Vulnerable" under the *NL ESA*. Based on available literature and the results of past studies, the only fish species of conservation concern that could potentially occur within the proposed Study Area is the American eel. Additional fish species that have the potential to occur within the region are described within the report.

The information provided through this study is intended to support the Project's Environmental Assessment (EA) registration and review, and will be used in its on-going planning and design and eventual permitting and implementation.

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1.0 INTRODUCTION

Newfoundland Labrador Hydro (Hydro) owns and operates an extensive electrical generation and transmission system on the Island of Newfoundland, which includes a 613 megawatt (MW) hydroelectric generation station at Bay d'Espoir in the south-central portion of the Island, as well as several transmission lines that extend between it and other electrical infrastructure and load centres across the Island. This includes two existing transmission lines that run from that facility to Sunnyside which were constructed in the late 1960s, as well as a transmission system that extends between Sunnyside and Chapel Arm.

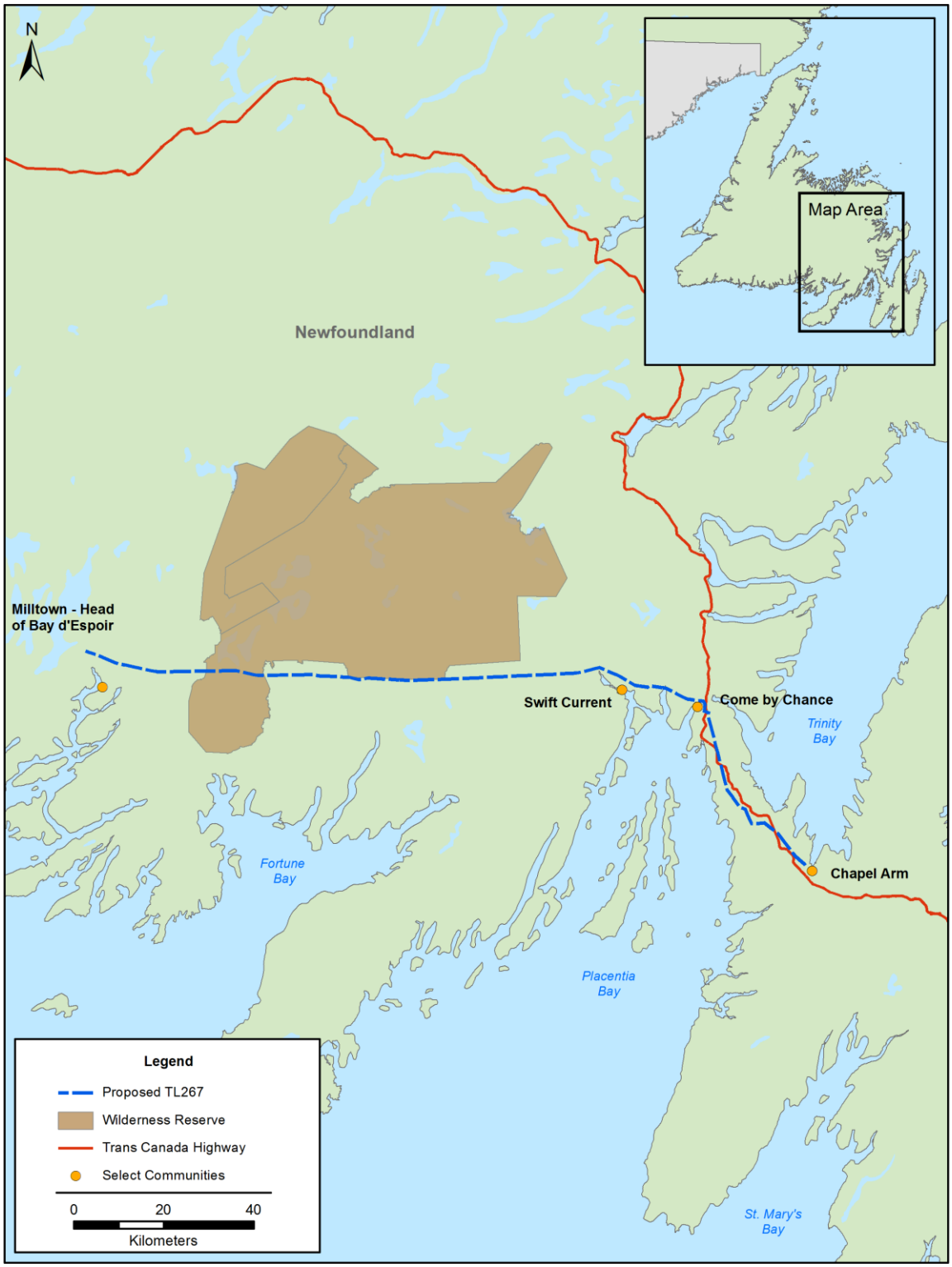
The proposed development project that is the subject of this study includes the construction and operation of a new 230 kilovolt (kV) transmission line that will be approximately 188 km long and connect the existing Bay d'Espoir and Western Avalon Terminal Stations (hereinafter also referred to as the "Project" or "TL 267"). The proposed TL 267 will parallel existing transmission line infrastructure from Bay d'Espoir to Come By Chance (TL 202 and TL 206) and further parallels TL 203 from Come By Chance to the Western Avalon substation in Chapel Arm (Figure 1.1). Upgrades to existing infrastructure at the Bay d'Espoir and Western Avalon terminal stations will also be completed as part of this Project. The existing transmission lines (TL 202, 203 and 206) were cleared and constructed within the boundaries of the easement granted to Hydro by Government at the time of their development, as will the proposed TL 267.

Given that this new transmission line and associated infrastructure will follow entirely along existing transmission lines and other infrastructure in the region, the Project is expected to have few if any environmental issues associated with it. Hydro is, however, committed to ensuring that Project construction and operations are conducted in an environmentally responsible and acceptable manner, in full compliance with associated environmental regulations and permits, as well as the company's own environmental policies, plans and standards.

The Proponent has therefore planned and completed an environmental study program in relation to the proposed Project, in order to obtain and compile information on key aspects of the existing biophysical and socioeconomic environments within and near the Project Area. The information provided through this study program is intended to support the Project's Environmental Assessment (EA) registration and review, and will be used in on-going Project planning and design, as well as in the eventual permitting and construction / mitigation planning for the Project.

This *Freshwater Environment Study* comprises one component of that environmental study program.

Figure 1.1 The Proposed Bay d'Espoir to Western Avalon Transmission Line (TL 267)



1.1 Study Purpose and Objectives

The proposed transmission line and its associated components and activities will cross over, occur in proximity to, or may otherwise interact with various watercourses and waterbodies in south-central and eastern Newfoundland. In the aquatic environment, construction and maintenance work associated with watercourse crossings, vegetation clearing and ground excavation, fuel and herbicide use and storage and other activities have the potential to affect water quality, fish and fish habitat and associated human activities (including navigation). Any such effects can be typically be managed through the use of sound Project planning and design, as well as the use of proven construction and operating practices and undertaking Project activities in accordance with relevant legislation, permits and other regulatory requirements and guidance, as well as Hydro's own applicable plans and procedures.

Information on the existing freshwater environment in and near the proposed Study Area can help in the avoidance or reduction of potential environmental issues in Project design and planning, as well as being required and/or useful for future Project permitting processes.

The purpose and focus of this Freshwater Environment Study has therefore been to identify and describe each of the watercourses, waterbodies and larger watershed areas that occur within (and which are crossed by) the proposed TL 267. This has been undertaken through the compilation and analysis of the available high resolution spatial imagery and Light Detection and Ranging (LiDAR) within a Geographic Information System (GIS), which was subsequently used to identity all such water crossings and to describe their key physical and biological characteristics - particularly those attributes which have relevance to fish and fish habitat, and which are thus most relevant to Project environmental planning and eventual permitting. The study also provides a literature review related to fish species which are known or likely to occur in the region, including their presence, distribution and abundance, habitat associations, important times, and other key aspects of the life history of each species.

With the completion of the *Freshwater Environment Study*, the consolidated high resolution imagery, GIS and associated databases are now in place. These can be quickly and easily applied to additional Project components and construction activities if and as they are defined. The GIS system can therefore be useful in planning and designing these Project elements with consideration of surface water features and interactions, as well as in identifying and describing any potentially affected watercourses once these are sited. This initial desk-top analysis can then be supplemented with - and be used in the planning of - future field investigations of such worksites and watercourses (such as any new or expanded fording sites), which may be required as part of future environmental permitting.

1.2 Regulatory and Management Framework

The proposed Project will require compliance with and various approvals under a number of federal and provincial Acts and Regulations, including, potentially, the federal *Fisheries Act*, the federal *Navigation Protection Act* (*NPA*) and the provincial *Water Resources Act*. Aquatic species of conservation concern under the federal *Species at Risk Act* (*SARA*) and the provincial *Endangered Species Act* (*NL ESA*) are also described and considered in this report.

Further information on this legislation, their associated Regulations and potential permit requirements for the Project are provided in Table 1.1. Reference to these requirements is made throughout the report, as background and context for the study and the eventual environmental planning and permitting requirements that it is intended to inform.

Nine Scheduled Salmon Rivers of which one is also Canadian Heritage River have been identified along the proposed TL 267. Scheduled Salmon Rivers are managed by Fisheries and Oceans Canada for recreational Atlantic salmon fishing in consultation with user groups and stakeholders. Management of these rivers include potential closures for angling (depending on environmental conditions or population indicators), classification (tag limits) and fishing gear types (DFO 2015a). Canadian Heritage Rivers do not have any special legislation protecting them, but are identified as having high levels of associated natural, cultural and recreational heritage (CHRS 2014).

Scheduled Salmon Rivers and the Canadian Heritage River associated with the Project are listed below and illustrated in Figure 1.2. Further descriptions of the crossing locations at each of these rivers is provided in later sections of this report with further descriptions and mapping provided in Appendices A and B, respectively.

Scheduled Salmon Rivers along the proposed TL 267 include:

- Conne River & tributary streams, including Bernard's Brook & Twillick Brook, Bay d'Espoir;
- Bay du Nord River (also a Canadian Heritage River);
- Long Harbour River & tributary streams, Fortune Bay;
- Piper's Hole River;
- Black River, Placentia Bay below falls;
- North Harbour River;
- Watson's Brook, Placentia Bay;
- Come By Chance River; and
- Bellevue River, Trinity Bay.

Protected public water supply areas (PPWSA) are surface waterbodies protected under Section 39 of the NL *Water Resources Act*. Source protection is the first stage of the multi-barrier approach the provincial Water Resources Management Division of the Department of Environment and Conservation takes in order to provide clean and safe drinking water to the province (DOEC 2013). Watercourse crossings proposed within PPWSAs must be approved by

the Water Resources Management Division (as described in Table 1.1). PPWSAs within the Study Area include:

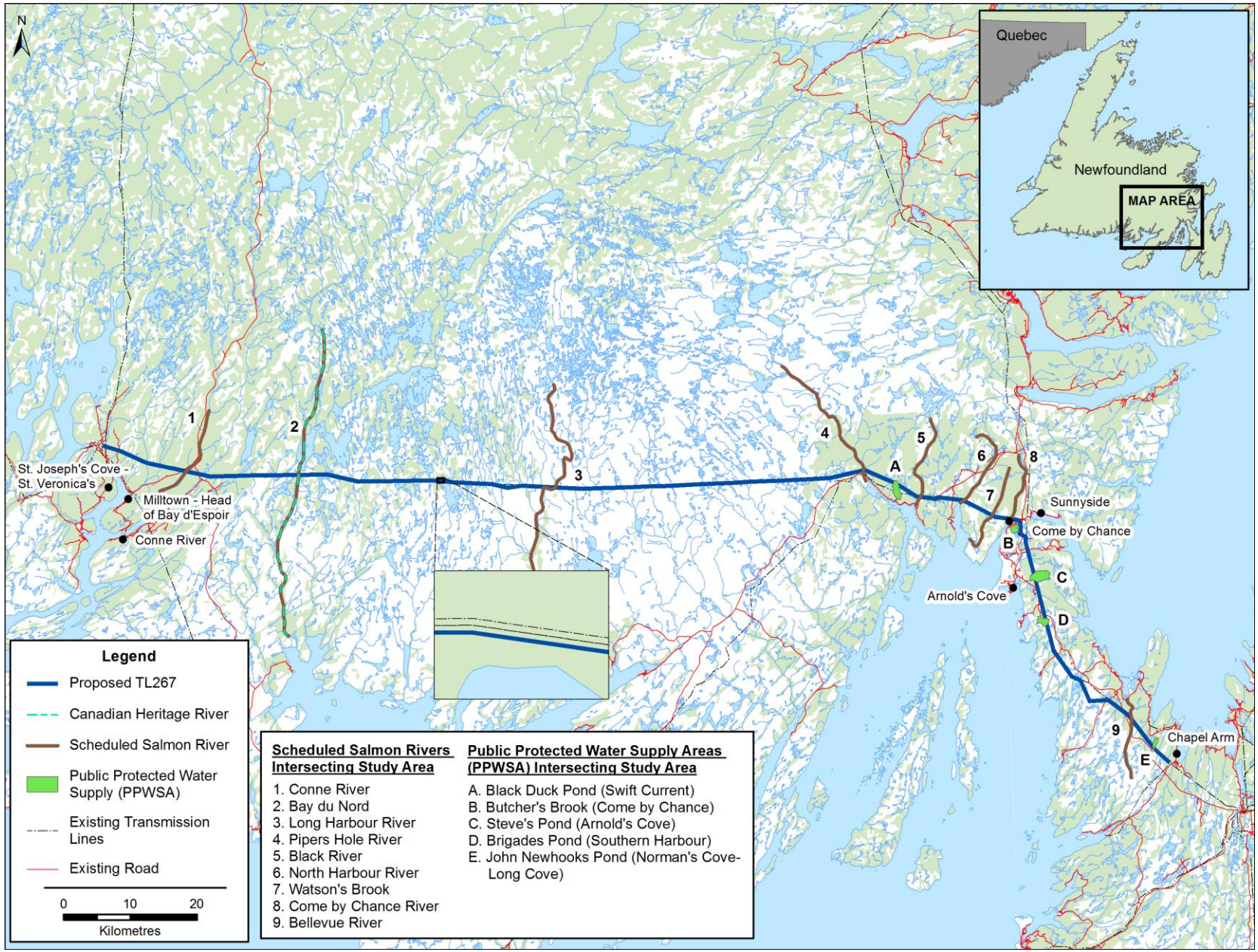
- Black Duck Pond (Swift Current);
- Butcher's Brook (Come By Chance);
- Steve's Pond (Arnold's Cove);
- Brigades Pond (Southern Harbour); and
- John Newhooks Pond (Norman's Cove- Long Cove).

Table 1.1 Legislative, Regulatory and Permitting Considerations and Potential Requirements

Approval Potentially Required	Legislation / Regulation	Activity Requiring Approval or Compliance	Issuing Department or Agency	Considerations and Requirements
Government of Newfoundland and Labrador				
Certificate of Approval for any Alteration to a Body of Water	*Water Resources Act*	Any activities within, near and/or which may alter a water body	Water Resources Management Division, Department of Environment and Conservation	An application form is required for each alteration of a body of water.
Water Use Authorization	*Water Resources Act*	Water withdrawal for use at temporary camps or during construction and operation activities	Water Resources Management Division, Department of Environment and Conservation	Water use authorization is required for all beneficial uses of water.
Policy Directives	*Water Resources Act*	Project activities	Water Resources Management Division, Department of Environment and Conservation	The Department has a number of potentially applicable policy directives in place, including those related to: Infilling Bodies of Water; Use of Creosote Treated Wood in Fresh Water; Treated Utility Poles in Water Supply Areas; Land and Water Developments in Protected Water Supply Areas; Development in Shore Water Zones; and Development in Wetlands.
Development Activity in a Public Protected Water Supply Area	*Water Resources Act*	Any activities that may take place within or in the vicinity of a protected water supply area	Water Resources Management Division, Department of Environment and Conservation	The Department has a set of standards that dictates the activities and allowable distances (upstream and downstream) permitted within a public protected water supply area.
Compliance Standard	*NL Endangered Species Act*	Any activity that may take place within of in the vicinity of provincially listed species at risk	Wildlife Division, Department of Environment and Conservation	A letter issued to the applicable regulatory body to request a permit to work within an area that has aquatic species at risk.

Approval Potentially Required	Legislation / Regulation	Activity Requiring Approval or Compliance	Issuing Department or Agency	Considerations and Requirements
Government of Canada				
Letter of Notification	*Fisheries Act*	Construction of watercourse crossings, fording sites, water withdrawals, or any other activities in or near water that may support a fishery	Fisheries and Oceans Canada	Where potential for harmful effects to fish habitat can be prevented, a Letter of Notification will be issued outlining appropriate mitigation procedures or conditions to be followed. This process is conducted in tandem (as done in previous large transmission projects) with the provincial permitting process for approval for altering a body of water.
Permit for Construction Within Navigable Waters	*Navigation Protection Act*	Construction of watercourse crossings	Transport Canada	Permit required only within scheduled waters. There are no scheduled waters within the Study Area. Any "non-scheduled" waters are subject to the Act if the owner wishes to opt-in.
Compliance Standard	*Species at Risk Act*	Activities that may affect species listed on Schedule 1 of *SARA*, as extirpated, endangered or threatened	Fisheries and Oceans Canada (for aquatic species) and/or other relevant federal authorities	It is illegal to kill, harm, harass, capture or take endangered or threatened species protected under *SARA*. The Minister of Fisheries and Oceans may authorize activities which could affect an aquatic species if he or she believes that these activities will not jeopardize the survival or recovery of that species.

Figure 1.2 Some Key Areas and Locations Relevant to the Project and the Freshwater Environment



2.0 APPROACH AND METHODS

The following sections describe the general approach and methodology that were used in the planning and completion of this *Freshwater Environment Study*, including the associated Study Area, data analysis, and the overall methods used to compile and present the resulting environmental information.

The scale of the Study Area provides clear advantages to using remote sensing analysis as an initial step in collecting site-specific baseline data and characterizing potential fish habitat in the Study Area for future permitting. Literature reviews of existing fish survey information within the watersheds encompassed by the Project were coupled with site-specific habitat information, generated by remote sensing analysis, to also evaluate the potential for a particular species to occur at a particular water crossing. These elements are described in further detail below.

2.1 Study Areas

The proposed Project will include construction and operation of a new electrical transmission system along existing transmission lines and roadways in south-central and eastern Newfoundland for a total distance of approximately 188 km. In completing this *Freshwater Environment Study*, the associated analysis has focused upon a number of geographic scales, including:

> *Project Area* or *Transmission Line Right of Way (ROW)*: A specific routing has been selected for the transmission line, which will involve a cleared ROW approximately 40 m wide.
>
> *Study Area*: The larger (1 km wide) Study Area extends 500 m on either side of the centre line of the identified ROW for the proposed TL 267, as described above. This surrounding area is considered in order to provide relevant, regional context for the analysis, as well as address the potential for Project-related activities to occur outside the 40 m wide transmission line routing itself.

Hydro also maintains a number of access trails and approved watercourse crossing (fording) sites as part of its on-going operation of the existing transmission lines through this region, some or all of which may be used (and upgraded as required) for this Project.

This study focuses primarily on the freshwater environment along the TL 267 ROW as far east as where it meets TL 203, near Come By Chance. The remaining 44 km of the TL 267 ROW, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a previous, similar study (AMEC 2010).

2.2 Crossing Identification

Each crossing location was first identified using the 1:50,000 watercourse map atlas in ArcGIS. High resolution color imagery was then used to confirm the actual location of crossing in relation to the ROW. While viewing the aerial images, it was also noted that some watercourse crossings were visible in the imagery but not mapped at the 1:50,000 scale. For the purposes of permitting, those smaller watercourse and waterbody crossing locations were not included in the assessment.

It should be noted that the watercourse and waterbody crossings identified and described herein are those associated with the transmission line ROW itself and known (existing) fording locations only. In terms of the former, there is not likely to be any in or near water "footprint" or any other direct interaction, as the transmission line conductors will span watercourses and appropriate buffers will be maintained in the cleared ROW near all surface waters. At this stage of the planning process, the final access plan has also not been developed for the clearing and construction of the transmission line, although where possible, existing access trails and fords will be utilized and upgraded as needed. These water crossings have therefore been identified and analysed as an initial means of evaluating and describing the freshwater environment in the area, and for compiling and testing the imagery and analytical framework.

A list of potential watercourse crossing locations along the existing trails and associated ford locations is provided in Appendix A.

2.3 Watershed Analysis

A review was conducted of available watershed information that could inform the watershed delineation and the potential for fish presence. This information included existing and available mapping information such as:

- 1:250,000 and 1:50,000 topographic maps;
- Available digital maps and aerial photos of the area from the Government of Newfoundland and Labrador; and
- Aerial photos and detailed LiDAR Imagery provided by Hydro.

In terms of the latter item, high resolution colour imagery was acquired by Hydro for the proposed TL 267 ROW and surrounding area. This imagery (flown by a fixed wing aircraft with an attached high resolution camera) consists of 3,504 individual images covering the Project area extending from Bay d'Espoir to Come By Chance at a resolution of 15 cm per pixel.

Watershed area is used to determine a watercourse's flow at various times of the year. The watersheds within the Study Area were delineated using the 1:50,000 digital elevation models (DEMs) that are available from GeoBase. Geobase is a federal, provincial and territorial governments' initiative that provides base layer geospatial data at no cost and with no restrictions for users. Relevant DEMs were identified and grouped to generate complete coverage for the Study Area. The estimated high-points of each watershed were determined and joined to give an overall watershed area upstream of the potential crossing location.

ArcGIS software and the ArcHydro suite of tools were used to delineate and display the drainage areas for each of the identified crossings. One consideration in conducting this analysis was that the crossings themselves were identified using high resolution aerial photos, whereas the watershed areas are based on the 1:50,000 scale DEMs. This resulted in some inconsistencies between spatial layers and an inability of the ArcHydro software to identify some watersheds. Fortunately, watercourses that lacked watershed statistics were extremely small, had only small drainage areas and/or they did not exist at the time the digital elevation models were generated. An additional consequence of applying

the DEM on 1:50,000 maps was that watershed boundaries are only approximate. Nonetheless, the resolution was considered appropriate for the exercise and the results remain useful for characterizing important features for fish habitat and navigable waters.

Quality Assurance (QA) procedures were put in place and implemented throughout the exercise and provide an additional assurance and measure of accuracy. Drainage area accuracy was confirmed through comparisons between the 1:50,000 DEMs and aerial photography. All crossings were assigned to one of seven size intervals (Table 2.1) that are aligned with other northern linear development criteria (AMEC 2010). Intermittent streams were classified as crossings with watershed sizes of < 2.6 km^2. This threshold was based on previous surveys where intermittent streams were determined to have watersheds of 2.0 - 2.6 km^2 (AMEC 2003, 2010).

Table 2.1 Transmission Line Potential Watercourse Crossing Types by Watershed Size

Watercourse Type	Watershed Size Interval (km^2)
Intermittent (N)	<2.6
Small (S1)	2.6 - 50
Small (S2)	50 – 200
Small (S3)	200 – 500
Intermediate (I1)	500 – 1,000
Intermediate (I2)	1,000 – 10,000
Large (L)	>10,000

2.4 Habitat Description

Once all water crossings were identified and confirmed at the 1:50,000 scale, high resolution images were further examined in GIS to assess the habitat associated with each of those crossings. This high resolution imagery was ideal for assessing habitat features such as riparian vegetation, substrate type, wetted width and channel width as summarized in Figure 2.1. In cases where watercourses were obscured by vegetation on aerial photography, measurements were taken in areas above or below the crossing where the stream was visible, as long as it was within the Study Area. The habitat variables analysed were consistent with typical requirements for permits from NL Water Resources Management Division with details provided in Appendix A.

A physical description of the fish habitat at each potential water crossing was determined using the aerial photography and topographic mapping. The resolution / coarseness of the categories is based on image resolution and previous assessments of classification accuracy (AMEC 2010). This information was used to determine if fish were likely to be present in and utilize the watercourse crossing location and surrounding area. Fish habitat data extracted from aerial photography included:

- An estimate of flow morphology (Table 2.2);
- An estimate of the dominant substrate composition (Table 2.3);
- An estimate of the dominant riparian habitat (Table 2.4); and
- Any incidental observations such as erosion and shoreline substrates.

These characterizations and determinations were based on DFO Guidelines (2012a) for characterizing fish habitat. If the resulting data fell within the guidelines for suitable fish habitat ranges, the crossing was considered to be potential fish habitat. The minimum watershed area with potential for fish habitat for this assessment is defined as the minimum area required to produce watercourses that would not freeze entirely in winter in Newfoundland. Based on stream survey work in nearby areas, streams with small watershed sizes (less than 4.5 km^2) are typically frozen to the bottom in winter (or with diminished flow) and are therefore not considered to be fish habitat (AMEC 2012). Watersheds below that area would be classed as non-fish habitat and excluded from further assessment (except for limited verification of definition).

Table 2.2 Flow Morphology Variables for Aerial Photo Interpretation

Code	Name	Description
RA	Rapid	Large amount white water.
RI	Riffle (Run)	White water visible.
FL	Flat (Steady)	No white water visible.
DS	Discontinuous stream	Discontinuous stream – unable to follow entire stream, disappears within vegetation.

Table 2.3 Dominant Substrate Variables for Aerial Photo Interpretation

Code	Name	Description
LC	Littoral Coarse	> 50% boulder/rubble
LF	Littoral Fine	> 50% gravel/cobble/sand/silt/muck

Table 2.4 Dominant Riparian Habitat Variables for Aerial Photo Interpretation

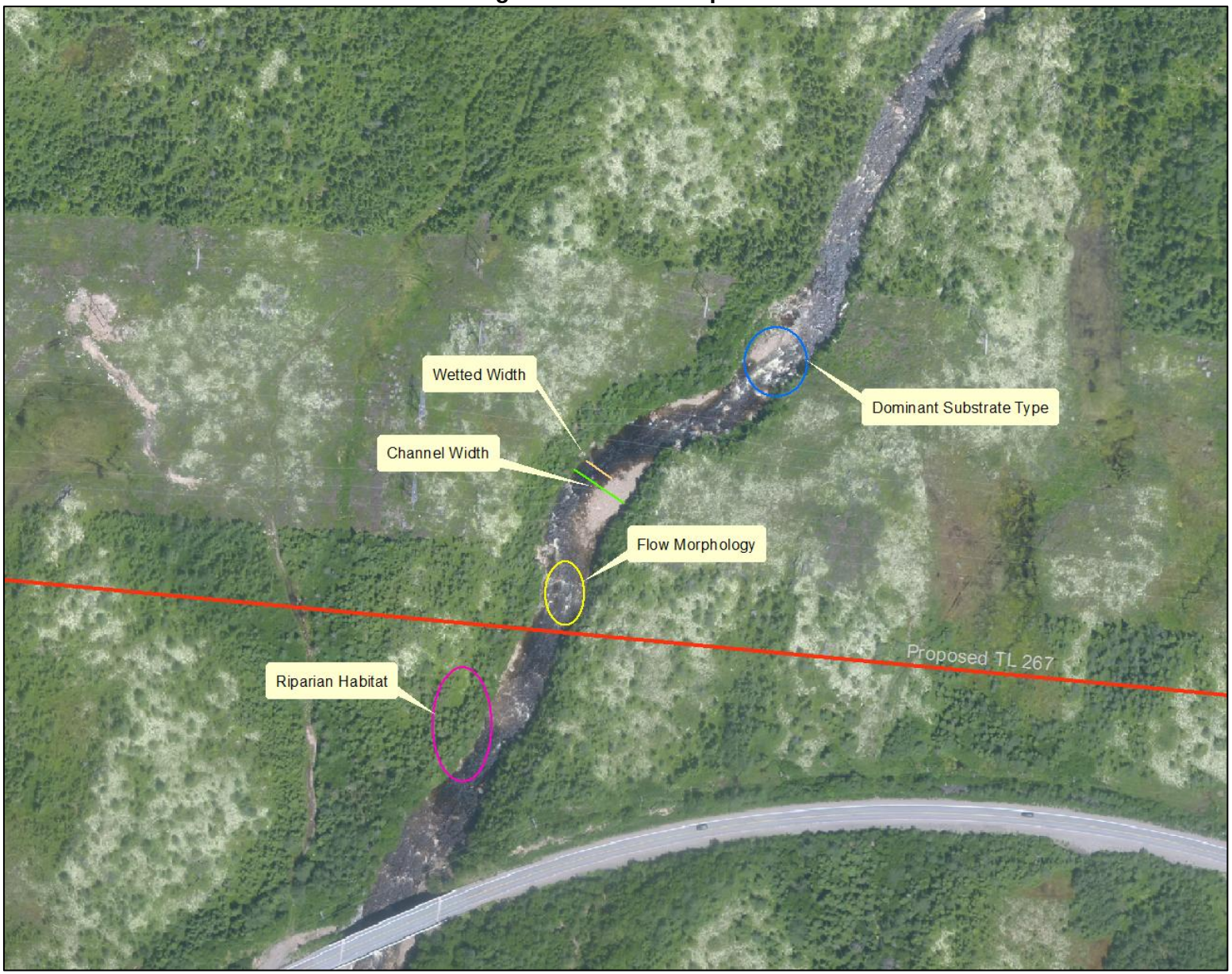
Code	Name	Description
CT	Conifer Tree	White or black spruce, balsam fir, tamarack
CS	Conifer Shrub	Dwarf spruce, balsam fir, tamarack
DT	Deciduous Tree	Yellow or white birch, aspen
DS	Deciduous Shrub	Alder, Labrador tea, sweet gale, dogwoods
GR	Grass	Grasses or sedges
LI	Lichen	Reindeer or other lichens
BO	Bog	Saturated area with shrubs, mosses, lichens and or grasses and sedges.
TB	Treed Bog	Bog with trees

2.5 Literature Review - Fish Species Presence / Utilization

To provide an information base related to potential fish species occurrence along the proposed transmission line and within the larger Study Area and overall region, a literature search of existing information from available scientific reports, government documents and previous studies was conducted. Area specific information and past fish and fish habitat surveys for this particular portion of the province is relatively lacking, likely due to the general remoteness of the area.

The distribution, biology, and spawning habits of each fish species that is known or likely to occur in the area have also been summarized, with a particular focus on any particularly sensitive species, locations and times.

Figure 2.1 Fish Habitat Parameters Examined During Aerial Photo Interpretation



3.0 RESULTS

Summaries of the literature reviews and mapping / aerial photograph interpretation are provided in the following section. The watershed delineation exercise detected 212 potential water crossings associated with the ROW, which included a combination of watercourses (88 streams and rivers) and waterbodies (124 lakes and ponds). In addition, 147 watercourses and waterbodies were identified and assessed along the existing access trail network (and associated approved fording locations) from Bay d'Espoir to Come By Chance.

As noted previously, this study focuses primarily on the freshwater environment along the transmission line as far east as where TL 267 meets TL 203, near Come By Chance. The remaining 44 km of the TL 267 ROW, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a previous, similar study (AMEC 2010), the relevant results of which are also generally summarized below for completeness.

3.1 Aerial Photograph Interpretation

In total, 359 potential watercourse and waterbody crossings were identified through mapping and aerial photography analysis along the proposed transmission line ROW (212 crossings) and existing fording locations (147 crossings). Appendix A provides detailed information on each crossing, including its location (coordinates) as well as its associated watershed size category, type, watercourse width (wetted and channel), flow morphology and substrate category. Detailed mapping of the crossing locations is provided in Appendix B.

3.1.1 Watershed Area

As shown in Table 3.1, the majority of proposed crossing locations (127; 35 percent) were associated with first level Intermediate watersheds (500-1000 m^3). Ninety-eight (27 percent) of the proposed crossing locations were associated with first level Small (2.6-50 km^2), 47 (13 percent) were associated with second level Small (50 - 200 km^2) and 87 (24 percent) were associated with Intermittent (less than 2.6 km^2).

Table 3.1 Summary of Watershed Size Category as Determined by Aerial Photo Interpretation

Watershed Size Category		Number of ROW Crossings	Number of Ford Crossings	Total	% of Total Crossings
		WC/WB*	WC/WB		
Intermittent (N)	<2.6 km^2	25/25	32/5	87	24
Small (S1)	2.6 – 50 km^2	22/30	40/6	98	27
Small (S2)	50 – 200 km^2	13/14	17/3	47	13
Small (S3)	200 – 500 km^2	-	-	-	0
Intermediate (I1)	500 – 1,000 km^2	28/55	36/8	127	35
Intermediate (I2)	1,000 – 10,000 km^2	-	-	-	0
Large (L)	>10,000 km^2	-	-	-	0
Total		88/124	125/22	359	100
* WC / WB = watercourse / waterbody					

The identified ROW crossing widths ranged from less than 1 m to 331 m for both wetted width and channel width (Table 3.2). In places where wetted width and channel width were less than 1 m, it was noted that the stream crossing location was dry at the time of collecting aerial imagery but is likely inundated during the spring freshet or during heavy rain events. Ford crossing locations ranged from less than 1 m to 68 m for wetted width and from less than 1 m to 75 m for channel width (Table 3.3).

Table 3.2 Summary of Wetted Width and Channel Width for ROW Crossing Locations

Watershed Size Category		Wetted Width (m)			Channel Width (m)		
		Min	Max	Avg	Min	Max	Avg
Intermittent (N)	<2.6 km^2	<1	238	38	<1	238	39
Small (S1)	2.6 – 50 km^2	<1	233	44	1	233	48
Small (S2)	50 – 200 km^2	<1	191	43	1	191	47
Small (S3)	200 – 500 km^2	-	-	-	-	-	-
Intermediate (I1)	500 – 1,000 km^2	<1	331	47	1	331	50
Intermediate (I2)	1,000 – 10,000 km^2	-	-	-	-	-	-
Large (L)	>10,000 km^2	-	-	-	-	-	-

Table 3.3 Summary of Wetted Width and Channel Width for Ford Crossing Locations

Watershed Size Category		Wetted Width (m)			Channel Width (m)		
		Min	Max	Avg	Min	Max	Avg
Intermittent (N)	<2.6 km^2	<1	68	9	<1	68	7
Small (S1)	2.6 – 50 km^2	<1	31	10	<1	66	10
Small (S2)	50 – 200 km^2	1	52	19	1	60	20
Small (S3)	200 – 500 km^2	-	-	-	-	-	-
Intermediate (I1)	500 – 1,000 km^2	<1	60	13	1	75	12
Intermediate (I2)	1,000 – 10,000 km^2	-	-	-	-	-	-
Large (L)	>10,000 km^2	-	-	-	-	-	-

Substrates of ROW and ford crossing locations were dominated (74 percent) by "littoral fine" material (Table 3.4). "Littoral fine" substrate comprises of gravel, sand, silt or muck. This substrate type was primarily found in smaller ponds and streams, which formed the bulk of the watercourses and waterbodies in the Study Area. A higher representation of coarse substrates, however, was found in the larger watersheds (first level, intermediate) accounting for ten percent of the total.

Table 3.4 Summary of Watercourse Substrate

Watershed Size Category		Littoral Fine	Littoral Coarse	Unclassified*
		ROW/Ford	ROW/Ford	ROW/Ford
Intermittent (N)	<2.6 km^2	42/28 (20)	5/6 (3)	3/3 (2)
Small (S1)	2.6 – 50 km^2	38/33 (20)	13/11 (7)	1/2 (1)
Small (S2)	50 – 200 km^2	20/17 (10)	6/3 (3)	1/0 (<1)
Small (S3)	200 – 500 km^2	-	-	-
Intermediate (I1)	500 – 1,000 km^2	60/27 (24)	22/13 (10)	1/4 (1)
Intermediate (I2)	1,000 – 10,000 km^2	-	-	-
Large (L)	>10,000 km^2	-	-	-
Total		160/105 (74)	46/33 (22)	6/9 (4)

Watershed Size Category	Littoral Fine	Littoral Coarse	Unclassified*
	ROW/Ford	ROW/Ford	ROW/Ford
*Watercourse crossing was unable to be assessed due to insufficient resolution or stream coverage by vegetation.. **Percentage of total stream crossings is noted in parentheses.			

Flow morphology within all waterbodies (146, or 38 percent) was classified by "Flat" or "Discontinuous" flow states. Watercourse crossings that had the same flow structure, accounted for a total of 273 crossings or 76 percent of all crossings. Flow morphology of watercourses in the Study Area was dominated by "Flat" flow states in intermittent (N) and small (S1) watershed sizes. Only five watercourse crossings (one percent) had "Rapids" and 26 (eight percent) had "Riffle" flow structures (Table 3.5).

Table 3.5 Summary of Flow Morphology

Watershed Size Category		Flow Morphology				
		Rapid	Riffle	Flat	Discontinuous	Unclassified*
		WC/WB	WC/WB	WC/WB	WC/WB	WC/WB
Intermittent (N)	<2.6 km^2	0/0	1/0	33/30	23/0	-
Small (S1)	2.6 – 50 km^2	1/0	10/0	40/33	11/3	-
Small (S2)	50 – 200 km^2	2/0	10/0	18/16	3/1	-
Small (S3)	200 – 500 km^2	-	-	-	-	-
Intermediate (I1)	500 – 1,000 km^2	2/0	5/0	44/62	12/1	1/0
Intermediate (I2)	1,000 – 10,000 km^2	-	-	-	-	-
Large (L)	>10,000 km^2	-	-	-	-	-
Total		5/0 (1)**	26/0 (8)	132/141 (76)	49/5 (15)	1/0 (<1)
*Watercourse crossing was unable to be assessed due to insufficient resolution, stream coverage by vegetation or it was a dry stream. ** Percentage of total stream crossings is noted in parentheses.						

Riparian vegetation in the Study Area varied somewhat but was predominantly comprised of bog (115, or 32 percent), deciduous shrubs (96, or 27 percent) and grasses (62, or 17 percent) (Table 3.6).

Table 3.6 Summary of Riparian Vegetation

Watershed Size Category		Dominant Riparian Vegetation*								
		BO	TB	CS	CT	DT	DS	GR	LI	Unclassified**
		WC/WB								
Intermittent (N)	<2.6 km^2	19/18	2/0	4/1	1/1	6/1	12/5	12/4	1/0	-
Small (S1)	2.6 – 50 km^2	5/17	0/3	8/1	8/1	6/0	21/7	14/7	-	-
Small (S2)	50 – 200 km^2	3/9	-	2/1	6/0	3/0	12/3	4/4	-	-
Small (S3)	200 – 500 km^2	-	-	-	-	-	-	-	-	-
Intermediate (I1)	500 – 1,000 km^2	11/33	0/1	4/3	15/0	6/0	23/13	4/13	-	1/0
Intermediate (I2)	1,000 – 10,000 km^2	-	-	-	-	-	-	-	-	-

Watershed Size Category		Dominant Riparian Vegetation*								
		BO	TB	CS	CT	DT	DS	GR	LI	Unclassified**
Large (L)	>10,000 km^2	-	-	-	-	-	-	-	-	-
Total		38/77 (32)***	2/4 (2)	18/6 (7)	30/2 (9)	21/1 (6)	68/28 (27)	34/28 (17)	1/0 (<1)	1/0 (<1)

* Dominant Riparian Vegetation : BO – Bog, CS – Coniferous Shrub, CT – Coniferous Trees, DT-Deciduous Trees, DS – Deciduous Shrub, GR – Grass, LI – Lichen, TB – Treed Bog
** Watercourse crossing was unable to be assessed due to insufficient resolution.
***Percentage of total stream crossings is noted in parentheses.

3.1.2 Potential Fish Habitat

Potential fish habitat was identified at 54 (or 15 percent) of the identified water crossings, and 305 (or 85 percent) of the crossings were not considered potential fish habitat due to a combination of factors including lack of connectivity to other watercourses and waterbodies, small watershed size (less than 4.5 km^2), sub-optimal substrate types and riparian cover or lack thereof (Table 3.7). The majority of watercourses and waterbodies found within the Study Area are surrounded by bog or wetlands which do not provide optimal habitat for most fish species.

Table 3.7 Summary of Potential Fish Habitat

Watershed Size Category		Potential Fish Habitat	
		Yes	No
Intermittent (N)	<2.6 km^2	-	87 (24)*
Small (S1)	2.6 – 50 km^2	15 (4)	83 (23)
Small (S2)	50 – 200 km^2	10 (3)	37 (10)
Small (S3)	200 – 500 km^2	-	-
Intermediate (I1)	500 – 1,000 km^2	29 (8)	98 (27)
Intermediate (I2)	1,000 – 10,000 km^2	-	-
Large (L)	>10,000 km^2	-	-
Total		54 (15)	305 (85)

*Percentage of total stream crossings is noted in parentheses.

Of the streams identified, eight are associated with Scheduled Salmon Rivers and one with a PPWSA. Further descriptions of the crossing locations at each of the Scheduled Salmon Rivers and the PPWSA are provided in Table 3.8, and additional information and mapping is provided in Appendices A and B. Butcher's Brook (Come By Chance) PPWSA is within the 1 km wide Study Area from Bay d'Espoir to Come By Chance but there is no associated water crossing along the ROW. It should be noted that Bellevue River (Scheduled Salmon River) and Steve's Pond, Brigades Pond and John Newhooks Pond (PPWSAs) are located along the Isthmus of the Avalon and watercourses in that area have been previously described in AMEC (2010).

Table 3.8 Summary of Water Crossing Locations Associated with Scheduled Salmon Rivers, Canadian Heritage River and PPWSAs

ID	River Name	Easting	Northing	Wetted Width (m)	Channel Width (m)	Watercourse or Waterbody	Dominant Substrate	Riparian	Flow Morphology	Watershed Category
Scheduled Salmon Rivers and Canadian Heritage River										
10	Conne River	602354.4	5311586	62	65	WC	LC	CT	RI	I1
29	Bay du Nord River	618765.9	5311125	44	56	WC	LC	DS	FL	I1
78	Long Harbour River	657018.9	5309263	76	77	WC	LC	CT	RA	I1
182	Piper's Hole River	703595.9	5311813	62	66	WC	LC	DT	RA	I1
190	Black River	712161.1	5307825	19	20	WC	LF	CS	RI	S2
200	North Harbour River	718474.5	5307327	8	32	WC	LC	CT	RA	S2
205	Watson's Brook	722893	5305045	2	3	WC	LF	DS	DS	S1
209	Come By Chance River	725715.5	5304499	37	40	WC	LF	DS	RI	S2
Public Protected Water Supply Area										
186	Black Duck Pond	708248.5	5309953	0	1	WC	LF	DT	DS	N

3.2 Previous Studies

AMEC (2010) conducted a similar Freshwater Environment Study for the then proposed Labrador - Island Transmission Link as part of that project's EA review. In that study, an initial desktop identification of crossing locations was conducted with additional field surveys conducted at select crossing locations between Central Labrador and the Avalon Peninsula in Eastern Newfoundland. In that study, there were a total of 103 watercourse crossings identified in the Avalon Peninsula Region alone (which overlaps with a 44 km portion of the proposed TL 267). Desktop analysis showed that the most common flow morphologies were riffles (67 percent) and flats (26 percent). Streams within the Avalon Region were dominated by fine substrates (68 percent) with the remaining streams having coarse substrates channel and wetted widths for watercourse crossings in the region averaged 7.91 m and 6.24 m, respectively.

Additional details on the identified habitats within the Avalon region can be found in Appendix A of the previous Freshwater Environment Study (AMEC 2010) but for completeness these are also summarized in Appendix A of this document. Fish species collected as part of that previous field study program are also discussed below.

3.3 Potential Fish Species Presence in the Study Area

The literature review completed as part of this study indicated that at least five fish species are known or likely to occur in the watersheds associated with the Study Area. Brook trout (both anadromous and landlocked, *Salvelinus fontinalis*), Atlantic salmon (*Salmo salar*) or ouananiche (landlocked salmon), American eel (*Anguilla rostrata*), rainbow smelt (*Osmerus mordax*) and threespine stickleback (*Gasteroteus aculeatus*) are likely be found throughout the Study Area based on this review.

Of these, only two species are typically considered to be of recreational and/or subsistence fishery value (brook trout *Salvelinus fontinalis* and Atlantic salmon / ouananiche *Salmo salar*). The remaining species (American eel, rainbow smelt and threespine stickleback) do, however, play an ecological role in the aquatic food chain. There are currently no known commercial fisheries within the Study Area.

Fish species of special conservation concern may be legally protected under the *NL ESA* and/or the *SARA*. Within Newfoundland and Labrador, there are four fish species that are listed under one or both of these Acts. Banded killifish (*Fundulus diaphanous*) and fourhorn sculpin (*Myoxocephalus quadricornis*) are listed as species of "Special Concern" under the *SARA,* whereas the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has also indicated that the American eel (*Anguilla rostrata*) is "Threatened" (although this designation does not afford legal protection). Banded killifish and American eel are also listed as "Vulnerable" under the *NL ESA*. Based on available literature and the results of past studies, the only fish species of conservation concern that could potentially occur within the proposed Study Area is American eel.

There are nine Scheduled Salmon Rivers throughout the Study Area, including one river in the Bay du Nord Wilderness Reserve (DOEC 1990). DFO maintains a salmon enumeration fence on Conne River, which had an average return of 907 adult Atlantic salmon from 2010 through 2014 (DFO 2015b).

A summary of each of the fish species described above is presented in Table 3.9.

Table 3.9 Summary of Fish Species that Occur or May Occur within the Study Area

Common Name	Scientific Name	Biological/Habitat Details
Atlantic salmon	*Salmo salar*	*Typical Habitat* • Preferred temperature: 8-16^{o}C • Preferred depth: Variable • Preferred substrate: gravel, cobble, boulder *Biology and Ecology* • Distributed throughout Newfoundland and Labrador • Occurs as landlocked (ouananiche) and anadromous life histories • Spawn in clean, well aerated, gravel bottom riffle sections of stream • Diet depends on the size and habitat of fish, as well as season • Juvenile anadromous salmon remain in natal watersheds for 2-5 years • Adult salmon generally remain at sea for 1-3 years before returning to their natal stream to spawn *Recreational / Commercial Value* • Recreational fishery • First Nations subsistence fishing • There has not been a commercial salmon fishery in Newfoundland since 1997
Brook trout	*Salvelinus fontinalis*	*Typical Habitat* • Preferred temperature: 11-16^{o}C • Preferred depth: 0.06-0.90 m • Preferred substrate: gravel, cobble, boulder *Biology and Ecology* • Inhabits lakes and rivers throughout Newfoundland and Labrador • Can be landlocked or anadromous • Feed mainly on aquatic and terrestrial insects and fish • Can hybridize with other salmonid species *Recreational / Commercial Value* • Recreational fishery • First Nations subsistence fishing • No commercial fishery in Newfoundland
American eel	*Anguilla rostrata*	*Typical Habitat* • Preferred temperature: variable; below freezing to over 19^{o}C • Preferred depth: $\leq$1 m • Preferred substrate: boulder, rubble, silt, muck, clay *Biology and Ecology* • The only catadromous (spawn at sea) species in Newfoundland and Labrador

		• All American eels spawn in the Saragasso Sea. • Can survive in very shallow water, and can move across wet grass or rocks during migrations • Eels hibernate over the winter in soft substrates *Recreational / Commercial Value* • Recreational/Commercial fishery • First Nations subsistence fishing • Few commercial licenses in Newfoundland
Rainbow smelt	*Osmerus mordax*	*Typical Habitat* • Preferred temperature: approximately 15^{o}C • Preferred depth: >2 m • Preferred substrate: cobble, gravel, sand, clay *Biology and Ecology* • Schooling pelagic species found in lakes and nearshore marine habitats. • Anadromous populations spawn in rivers in April to June • Landlocked populations are known to exist in both normal and dwarf form. *Recreational / Commercial Value* • Recreational fishery • Food source for other recreational fish species
Threespine stickleback	*Gasteroteus aculeatus*	*Typical Habitat* • Preferred temperature: 9-12^{o}C • Preferred depth: variable, generally <1 m • Preferred substrate: within or near vegetation *Biology and Ecology* • Common throughout Newfoundland and Labrador, in fresh, brackish and marine environments • Maximum lifespan is typically 2-2.5 years *Recreational / Commercial Value* • Limited; may be a food source for larger recreational species
Source: Grant and Lee (2004), DFO (2012b, 2014), AMEC (2010)		

As a result of the general remoteness of much of the Study Area, there have been very few systematic surveys conducted for fish in this region. As a result of this lack of direct data on fish presence in the Study Area, inferences on species occurrence in this report are based largely on their known presence and distribution within similar habitats in the region or beyond, as reflected in the general literature, or through the past field investigations along the Labrador-Island Transmission Link (which twins the proposed TL 267 for a 44 km section) from Come By Chance to Western Avalon and scientific programs conducted by Fisheries and Oceans Canada in Conne River.

Given the nature of the physical works associated with the Project, the greatest potential for effects to fish and fish habitat would be fording across spawning locations while eggs are still within the

substrate. Fording would have minimal implications for fish during mobile life stages (i.e., after emergence). The non-salmonid species within the Study Area are generally spring spawners although most of the recreational species are fall spawners (Table 3.10). American eel are catadromous species and do not spawn in freshwater habitat (Scott and Crossman 1973).

Each species that is expected to occur in the Study Area has specific spawning habitats as well as spawning seasons (Table 3.10). Some of these species prefer to spawn within riverine habitats, while others prefer lacustrine. Substrate type is also a critical factor in determining spawning habitats. While species will spawn on multiple substrate types, cobble and gravel are the most commonly used. Table 3.11 presents the type of substrate found in potential fish habitat along the proposed transmission line ROW. Within the aerial photograph interpretation, cobble and gravel are represented by the "Littoral Fine" substrate class and was found in 23 of the watercourses that were considered potential fish habitat.

Table 3.10 Spawning Habits of Identified Fish Species

Species	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
American Eel																								
Atlantic Salmon	i	i	i	i	i	i	i	h	h											s	s	i	i	i
Brook Trout	i	i	i	i	i	i	h	h	h										s	s	i	i	i	i
Stickleback										s	s	s	s	s	h	i	i	i						
Rainbow Smelt							s	s	s	s	s	i	h											

Low interaction
Moderate to high interaction (s-spawning; i-incubation; h-hatching)

Source: Scott and Crossman 1973; Grant and Lee 2004

Table 3.11 Dominant Substrate of Watercourse Crossings Considered Potential Fish Habitat

Watershed Size Category		Littoral Fine	Littoral Coarse
Intermittent (N)	<2.6 km^2	-	-
Small (S1)	2.6 – 50 km^2	9	11
Small (S2)	50 – 200 km^2	5	
Small (S3)	200 – 500 km^2	-	-
Intermediate (I1)	500 – 1,000 km^2	9	20
Intermediate (I2)	1,000 – 10,000 km^2	-	-
Large (L)	>10,000 km^2	-	-
Total		23 (43)*	31 (57)
*Percentage of total potential fish habitat stream crossings is noted in parentheses.			

4.0 SUMMARY AND CONCLUSION

Information on the existing freshwater environment in the Study Area can help in the avoidance or reduction of potential environmental issues through Project design and planning and in the development and application of mitigation, as well as being required in and/or useful for future Project permitting processes.

The purpose and focus of this *Freshwater Environment Study* has therefore been to identify and describe each of the watercourses, waterbodies and larger watershed areas that occur within (and which are crossed by) the proposed TL 267. This has been undertaken through the compilation and analysis of the available high resolution spatial imagery (LiDAR and air photos) within a GIS system, which was subsequently used to identify all such crossing locations and to describe their key physical and biological characteristics, with a focus on those attributes which have relevance to fish and fish habitat and which are thus most relevant to eventual Project environmental permitting. The study also provided a literature review related to fish species which are likely to occur in the region, including their presence, distribution and abundance, habitat associations, important times, and other key aspects of the life history of each species.

Given the stage of Project planning and engineering design at the time at which this *Freshwater Environment Study* was initiated and completed, the study has focussed on compiling the available spatial imagery into a GIS system for analytical purposes, defining and describing the key environmental parameters of interest, and presenting preliminary results for the water crossings that are associated with the identified transmission line ROW and any known ford crossing locations.

With this initial freshwater analysis completed, the consolidated high resolution imagery and GIS system and analytical framework are now in place, and these can be quickly and easily applied to additional Project components and construction activities once these are defined. The system can therefore be useful in planning and designing these Project elements with consideration of surface water features and interactions, as well as in identifying and describing any potentially affected watercourses once these are sited. This initial desk-top analysis can then be supplemented with (and be used in the planning of) future field investigations of such worksites and watercourses, such as any new or upgraded fording sites, as may be required as part of on-going environmental planning or future permitting.

5.0 REFERENCES

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Appendix A

Water Crossing Information

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Legend / Variables

Watershed Category	Watershed Size Interval (km^2)
Intermittent (N)	<2.6
Small (S1)	2.6 - 50
Small (S2)	50 – 200
Small (S3)	200 – 500
Intermediate (I1)	500 – 1,000
Intermediate (I2)	1,000 – 10,000
Large (L)	>10,000

Code	Name	Description
RA	Rapid	Large amount white water.
RI	Riffle (Run)	White water visible.
FL	Flat (Steady)	No white water visible.
DS	Discontinuous stream	Discontinuous stream – unable to follow entire stream, disappears within vegetation.
NA	Unclassified	Watercourse crossing was unable to be assessed due to insufficient resolution, stream coverage by vegetation or it was a dry stream.

Code	Name	Description
LC	Littoral Coarse	> 50% boulder/rubble
LM	Littoral Medium	> 50% cobble/gravel
LF	Littoral Fine	> 50% sand/silt/muck
NA	Unclassified	Watercourse crossing was unable to be assessed due to insufficient resolution, stream coverage by vegetation or it was a dry stream.

Code	Name	Description
CT	Conifer Tree	White or black spruce, balsam fir, tamarack
CS	Conifer Shrub	Dwarf spruce, balsam fir, tamarack
DT	Deciduous Tree	Yellow or white birch, aspen
DS	Deciduous Shrub	Alder, Labrador tea, sweet gale, dogwoods
GR	Grass	Grasses or sedges
LI	Lichen	Reindeer or other lichens
BO	Bog	Saturated area with shrubs, mosses, lichens and or grasses and sedges.
TB	Treed Bog	Bog with trees
NA	Unclassified	Watercourse crossing was unable to be assessed due to insufficient resolution.

Code	Description
ROW	Right of way crossing location
Ford	Existing ford crossing location
WC	Watercourse
WB	Waterbody

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
1	1	ROW	589792.9	5315480	65	75	WC	LF	DT	RI	53.9	S2	Y
2	2	ROW	591770.7	5314849	0	0	WC	NA	DT	DS	4.2	S1	N
3	3	ROW	593273.9	5314239	0	1	WC	NA	DS	DS	1.1	N	N
4	4	ROW	593548	5314114	0	1	WC	NA	DS	DS	1.2	N	N
5	5	ROW	593937.2	5313937	51	51	WB	LF	DS	FL	1.2	N	N
6	6	ROW	596218.5	5312938	110	143	WC	LF	DT	RI	40.0	S1	Y
7	7	ROW	598233.2	5312462	3	10	WC	LF	DT	FL	23.8	S1	N
8	8	ROW	600422.2	5311996	0	1	WC	NA	CS	DS	512.5	I1	N
9	9	ROW	601957.7	5311669	88	88	WB	LF	BO	FL	512.5	I1	N
10	10	ROW	602354.4	5311586	62	65	WC	LC	CT	RI	512.5	I1	Y
11	11	ROW	604322	5311174	5	28	WC	LF	CS	FL	13.2	S1	N
12	12	ROW	605493	5310932	14	14	WB	LF	BO	FL	3.0	S1	N
13	13	ROW	606686.4	5310899	0	1	WC	NA	CS	DS	0.4	N	N
14	14	ROW	607419.7	5310915	108	108	WB	LF	BO	FL	0.4	N	N
15	15	ROW	607717.3	5310921	0	1	WC	LF	CT	DS	0.5	N	N
16	16	ROW	608738	5310943	23	35	WB	LF	CT	FL	1.8	N	N
17	17	ROW	609059.2	5310950	5	7	WC	LF	BO	FL	1.7	N	N
18	18	ROW	609537.6	5310959	77	84	WC	LC	CT	RI	113.6	S2	Y
19	19	ROW	610208.9	5310974	66	66	WB	LF	DS	FL	113.6	S2	N
20	20	ROW	611529	5311001	2	3	WC	NA	CT	DS	113.6	S2	N
21	21	ROW	612247.2	5311016	5	5	WC	LC	DT	RI	113.6	S2	Y
22	22	ROW	613138.6	5311035	54	54	WB	LF	DS	FL	113.6	S2	N
23	23	ROW	613692.8	5311047	107	107	WB	LF	BO	FL	14.3	S1	N
24	24	ROW	614257.9	5311056	0	1	WC	LF	GR	DS	14.3	S1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
25	25	ROW	615240.1	5311072	7	7	WC	LC	DT	FL	14.3	S1	N
26	26	ROW	617013.2	5311101	56	56	WB	LF	DS	FL	999.4	I1	N
27	27	ROW	617128.8	5311102	37	37	WB	LF	CS	FL	999.4	I1	N
28	28	ROW	618099.6	5311116	0	1	WC	LF	DT	DS	999.4	I1	N
29	29	ROW	618765.9	5311125	44	56	WC	LC	DS	FL	999.4	I1	Y
30	30	ROW	620286.7	5311146	31	31	WB	LF	BO	FL	999.4	I1	N
31	31	ROW	620956.4	5311155	61	61	WB	LF	BO	FL	999.4	I1	N
32	32	ROW	622452.5	5311175	61	61	WB	LF	BO	FL	999.4	I1	N
33	33	ROW	622579	5311177	72	72	WB	LC	CS	FL	999.4	I1	N
34	34	ROW	623280.2	5311163	28	28	WC	LC	CT	FL	999.4	I1	Y
35	35	ROW	625186.8	5310723	55	55	WB	LF	BO	FL	999.4	I1	N
36	36	ROW	625385.2	5310677	1	1	WC	LF	BO	FL	999.4	I1	N
37	37	ROW	625478.6	5310655	17	17	WB	LF	BO	FL	999.4	I1	N
38	38	ROW	626744.7	5310363	0	1	WC	LF	BO	FL	999.4	I1	N
39	39	ROW	627048	5310292	19	19	WC	LF	CT	FL	999.4	I1	N
40	40	ROW	628785.8	5310131	218	218	WB	LC	DS	FL	999.4	I1	N
41	41	ROW	631603.2	5310174	32	32	WB	LF	DS	FL	999.4	I1	N
42	42	ROW	632210.8	5310183	3	3	WC	LF	CT	DS	999.4	I1	N
43	43	ROW	633791.8	5310207	22	22	WB	LF	CS	FL	999.4	I1	Y
44	44	ROW	634707.8	5310221	244	244	WB	LC	DS	FL	999.4	I1	Y
45	45	ROW	634900.2	5310224	43	43	WB	LF	DS	FL	999.4	I1	N
46	46	ROW	635396.3	5310232	152	152	WB	LC	DS	FL	999.4	I1	Y
47	47	ROW	636043.8	5310241	38	38	WB	LF	BO	FL	999.4	I1	N
48	48	ROW	636608.3	5310249	15	15	WC	LF	BO	FL	999.4	I1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
49	49	ROW	636882.4	5310253	18	18	WB	LF	BO	FL	999.4	I1	N
50	50	ROW	637083.1	5310256	8	8	WB	LC	BO	FL	999.4	I1	N
51	51	ROW	637147.8	5310257	9	9	WB	LF	BO	FL	999.4	I1	N
52	52	ROW	638648.6	5310278	11	11	WC	LC	CS	FL	999.4	I1	Y
53	53	ROW	639914.4	5310291	6	67	WC	LF	CT	FL	999.4	I1	N
54	54	ROW	640995.4	5310147	2	4	WC	LF	CT	FL	999.4	I1	N
55	55	ROW	642277.8	5309995	3	3	WC	LC	CT	RI	999.4	I1	Y
56	56	ROW	642340.5	5309992	2	2	WC	LF	CT	DS	999.4	I1	N
57	57	ROW	642858.5	5309968	331	331	WB	LF	DS	FL	999.4	I1	N
58	58	ROW	643112.4	5309956	2	2	WC	LF	BO	FL	999.4	I1	N
59	59	ROW	643918.3	5309918	148	148	WB	LF	DS	FL	4.7	S1	N
60	60	ROW	644192.3	5309905	6	6	WB	LF	BO	FL	3.0	S1	N
61	61	ROW	644808.5	5309876	238	238	WB	LF	DS	FL	2.2	N	N
62	62	ROW	646180.7	5309808	148	148	WB	LF	CS	FL	1.6	N	N
63	63	ROW	646705.5	5309783	8	8	WC	LF	GR	FL	1.6	N	N
64	64	ROW	646974.9	5309769	111	111	WB	LF	BO	FL	9.1	S1	N
65	65	ROW	647210.3	5309758	33	33	WB	LF	BO	FL	9.1	S1	N
66	66	ROW	647888.7	5309723	35	43	WB	LF	CS	FL	39.5	S1	N
67	67	ROW	648090.3	5309701	21	21	WC	LF	CS	RI	39.5	S1	N
68	68	ROW	649926.8	5309245	97	97	WB	LC	DS	FL	115.4	S2	Y
69	69	ROW	650966	5309270	3	3	WC	LF	GR	FL	115.4	S2	N
70	70	ROW	651620.6	5309378	100	100	WB	LF	CS	FL	115.4	S2	N
71	71	ROW	652800.8	5309476	32	41	WC	LF	CS	RI	115.4	S2	N
72	72	ROW	653036.4	5309464	15	15	WC	LC	CT	FL	24.6	S1	Y

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
73	73	ROW	654153	5309407	0	1	WC	LF	BO	FL	1.1	N	N
74	74	ROW	655118.9	5309359	19	28	WB	LC	BO	FL	1.0	N	N
75	75	ROW	655369.7	5309346	1	1	WC	LF	BO	FL	1.0	N	N
76	76	ROW	655480.3	5309341	11	21	WB	LC	DS	FL	1.0	N	N
77	77	ROW	655652.7	5309332	19	21	WC	LF	DS	FL	13.8	S1	Y
78	78	ROW	657018.9	5309263	76	77	WC	LC	CT	RA	626.5	I1	Y
79	79	ROW	657599	5309233	10	10	WC	LF	CT	FL	626.5	I1	Y
80	80	ROW	657740	5309226	4	7	WC	LC	CT	FL	626.5	I1	Y
81	81	ROW	658285.1	5309198	9	9	WB	LF	BO	FL	626.5	I1	N
82	82	ROW	659902.3	5309113	21	21	WB	LF	BO	FL	626.5	I1	N
83	83	ROW	660382.8	5309087	18	18	WB	LF	GR	FL	626.5	I1	N
84	84	ROW	660460	5309081	22	22	WC	LF	DS	FL	626.5	I1	N
85	85	ROW	660556.8	5309078	16	16	WB	LF	TB	FL	626.5	I1	N
86	86	ROW	660649.7	5309073	18	30	WB	LF	DS	FL	626.5	I1	N
87	87	ROW	660825.7	5309063	14	59	WB	LF	GR	FL	626.5	I1	N
88	88	ROW	661161.2	5309045	19	19	WB	LF	BO	FL	626.5	I1	N
89	89	ROW	662035.6	5309026	8	8	WB	LC	GR	DS	626.5	I1	N
90	90	ROW	662275.5	5309034	166	166	WB	LF	DS	FL	626.5	I1	Y
91	91	ROW	662463.3	5309041	1	1	WC	LF	BO	FL	626.5	I1	N
92	92	ROW	662731.5	5309050	44	44	WB	LF	BO	FL	626.5	I1	N
93	93	ROW	663626.7	5309082	21	21	WB	LF	DS	FL	626.5	I1	N
94	94	ROW	664165.9	5309101	58	58	WB	LF	GR	FL	626.5	I1	N
95	95	ROW	664479.6	5309112	148	148	WB	LF	GR	FL	626.5	I1	N
96	96	ROW	664723.5	5309121	27	27	WB	LF	GR	FL	626.5	I1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
97	97	ROW	665090.1	5309134	16	16	WB	LF	BO	FL	626.5	I1	N
98	98	ROW	665303.6	5309141	53	53	WB	LF	BO	FL	626.5	I1	N
99	99	ROW	665539.5	5309149	57	57	WB	LF	BO	FL	626.5	I1	N
100	100	ROW	665966.4	5309164	12	12	WB	LF	BO	FL	626.5	I1	N
101	101	ROW	666321.6	5309177	2	2	WC	LF	DS	RI	626.5	I1	Y
102	102	ROW	667396.8	5309217	75	75	WB	LF	GR	FL	626.5	I1	N
103	103	ROW	667655.4	5309227	10	10	WB	LF	BO	FL	626.5	I1	N
104	104	ROW	667792.3	5309232	237	237	WB	LF	GR	FL	626.5	I1	N
105	105	ROW	668289.7	5309251	0	1	WC	LF	CS	DS	1.1	N	N
106	106	ROW	668536.8	5309259	1	1	WC	LF	GR	FL	1.1	N	N
107	107	ROW	668714.2	5309266	15	15	WB	LF	BO	FL	1.1	N	N
108	108	ROW	669237.9	5309286	11	11	WB	LF	BO	FL	70.2	S2	N
109	109	ROW	669286.5	5309288	21	21	WB	LF	BO	FL	70.2	S2	N
110	110	ROW	669447.5	5309293	0	1	WC	LF	DS	DS	70.2	S2	N
111	111	ROW	669507.1	5309296	19	22	WC	LC	DS	RA	70.2	S2	N
112	112	ROW	669552.9	5309297	8	11	WC	LF	GR	FL	0.7	N	N
113	113	ROW	669629.7	5309300	33	33	WB	LF	BO	FL	0.7	N	N
114	114	ROW	669774.8	5309306	57	57	WB	LF	BO	FL	0.7	N	N
115	115	ROW	669857.3	5309309	8	8	WB	LF	BO	FL	0.7	N	N
116	116	ROW	670052.8	5309316	25	25	WB	LF	BO	FL	0.7	N	N
117	117	ROW	670676.4	5309339	8	8	WB	LF	BO	FL	70.2	S2	N
118	118	ROW	671076.1	5309353	0	1	WC	LF	BO	DS	0.9	N	N
119	119	ROW	671707	5309377	97	97	WB	LF	BO	FL	0.9	N	N
120	120	ROW	672243.6	5309397	15	15	WB	LF	BO	FL	2.6	S1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
121	121	ROW	672421	5309404	62	62	WB	LF	DS	FL	2.6	S1	N
122	122	ROW	672586.2	5309410	15	15	WB	LF	GR	FL	2.6	S1	N
123	123	ROW	672725.9	5309416	49	55	WB	LC	GR	FL	2.6	S1	N
124	124	ROW	673456.9	5309443	196	197	WB	LF	DS	FL	2.6	S1	N
125	125	ROW	674907.4	5309506	210	210	WB	LF	GR	FL	2.5	N	N
126	126	ROW	675292.8	5309524	1	1	WC	LF	BO	DS	0.5	N	N
127	127	ROW	675961.4	5309555	155	155	WB	LF	BO	FL	0.5	N	N
128	128	ROW	676254.7	5309569	57	57	WB	LF	GR	FL	0.5	N	N
129	129	ROW	676477.5	5309580	195	195	WB	LC	GR	FL	0.5	N	N
130	130	ROW	678338.1	5309670	6	6	WC	LF	GR	FL	16.8	S1	N
131	131	ROW	678431.8	5309674	1	1	WC	LF	GR	DS	16.8	S1	N
132	132	ROW	678871.4	5309695	6	7	WC	LC	GR	FL	16.8	S1	N
133	133	ROW	679167.8	5309710	136	139	WB	LF	DS	FL	16.8	S1	N
134	134	ROW	679607.6	5309731	41	82	WB	LC	GR	FL	16.8	S1	N
135	135	ROW	679894.1	5309745	5	5	WC	LC	GR	FL	16.8	S1	N
136	136	ROW	680127	5309755	5	20	WC	LC	GR	DS	16.8	S1	N
137	137	ROW	680274.5	5309764	38	38	WC	LF	CS	RI	16.8	S1	N
138	138	ROW	680671.1	5309783	77	78	WB	LF	GR	FL	16.8	S1	N
139	139	ROW	682145.5	5309853	15	15	WB	LF	GR	FL	59.2	S2	N
140	140	ROW	682378.4	5309864	191	191	WB	LF	GR	FL	59.2	S2	N
141	141	ROW	683143.9	5309899	61	61	WB	LF	BO	FL	1.0	N	N
142	142	ROW	683747.6	5309927	196	196	WB	LF	DS	FL	1.0	N	N
143	143	ROW	684885.6	5309980	73	73	WC	LF	DS	FL	59.2	S2	N
144	144	ROW	685352.6	5310001	61	61	WB	LF	BO	FL	59.2	S2	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
145	145	ROW	685538.8	5310010	29	29	WB	LC	BO	FL	59.2	S2	N
146	146	ROW	685699.1	5310017	26	27	WC	LF	DS	RI	59.2	S2	Y
147	147	ROW	685946.4	5310029	30	30	WB	LF	BO	FL	59.2	S2	N
148	148	ROW	686316.2	5310046	17	21	WC	LF	CT	RI	40.8	S1	Y
149	149	ROW	686820.9	5310070	188	188	WB	LF	BO	FL	3.4	S1	N
150	150	ROW	687216.4	5310090	1	8	WC	LF	CS	FL	3.4	S1	N
151	151	ROW	687643.8	5310111	7	7	WB	LF	TB	FL	3.4	S1	N
152	152	ROW	687857.7	5310121	26	26	WB	LF	TB	FL	3.4	S1	N
153	153	ROW	688213.7	5310138	40	40	WB	LF	GR	FL	3.4	S1	N
154	154	ROW	689747.8	5310211	20	20	WB	LC	BO	FL	1.5	N	N
155	155	ROW	690037.3	5310225	35	35	WB	LC	BO	FL	1.5	N	N
156	156	ROW	691372.8	5310287	45	45	WB	LF	GR	FL	1.5	N	N
157	157	ROW	691588.7	5310296	54	54	WB	LF	BO	FL	3.2	S1	N
158	158	ROW	691767.2	5310305	10	10	WB	LF	BO	FL	3.2	S1	N
159	159	ROW	692048.6	5310318	160	160	WB	LC	GR	FL	3.2	S1	N
160	160	ROW	692210.7	5310325	18	18	WB	LC	BO	FL	3.2	S1	N
161	161	ROW	692506.7	5310338	5	8	WC	LC	DS	FL	3.2	S1	N
162	162	ROW	692589.5	5310342	32	32	WB	LC	DS	FL	3.2	S1	N
163	163	ROW	693083.1	5310365	1	1	WC	LF	BO	FL	785.7	I1	N
164	164	ROW	693362	5310378	133	138	WB	LC	BO	FL	785.7	I1	N
165	165	ROW	693615	5310390	33	33	WB	LF	BO	FL	785.7	I1	N
166	166	ROW	693919.3	5310405	122	129	WB	LC	BO	FL	785.7	I1	N
167	167	ROW	694230.5	5310419	10	10	WB	LC	GR	FL	785.7	I1	N
168	168	ROW	694305.5	5310423	19	78	WB	LC	DS	FL	785.7	I1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
169	169	ROW	694462.2	5310430	13	16	WC	LC	DS	FL	785.7	I1	Y
170	170	ROW	694647.4	5310439	18	18	WB	LF	BO	FL	785.7	I1	N
171	171	ROW	694881.8	5310449	38	38	WB	LC	BO	FL	785.7	I1	N
172	172	ROW	695133.8	5310461	49	49	WB	LC	GR	FL	785.7	I1	N
173	173	ROW	695605.8	5310484	13	13	WB	LC	GR	FL	785.7	I1	N
174	174	ROW	695786.5	5310493	63	63	WB	LF	DS	FL	785.7	I1	Y
175	175	ROW	695929.3	5310500	7	12	WC	LF	GR	RI	785.7	I1	N
176	176	ROW	696140.9	5310510	19	19	WB	LF	GR	FL	785.7	I1	N
177	177	ROW	697060.5	5310554	143	143	WB	LF	BO	FL	785.7	I1	N
178	178	ROW	698231.1	5310609	149	149	WB	LF	GR	FL	785.7	I1	N
179	179	ROW	698927.4	5310701	66	66	WB	LF	BO	FL	785.7	I1	N
180	180	ROW	699659	5310876	1	1	WC	LF	DS	DS	785.7	I1	N
181	181	ROW	700625.6	5311104	0	1	WC	LF	DS	DS	785.7	I1	N
182	182	ROW	703595.9	5311813	62	66	WC	LC	DT	RA	785.7	I1	Y
183	183	ROW	704866.3	5311375	233	233	WB	LF	CT	FL	3.0	S1	N
184	184	ROW	707709.3	5310179	12	12	WB	LF	BO	FL	0.6	N	N
185	185	ROW	707849	5310123	55	55	WB	LF	DS	FL	0.6	N	N
186	186	ROW	708248.5	5309953	0	1	WC	LF	DT	DS	0.4	N	N
187	187	ROW	710410.8	5308620	6	10	WC	LC	DT	RI	13.1	S1	Y
188	188	ROW	711007	5308254	1	1	WC	LF	DT	DS	0.3	N	N
189	189	ROW	711283	5308079	0	1	WC	LF	DT	DS	0.2	N	N
190	190	ROW	712161.1	5307825	19	20	WC	LF	CS	RI	181.4	S2	Y
191	191	ROW	713240.8	5307685	4	8	WC	LC	DS	DS	4.4	S1	N
192	192	ROW	714314.3	5307508	1	1	WC	LF	DS	DS	1.8	N	N

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193	193	ROW	714728	5307750	4	4	WC	LF	GR	DS	1.8	N	N
194	194	ROW	714833.5	5307772	1	1	WC	LF	DS	DS	1.8	N	N
195	195	ROW	715073.1	5307740	0	1	WC	LF	DS	DS	1.8	N	N
196	196	ROW	716377	5307583	1	1	WC	LF	DT	FL	0.8	N	N
197	197	ROW	717497.9	5307447	0	1	WC	LF	TB	DS	0.3	N	N
198	198	ROW	717755.3	5307418	0	1	WC	LF	TB	DS	0.5	N	N
199	199	ROW	718119.3	5307375	10	22	WC	LF	CT	RA	9.7	S1	N
200	200	ROW	718474.5	5307327	8	32	WC	LC	CT	RA	89.5	S2	Y
201	201	ROW	719514.3	5306791	104	115	WB	LF	BO	FL	89.5	S2	N
202	202	ROW	720388.4	5306341	19	35	WB	LF	BO	DS	89.5	S2	N
203	203	ROW	721085.6	5305982	36	39	WB	LF	BO	FL	4.5	S1	N
204	204	ROW	721839.9	5305592	4	35	WB	LF	GR	FL	4.5	S1	N
205	205	ROW	722893	5305045	2	3	WC	LF	DS	DS	3.9	S1	Y
206	206	ROW	723123.5	5304928	40	40	WB	LF	BO	DS	3.9	S1	N
207	207	ROW	723429.3	5304791	77	77	WB	LF	TB	DS	3.9	S1	N
208	208	ROW	723898.4	5304758	16	16	WB	LF	BO	DS	3.9	S1	N
209	209	ROW	725715.5	5304499	37	40	WC	LF	DS	RI	63.5	S2	Y
210	210	ROW	727189.3	5303315	1	1	WC	LF	BO	FL	0.4	N	N
211	211	ROW	727067.3	5302554	1	2	WC	LF	DT	FL	0.2	N	N
212	212	ROW	727514.5	5302019	15	15	WB	LF	DT	FL	0.9	N	N
213	71	Ford	593295	5314304	0	1	WC	LF	DS	FL	1.12	N	N
214	70	Ford	593582.6	5314182	0	1	WC	LF	DS	FL	1.19	N	N
215	69	Ford	596164.5	5312978	13	19	WC	LF	CT	FL	39.99	S1	N
216	68	Ford	598200.1	5312500	4	4	WC	LF	DS	FL	23.75	S1	N

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217	67	Ford	598412.8	5312456	1	1	WC	LF	DS	FL	23.75	S1	N
218	66	Ford	600585.6	5312028	0	1	WC	LF	DS	FL	512.5	I1	N
219	65	Ford	604505	5311198	11	11	WC	LF	DS	FL	13.17	S1	N
220	64	Ford	605603.1	5311023	5	5	WC	LF	CT	FL	2.98	S1	N
221	63	Ford	606916.3	5310975	0	0	WC	NA	DT	DS	0.44	N	N
222	62	Ford	607482.5	5310844	3	3	WC	LF	GR	DS	0.35	N	N
223	61	Ford	607841.1	5311001	0	1	WC	LF	GR	DS	0.47	N	N
224	60	Ford	608729	5310914	28	39	WC	LF	DS	FL	1.76	N	N
225	59	Ford	608897.5	5310788	11	2	WC	LF	CS	FL	1.73	N	N
226	58	Ford	609631.6	5311171	44	3	WC	LF	CT	FL	113.6	S2	N
227	57	Ford	609769.6	5311083	22	22	WC	LF	DS	RI	113.6	S2	N
228	56	Ford	610195.8	5310941	33	33	WC	LF	DT	FL	113.6	S2	N
229	55	Ford	611527.8	5311047	1	1	WC	LF	DS	DS	113.6	S2	N
230	54	Ford	612277.5	5311056	6	6	WC	LC	DS	FL	113.6	S2	N
231	53	Ford	613171.2	5311146	8	8	WC	LF	CT	FL	113.6	S2	N
232	52	Ford	614277.7	5311166	5	5	WC	LF	DS	FL	14.31	S1	N
233	51	Ford	615318.9	5311153	14	14	WC	LF	DS	FL	14.31	S1	N
234	50	Ford	617111.5	5311108	60	75	WC	LF	CT	FL	999.4	I1	N
235	49	Ford	618106.2	5311173	1	1	WC	LF	DS	FL	999.4	I1	N
236	48	Ford	623150	5311208	24	30	WC	LC	CS	FL	999.4	I1	Y
237	47	Ford	623355.6	5311029	29	32	WC	LC	CT	FL	999.4	I1	Y
238	46	Ford	625397.4	5310778	5	5	WC	LC	DS	FL	999.4	I1	N
239	45	Ford	626504.1	5310797	3	3	WC	NA	DS	DS	999.4	I1	N
240	44	Ford	627031.6	5310261	10	11	WC	LF	DT	FL	999.4	I1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
241	43	Ford	628865.3	5309703	1	1	WC	NA	DT	DS	999.4	I1	N
242	42	Ford	631504.8	5310238	3	3	WC	LC	DS	FL	999.4	I1	Y
243	41	Ford	631572.3	5310248	2	2	WC	NA	DS	DS	999.4	I1	N
244	40	Ford	633788.9	5310268	7	7	WC	LC	DS	FL	999.4	I1	Y
245	39	Ford	636672.7	5310224	23	23	WC	LC	BO	FL	999.4	I1	Y
246	37	Ford	637104.3	5310241	5	5	WC	LC	DS	FL	999.4	I1	Y
247	38	Ford	637125.7	5310031	37	37	WC	LF	CT	FL	999.4	I1	N
248	36	Ford	638656.1	5310368	7	7	WC	LC	DS	FL	999.4	I1	Y
249	35	Ford	639917.8	5310345	45	45	WC	LF	GR	FL	999.4	I1	N
250	34	Ford	641026.4	5310211	6	6	WC	LF	BO	FL	999.4	I1	N
251	33	Ford	642206.4	5310074	9	9	WC	LC	GR	FL	999.4	I1	N
252	32	Ford	642449.4	5310088	6	6	WC	LF	CT	FL	999.4	I1	N
253	31	Ford	643965.6	5310061	5	5	WC	LC	GR	FL	4.7	S1	N
254	30	Ford	644178.3	5309967	4	4	WC	LF	BO	FL	2.97	S1	N
255	29	Ford	644226.9	5310251	4	4	WC	LF	BO	FL	2.97	S1	N
256	28	Ford	644805.4	5310161	9	9	WC	LC	BO	FL	2.22	N	N
257	27	Ford	646025.8	5310034	7	7	WC	LF	BO	FL	1.62	N	N
258	26	Ford	646076.3	5309933	13	13	WC	LF	BO	RI	1.62	N	N
259	24	Ford	646655.2	5310084	13	13	WC	LF	DS	FL	5.73	S1	Y
260	25	Ford	646722.7	5309826	5	6	WC	LC	DS	FL	5.73	S1	Y
261	23	Ford	646926.7	5310047	6	6	WC	LF	BO	FL	9.09	S1	N
262	22	Ford	648143.6	5309688	15	18	WC	LF	DS	RI	39.5	S1	Y
263	21	Ford	650534.9	5309861	4	4	WC	LF	BO	FL	115.4	S2	N
264	20	Ford	651387	5309637	7	7	WC	LC	GR	FL	115.4	S2	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
265	19	Ford	651525.7	5309390	2	2	WC	LF	BO	FL	115.4	S2	N
266	18	Ford	652758.4	5309557	29	38	WC	LC	DS	RI	115.4	S2	Y
267	17	Ford	653040.7	5309532	5	9	WC	LC	DS	RI	24.6	S1	Y
268	16	Ford	654084.8	5309520	7	1	WC	LC	BO	FL	1.11	N	N
269	15	Ford	655178.8	5309415	1	1	WC	LF	BO	FL	1.01	N	N
270	14	Ford	655330.8	5309379	7	7	WC	LF	BO	FL	1.01	N	N
271	13	Ford	655637.9	5309323	27	27	WC	LF	CS	FL	13.8	S1	Y
272	88	Ford	657732.6	5309270	12	12	WC	LC	DT	FL	626.5	I1	Y
273	87	Ford	659130.1	5309169	11	6	WB	LC	BO	FL	626.5	I1	N
274	86	Ford	659277.3	5309219	5	1	WC	LC	DS	FL	626.5	I1	Y
275	85	Ford	660680.9	5309446	50	50	WC	LF	DT	FL	626.5	I1	N
276	84	Ford	661080.4	5309148	1	1	WC	LF	BO	FL	626.5	I1	N
277	83	Ford	662291.7	5309102	18	10	WB	LF	BO	FL	626.5	I1	N
278	82	Ford	662416.5	5309103	58	58	WB	LF	BO	FL	626.5	I1	N
279	81	Ford	663206.1	5309011	6	2	WB	LF	BO	FL	626.5	I1	N
280	80	Ford	664098	5309153	4	4	WC	LC	DS	DS	626.5	I1	N
281	79	Ford	664422.5	5309215	20	20	WB	LF	BO	FL	626.5	I1	N
282	78	Ford	664950.8	5309381	3	5	WC	LF	BO	FL	626.5	I1	N
283	77	Ford	665329.1	5309250	2	2	WB	LF	BO	FL	626.5	I1	N
284	76	Ford	666495.9	5309320	5	2	WC	LF	DS	FL	626.5	I1	Y
285	75	Ford	666961.2	5309339	4	4	WB	LF	BO	FL	626.5	I1	N
286	74	Ford	667525.2	5309202	24	5	WB	LF	DS	FL	626.5	I1	N
287	73	Ford	668392	5309455	16	16	WB	LF	BO	FL	1.09	N	N
288	72	Ford	669498	5309349	24	60	WC	LF	DS	FL	70.2	S2	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
289	71	Ford	669720.3	5309442	3	13	WC	LF	BO	FL	0.65	N	N
290	70	Ford	670113.9	5309400	4	4	WC	LF	BO	FL	0.65	N	N
291	68	Ford	671274.7	5309468	11	11	WC	LC	BO	FL	0.89	N	N
292	69	Ford	671312.9	5309511	3	3	WC	LF	CS	FL	0.89	N	N
293	67	Ford	672118.4	5309104	5	5	WC	LC	CS	RI	2.64	S1	N
294	66	Ford	672467.7	5309038	14	14	WB	LC	BO	FL	2.64	S1	N
295	65	Ford	672700.8	5309542	3	3	WC	LF	BO	FL	2.64	S1	N
296	64	Ford	672831.5	5309542	3	3	WC	LF	BO	FL	2.64	S1	N
297	63	Ford	674765.1	5309553	4	4	WC	LC	GR	FL	2.51	N	N
298	61	Ford	675066.5	5309610	10	10	WC	LC	BO	FL	2.51	N	N
299	62	Ford	675543.7	5309615	21	2	WC	LF	GR	FL	0.51	N	N
300	60	Ford	675702.2	5309594	1	1	WB	LF	BO	FL	0.51	N	N
301	59	Ford	676019.4	5309692	21	2	WC	LF	DS	FL	0.51	N	N
302	58	Ford	676552.1	5309691	1	1	WC	LF	GR	FL	0.51	N	N
303	57	Ford	677256.1	5309663	15	15	WB	LF	BO	FL	16.8	S1	N
304	56	Ford	678010.2	5309707	2	2	WB	LF	BO	FL	16.8	S1	N
305	55	Ford	678360.2	5309688	23	23	WC	LF	GR	FL	16.8	S1	N
306	54	Ford	678729.3	5309718	4	4	WC	LF	DS	FL	16.8	S1	N
307	53	Ford	679080.2	5309763	31	31	WC	LF	DS	DS	16.8	S1	N
308	52	Ford	679588.2	5309800	20	66	WB	LC	DS	FL	16.8	S1	Y
309	51	Ford	679849.3	5309779	28	12	WC	LF	DS	FL	16.8	S1	Y
310	50	Ford	680120	5309805	21	21	WC	LF	GR	DS	16.8	S1	N
311	49	Ford	680951.8	5309724	3	3	WC	LF	GR	DS	16.8	S1	N
312	48	Ford	681471.7	5309961	52	52	WB	LF	GR	FL	59.2	S2	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
313	47	Ford	683108.4	5309906	68	68	WB	LF	BO	FL	0.96	N	N
314	46	Ford	683656.1	5309994	37	4	WC	LC	DS	FL	0.96	N	N
315	45	Ford	684495.7	5310037	15	15	WB	LF	BO	FL	59.2	S2	N
316	44	Ford	684772.1	5310115	30	30	WB	LF	GR	FL	59.2	S2	N
317	43	Ford	685516.4	5310080	32	32	WC	LF	DS	FL	59.2	S2	N
318	42	Ford	686345.4	5310300	19	19	WC	LF	DS	FL	40.8	S1	N
319	41	Ford	686729.5	5310159	14	2	WC	LF	GR	FL	3.41	S1	N
320	40	Ford	687283.5	5310042	4	1	WC	LF	CS	FL	3.41	S1	N
321	39	Ford	687655.6	5310164	6	6	WC	LF	GR	FL	3.41	S1	N
322	38	Ford	691394.9	5310357	6	6	WC	LF	BO	FL	1.53	N	N
323	37	Ford	692112.7	5310687	9	9	WC	LC	DS	FL	3.2	S1	N
324	36	Ford	692487.4	5310410	6	6	WC	LC	GR	FL	3.2	S1	N
325	35	Ford	694467.8	5310398	15	15	WC	LF	DS	FL	785.7	I1	N
326	34	Ford	695803.4	5310545	1	1	WC	LF	DS	FL	785.7	I1	Y
327	33	Ford	695902.7	5310498	21	21	WC	LF	DS	RI	785.7	I1	Y
328	32	Ford	697627.5	5308655	0	0	WC	NA	NA	NA	785.7	I1	N
329	31	Ford	698159.3	5310468	1	1	WC	LF	BO	FL	785.7	I1	N
330	30	Ford	698314.6	5310523	14	14	WC	LF	CS	FL	785.7	I1	N
331	29	Ford	699666.6	5310972	2	2	WC	LF	DS	FL	785.7	I1	Y
332	27	Ford	700500.3	5311111	1	1	WC	LF	GR	DS	785.7	I1	N
333	28	Ford	700662.5	5311029	0	0	WC	LF	DS	DS	785.7	I1	N
334	24	Ford	704869.3	5311426	14	14	WB	LC	DS	FL	2.96	S1	N
335	25	Ford	704929.5	5311420	15	15	WB	LF	BO	FL	2.96	S1	N
336	26	Ford	704964.2	5311089	5	5	WC	LF	CS	FL	2.96	S1	N

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
337	23	Ford	706888	5310692	0	0	WC	NA	CT	DS	13.07	S1	N
338	22	Ford	707782	5310194	5	5	WC	LF	LI	FL	0.57	N	N
339	21	Ford	708285.8	5310045	19	19	WB	LF	BO	FL	0.35	N	N
340	19	Ford	709462.4	5308329	0	1	WC	NA	CT	DS	13.07	S1	N
341	20	Ford	709734.4	5308955	4	4	WC	LF	DT	FL	13.07	S1	N
342	18	Ford	710498.4	5308642	9	9	WC	LF	DS	FL	13.07	S1	Y
343	17	Ford	711041.9	5308353	0	1	WC	NA	DS	DS	0.33	N	N
344	16	Ford	711319.8	5308186	0	0	WC	NA	GR	DS	0.22	N	N
345	15	Ford	713304.6	5307796	6	7	WC	LC	CT	RI	4.4	S1	N
346	14	Ford	714631	5307908	2	2	WC	LF	BO	FL	1.8	N	N
347	13	Ford	714880.7	5307836	0	1	WC	LF	GR	DS	1.8	N	N
348	12	Ford	715049	5307846	0	1	WB	LF	BO	FL	1.8	N	N
349	11	Ford	716367.4	5307647	0	1	WC	LF	GR	DS	0.77	N	N
350	10	Ford	717475.8	5307500	1	1	WC	LF	BO	FL	0.26	N	N
351	9	Ford	717711.1	5307512	1	1	WC	LF	DS	FL	0.45	N	N
352	8	Ford	718106.4	5307440	11	11	WC	LC	DS	RI	9.67	S1	Y
353	7	Ford	718622.9	5307495	20	38	WC	LF	CT	RI	89.49	S2	Y
354	6	Ford	719107.4	5307054	2	2	WC	LF	BO	FL	89.49	S2	N
355	5	Ford	719518.4	5306864	11	11	WC	LF	GR	FL	89.49	S2	N
356	4	Ford	719555.2	5306855	4	4	WC	LF	GR	FL	89.49	S2	N
357	3	Ford	721826.6	5305722	7	7	WC	LF	GR	FL	4.52	S1	N
358	2	Ford	722948.8	5305186	10	10	WC	LF	DS	FL	3.93	S1	N
359	1	Ford	725758.1	5304599	41	41	WC	LF	DS	FL	63.49	S2	N

Summary of Previous Study Results from Come By Chance to Chapel Arm – AMEC (2010)

Map ID	ID	Crossing Type	Easting	Northing	Wetted Width (m)	Channel Width (m)	Crossing Type (WC/WB)	Dominant Substrate	Riparian	Flow Morphology	Watershed Size (km^2)	Watershed Category	Potential for Fish Habitat (Y/N)
P500	P500	ROW	728033	5301489	1.0	55.1	WC	LF	N/A	DS	N/A	N/A	N/A
P501	P501	ROW	728396	5299388	10.1	13.8	WC	LC	N/A	RI	N/A	N/A	N/A
P502	P502	ROW	729298	5295847	4.6	9.8	WC	LF	N/A	FL	N/A	N/A	N/A
P503	P503	ROW	729575	5294765	0.9	1.0	WC	LF	N/A	FL	N/A	N/A	N/A
P504	P504	ROW	730027	5292993	3.0	3.0	WC	LF	N/A	RI	N/A	N/A	N/A
P505	P505	ROW	730729	5290243	1.0	1.0	WC	LC	N/A	RI	N/A	N/A	N/A
P506	P506	ROW	734588	5281394	2.7	2.7	WC	LC	N/A	RI	N/A	N/A	N/A
P507	P507	ROW	737093	5278725	1.0	1.0	WC	LC	N/A	FL	N/A	N/A	N/A
P508	P508	ROW	738471	5277277	1.0	1.0	WC	LC	N/A	RI	N/A	N/A	N/A
P509	P509	ROW	741698	5276378	3.5	3.5	WC	LC	N/A	RI	N/A	N/A	N/A
P510	P510	ROW	742100	5276079	1.0	1.0	WC	LF	N/A	RI	N/A	N/A	N/A
P511	P511	ROW	743188	5275269	3.3	3.3	WC	LC	N/A	RI	N/A	N/A	N/A
P512	P512	ROW	743733	5274628	3.0	3.0	WC	LC	N/A	RI	N/A	N/A	N/A
P513	P513	ROW	745038	5272887	2.0	2.0	WC	LF	N/A	RI	N/A	N/A	N/A
P514	P514	ROW	745565	5272185	2.8	2.8	WC	LF	N/A	RI	N/A	N/A	N/A
P515	P515	ROW	745933	5271694	5.2	5.2	WC	LC	N/A	RI	N/A	N/A	N/A
P516	P516	ROW	746826	5270503	3.3	3.3	WC	LF	N/A	RI	N/A	N/A	N/A
P517	P517	ROW	747450	5269759	2.9	2.9	WC	LF	N/A	RI	N/A	N/A	N/A
P518	P518	ROW	747742	5269510	2.3	2.3	WC	LC	N/A	RI	N/A	N/A	N/A
P519	P519	ROW	748919	5268507	2.5	2.4	WC	LF	N/A	RI	N/A	N/A	N/A
P1000	P1000	ROW	737810	5277385	3.3	3.3	WC	LF	N/A	FL	N/A	N/A	N/A
P1001	P1001	ROW	733865	5282391	3.4	3.4	WC	LF	N/A	FL	N/A	N/A	N/A

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Appendix B

Map Atlas - Potential Water Crossings (1:50,000 scale)

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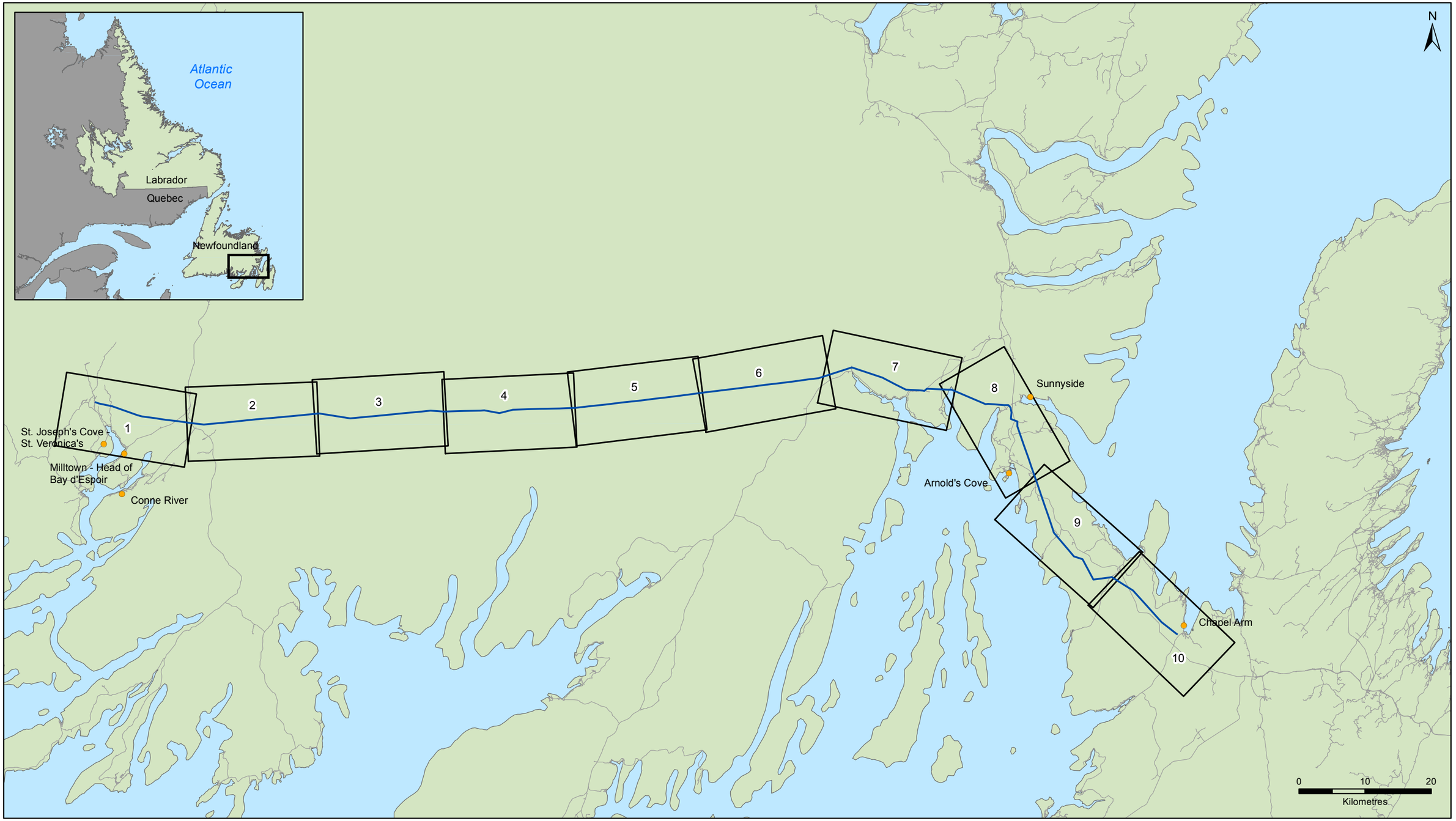
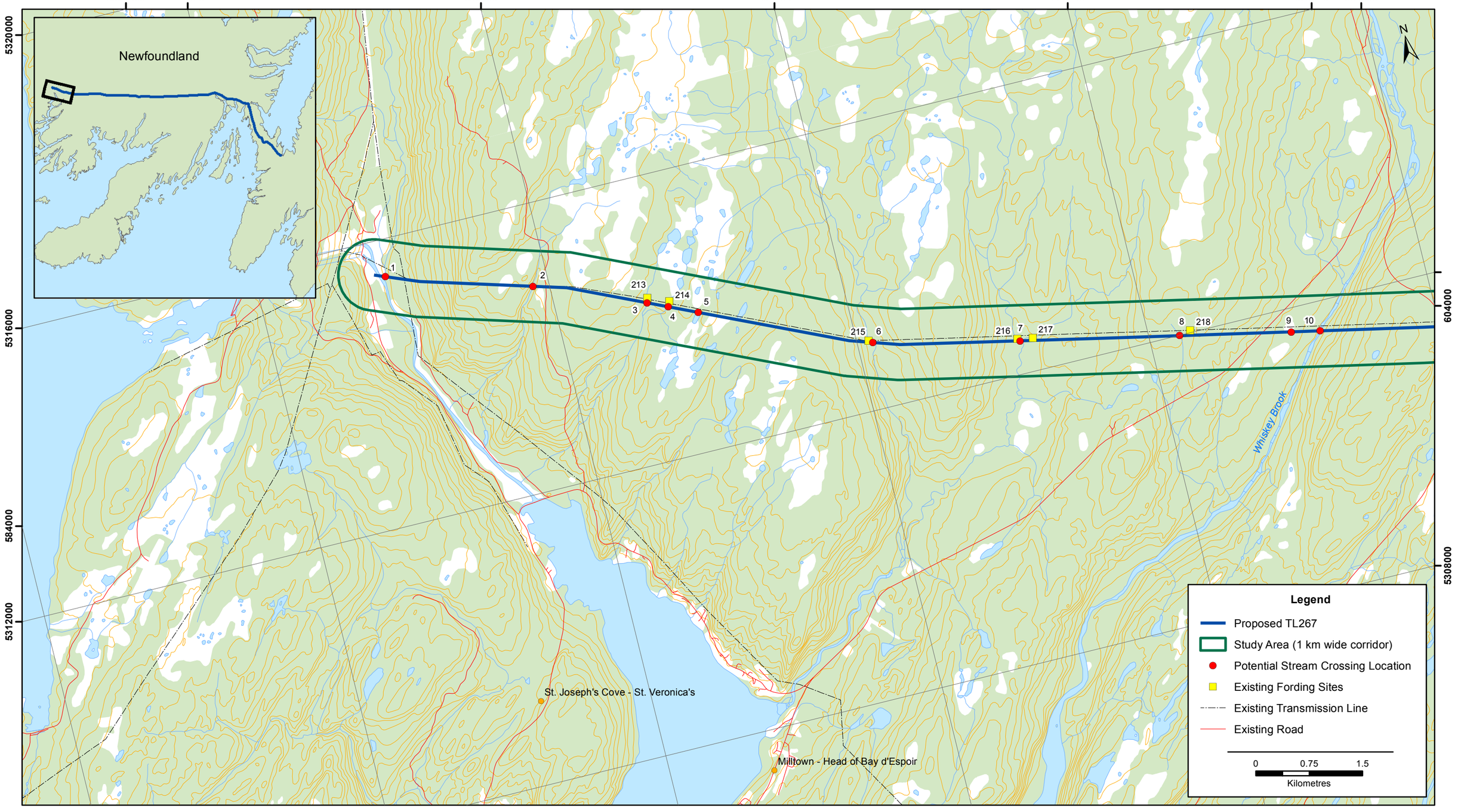


MAP INDEX

PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT



PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT

604000 608000 612000 616000 620000 5316000

5316000 5312000 5308000

Newfoundland

N

Medonnegonix Lake

Long Pond

River Pond

Western Pond

11 219 12 220 13 221 14 15 222 223 16 224 17 225 18 226 227 19 228 229 20 230 21 231 22 23 232 24 233 25 26 27 234 235 28 29 30 31 32 33

Legend

- Proposed TL267
- Study Area (1 km wide corridor)
- Potential Stream Crossing Location
- Existing Fording Sites
- Existing Transmission Line
- Existing Road

0 0.75 1.5

Kilometres

PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT

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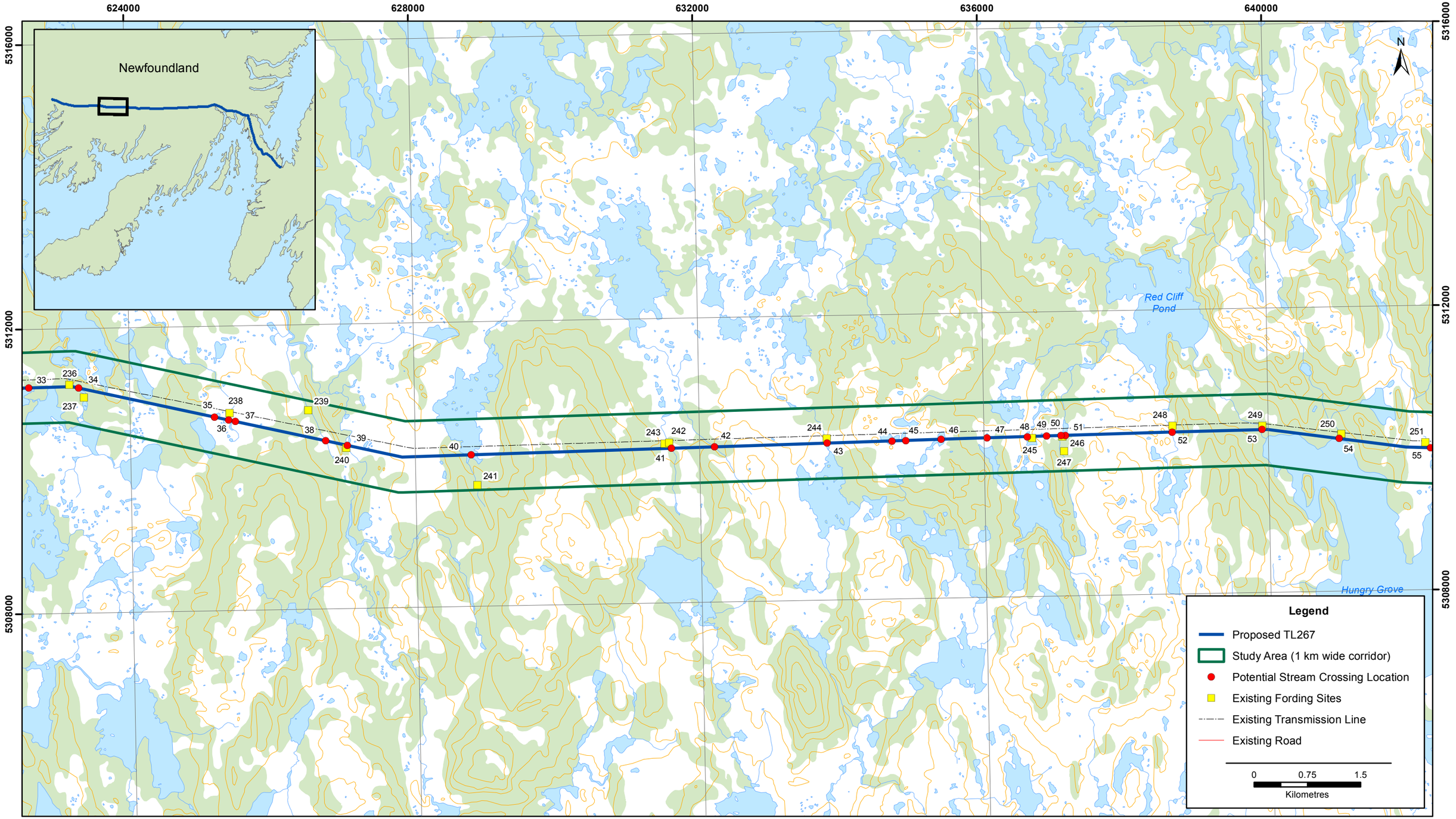
624000
628000
632000
636000
640000
5316000
5312000
5308000
N
Newfoundland
Red Cliff Pond
Hungry Grove
33
236
34
237
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238
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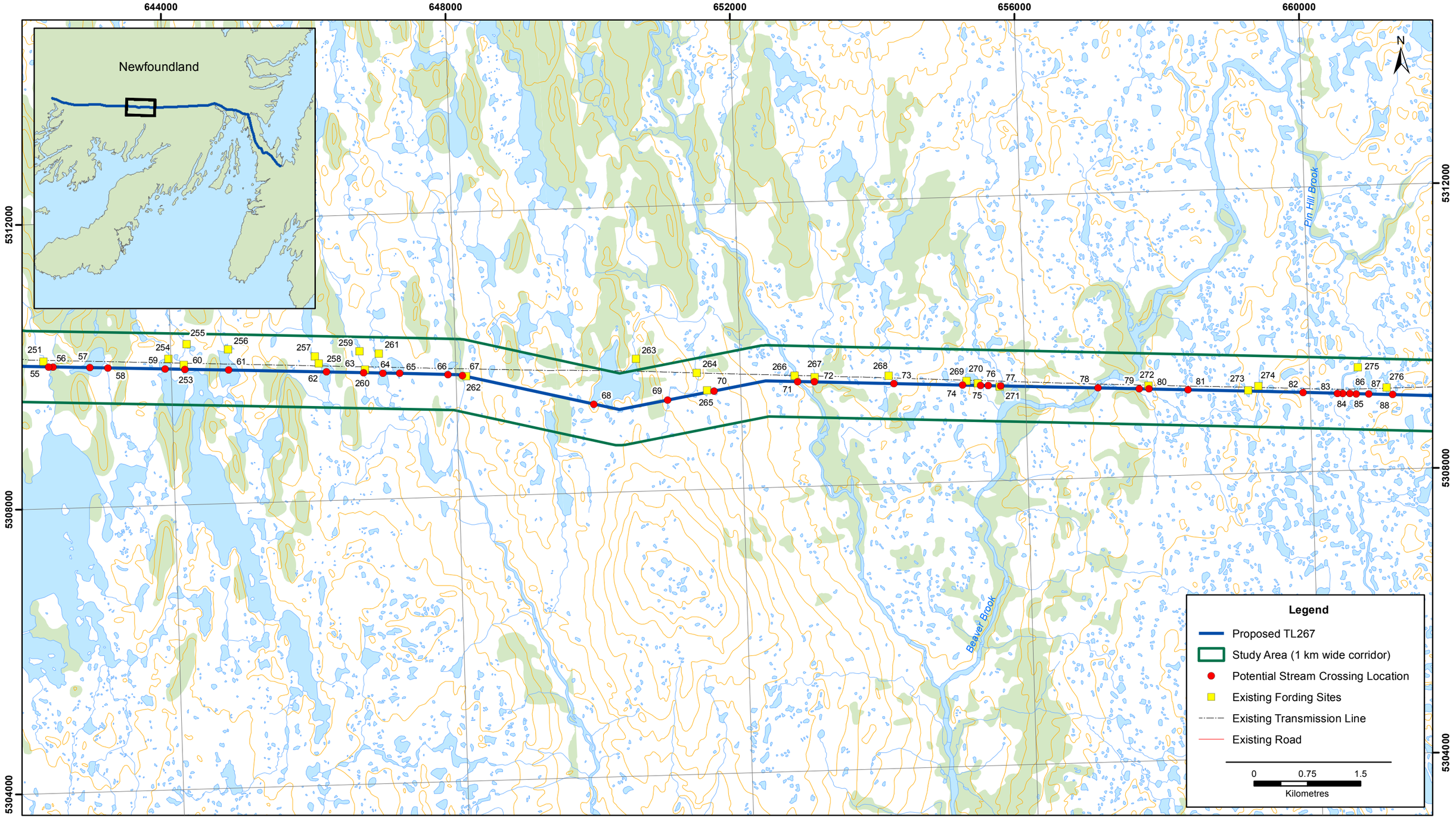
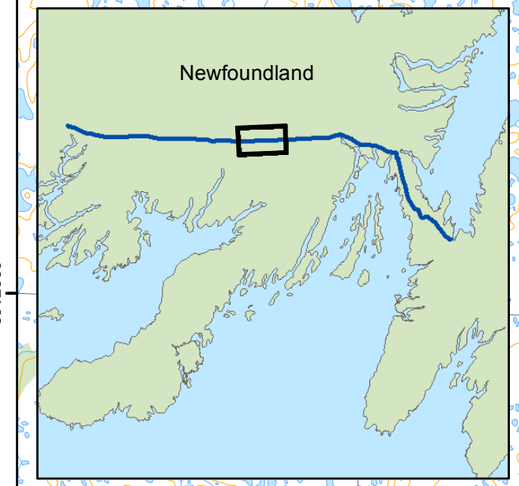
55
Legend
Proposed TL267
Study Area (1 km wide corridor)
Potential Stream Crossing Location
Existing Fording Sites
Existing Transmission Line
Existing Road
0
0.75
1.5
Kilometres



PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT

664000 668000 672000 676000 680000

5312000 5308000 5304000



N

Pin Hill Pond

Dunns Mountain Pond

76 277 278 91 92 93 89 90 279 280 94 95 281 96 282 97 283 98 99 100 284 101 285 102 103 104 286 105 287 106 107 108 288 109 110 111 113 112 289 114 115 116 290 117 118 291 292 119 120 293 121 122 295 294 123 296 124 297 125 298 126 299 127 300 128 301 129 302 303 130 304 131 305 132 306 133 307 134 308 309 135 310 136 137 138 311

Legend

- Proposed TL267
- Study Area (1 km wide corridor)
- Potential Stream Crossing Location
- Existing Fording Sites
- Existing Transmission Line
- Existing Road

0 0.75 1.5
Kilometres

PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT

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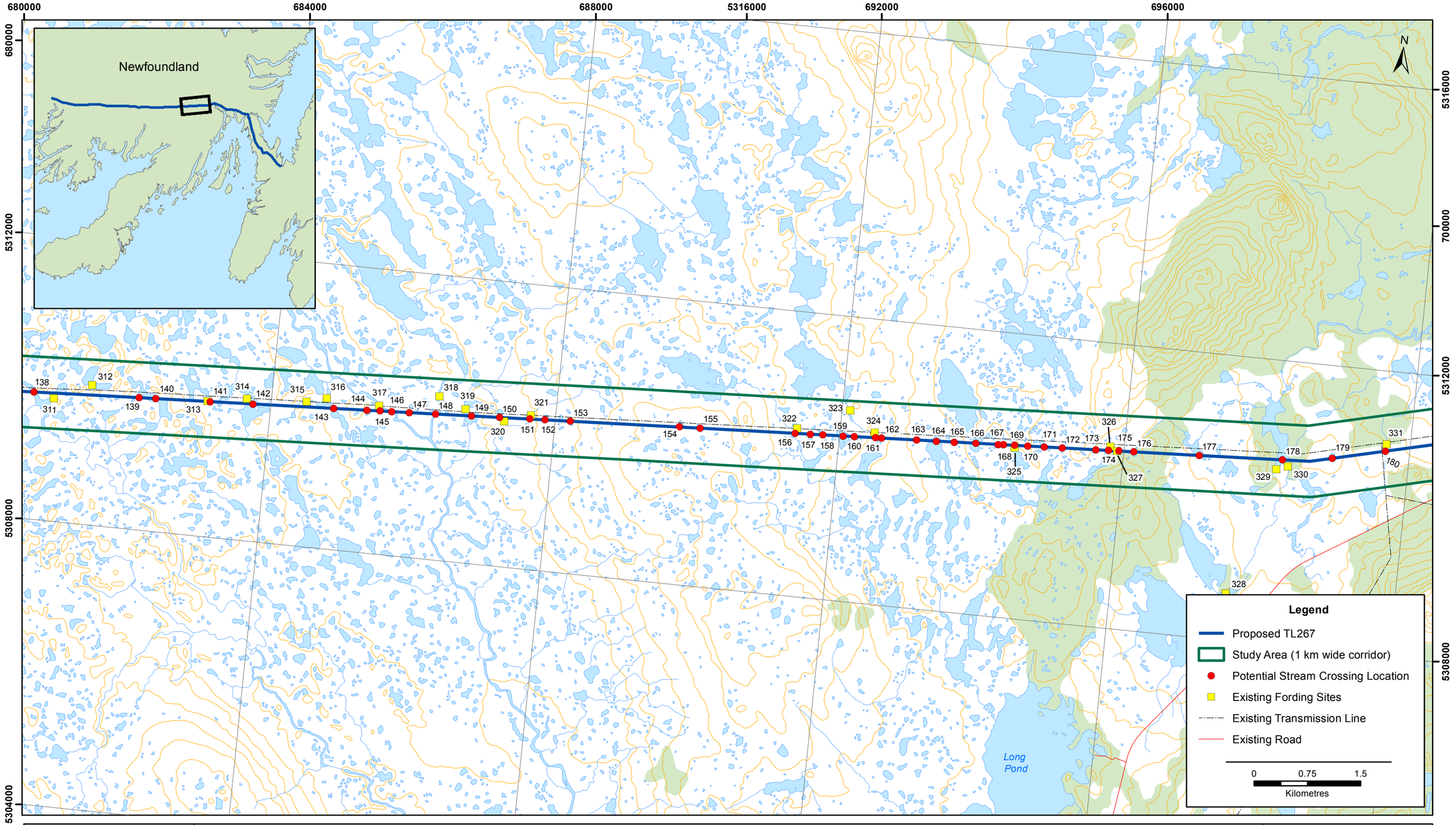
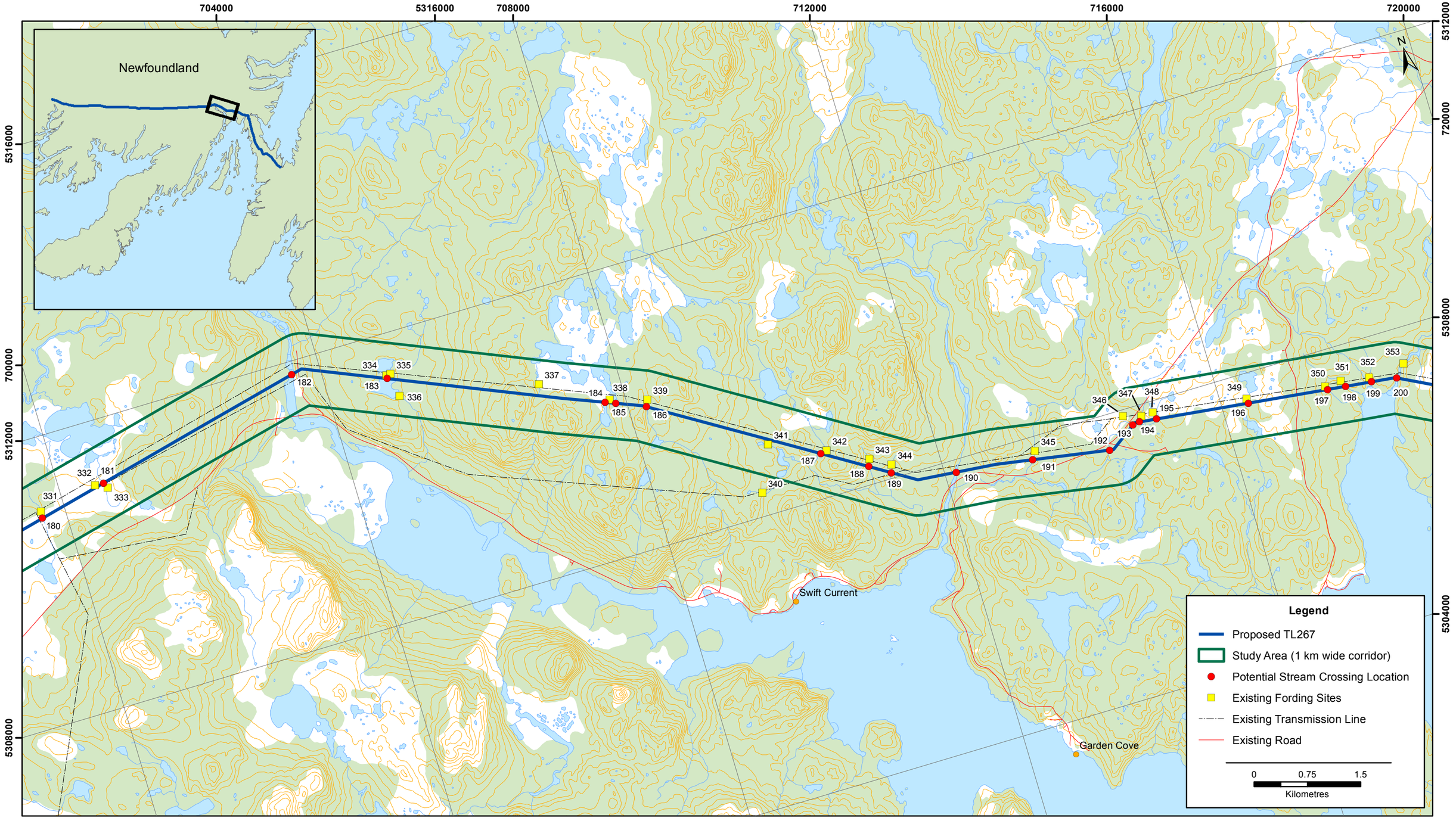


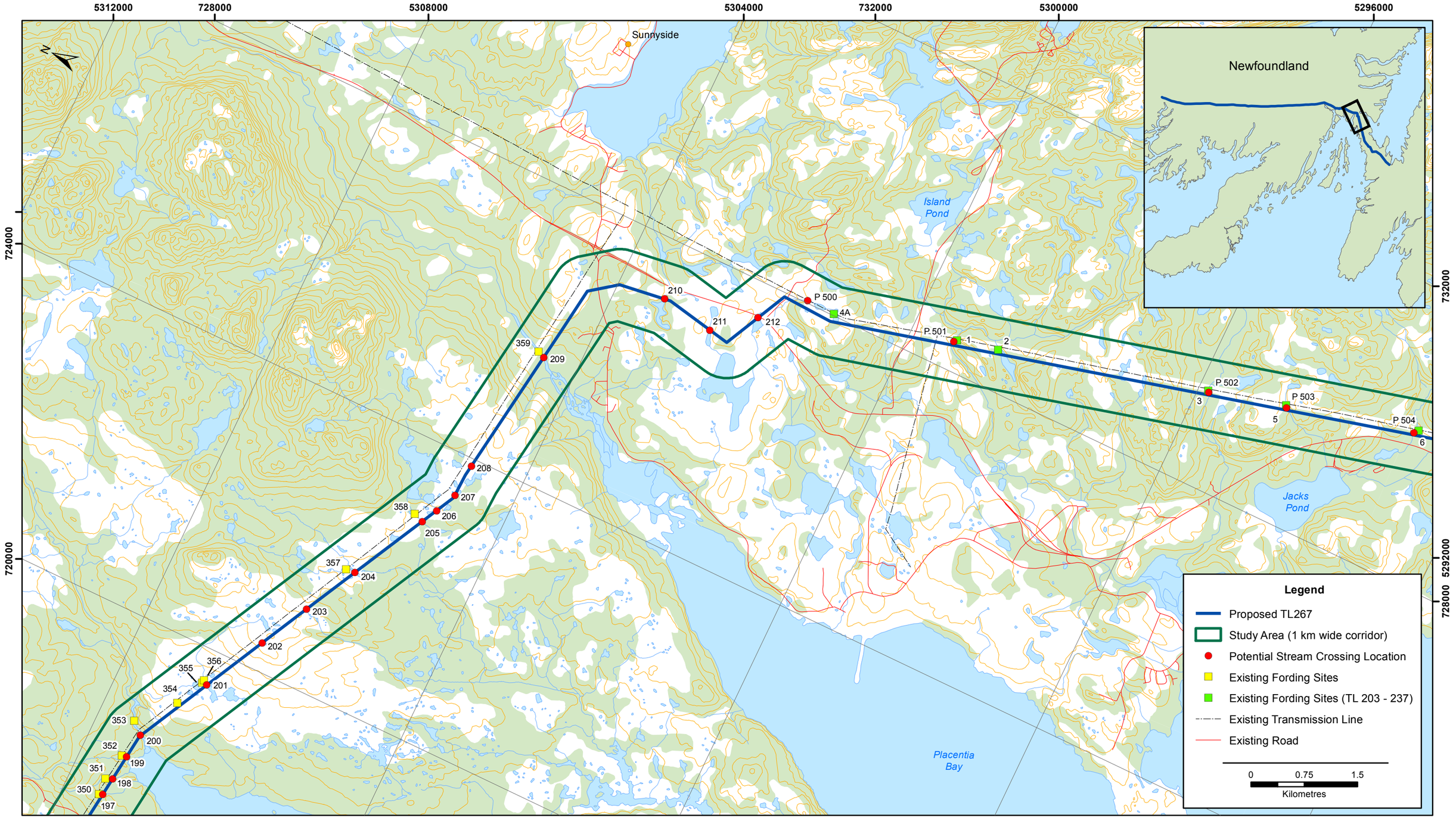
PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT

newfoundland labrador hydro
a nalcor energy company

amec foster wheeler



PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT


5312000
728000
5308000
5304000
732000
5300000
5296000
724000
720000
732000
728000
5292000
N
Sunnyside
Island Pond
Jacks Pond
Placentia Bay
Newfoundland
210
211
212
P 500
4A
P 501
1
2
P 502
3
P 503
5
P 504
6
359
209
208
207
358
206
205
357
204
203
202
356
355
201
354
353
200
352
199
351
198
350
197
Legend
Proposed TL267
Study Area (1 km wide corridor)
Potential Stream Crossing Location
Existing Fording Sites
Existing Fording Sites (TL 203 - 237)
Existing Transmission Line
Existing Road
0
0.75
1.5
Kilometres

732000 5292000 736000 5288000 740000 5284000 744000

728000 724000 744000 740000

N

Newfoundland

Chance Cove Pond

Chance Cove

Rocky Pond

Doe Hills Pond

Long Pond

Big Gull Pond

Placentia Bay

Southern Harbour

P 504 6 7 P 505 8 10 P 1001 11 12 12A P 506 NA 13 NA P 507 14 15 P 1000 P 508

Legend

- Proposed TL267
- Study Area (1 km wide corridor)
- Potential Stream Crossing Location
- Existing Fording Sites
- Existing Fording Sites (TL 203 - 237)
- Existing Transmission Line
- Existing Road

0 0.75 1.5
Kilometres

newfoundland labrador hydro a nalcor energy company

amec foster wheeler

5280000 748000 5276000 752000 5272000 756000

744000 740000 5276000 752000 5260000 5264000 56000

N

Norman's Cove - Long Cove

Chapel Arm

Newfoundland

P 509 19 P 510 20 P 511 21 P 512 22 23 P 513 24 P 514 25 P 515 26 P 516 27 P 517 28 P 518 P 519 29

Beaver Pond

Beaver Pond

Blue Gull Pond

Legend

- Proposed TL267
- Study Area (1 km wide corridor)
- Potential Stream Crossing Location
- Existing Fording Sites
- Existing Fording Sites (TL 203 - 237)
- Existing Transmission Line
- Existing Road

0 0.75 1.5
Kilometres

PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) - FRESHWATER ENVIRONMENT

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