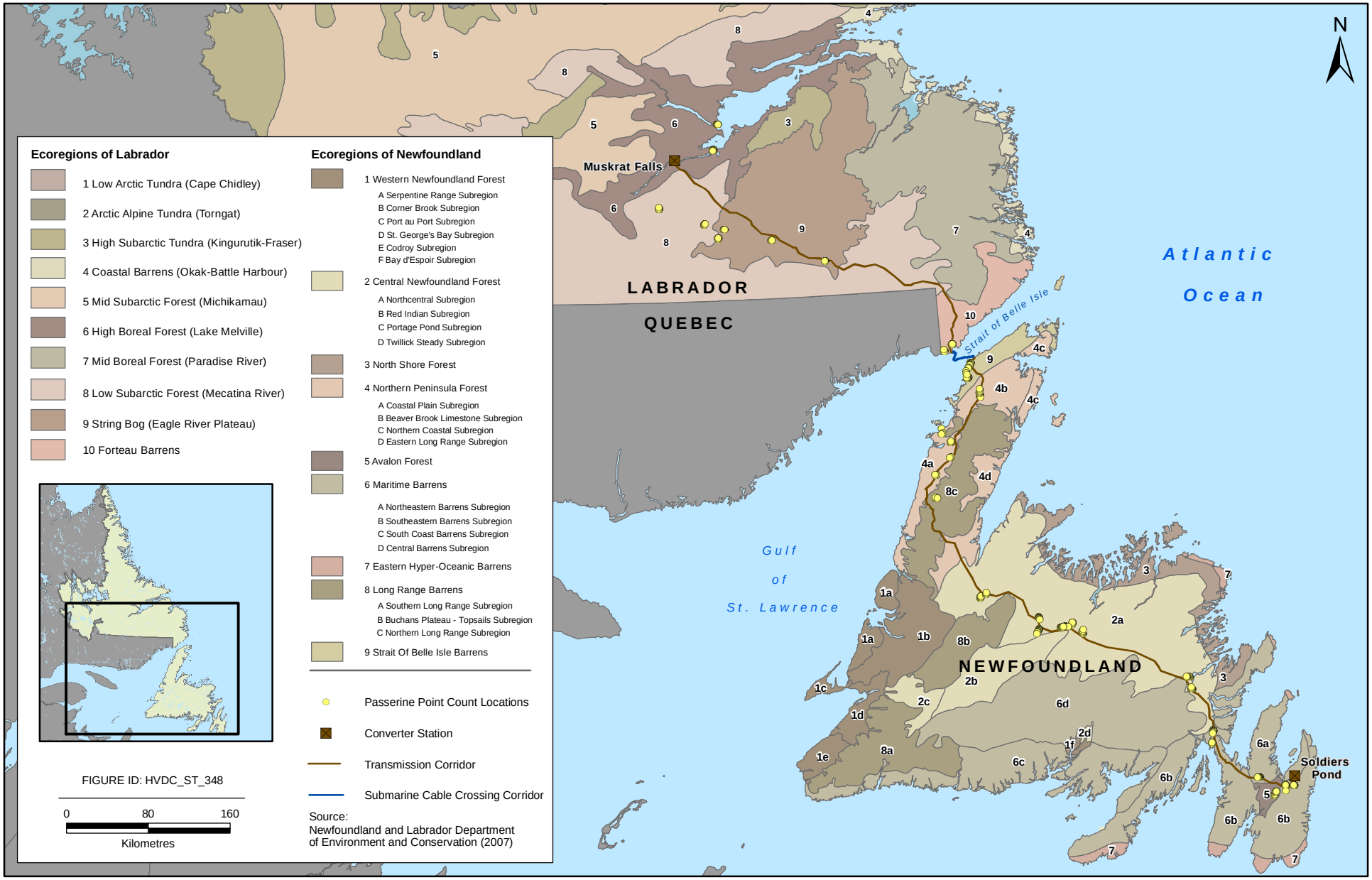


FIGURE 10.3.7-3

Passerine Survey Locations (2008)

AEK has been collected from consultation initiatives with Aboriginal groups in the Study Area (a summary of all Aboriginal consultation initiatives conducted for the Project can be found in Chapter 7 of the EIS). Sources of AEK include, but are not limited to, land use surveys and interviews, reviews of existing published and unpublished literature and through the provision of information to Nalcor by an the Aboriginal group or organization.

LEK was collected from consultation initiatives with various communities (a summary of all consultation with public stakeholders can be found in Chapter 8 of the EIS) including Open Houses and correspondence. A general literature and media search was also conducted.

10.3.7.3 Description of Avifauna

During 2008 surveys of the Study Area (as defined in the Component Study) (Stantec 2012b, 2010f), a total of 4,308 birds, representing 87 species, were recorded at 321 point counts along 33 transects. This included 57 passerine species, 19 waterbird species, five woodpecker species, four raptor species and two species classified as 'other'.

Due to the number of species that occur in the province, it is not practical or appropriate to look at each in detail. Therefore, representative species from each of the main groups of birds have been selected and considered further with respect to habitat use within the Study Area. Although birds may migrate along traditional corridors that overlap portions of the Study Area, exact routes for any given year cannot be determined with accuracy. Instead, information on habitat preferences and movement patterns of select species / groups are discussed generally and in the context of the geographic regions described above. In terms of spatial overlap with the Study Area, habitat use by avifauna during breeding is a key focus.

Table 10.3.7-1 identifies selected avian species, the breeding status of each species by geographic region of the Study Area, as well as habitat use and availability. Occurrence is based primarily on distribution maps provided by NatureServe Explorer (2010, internet site), with supplemental sources cited in the table as appropriate.

Table 10.3.7-1 also provides a description of the status of each species in relation to COSEWIC, *SARA* and the *NLESA*. In some cases, the representative species selected for each of the four avifauna groups are of special conservation concern (e.g., Harlequin Duck, Rusty Blackbird (*Euphagus carolinus*), Short-eared Owl (*Asio flammeus*). Given the importance of SSCC, an additional eight species known to occur in the province were considered. Of these, only two (i.e., Common Nighthawk (*chordeiles minor*) and Red Knot (*Calidris canutus rufa*) (Table 10.3.7-1) were considered to occur in the Study Area and are therefore discussed. Two species (i.e., Barn Swallow (*Hirundo rustica*) and Bobolink (*Dolichonyx oryzivorus*), listed by COSEWIC as threatened, occur in Newfoundland but are not known to occur in the Study Area.

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region

Avifauna Species	Status / Habitat Use and Availability[a]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Waterfowl					
Canada Goose (*Branta canadensis*)	Occurs throughout the province; has distinct habitat association (i.e., ribbed fens and fen-marsh complexes) (Goudie and Whitman 1987) and is representative of early nesting waterfowl. Primary Wetland habitat for this species occupies 1,198 km^2 (21%) of the Study Area in Labrador and 1,088 km^2 (10%) in Newfoundland. Note that the actual amount of primary habitat is likely lower than the areas calculated above, as the ELC completed for this Project distinguishes Wetland as a Habitat Type and Canada Goose prefers specific wetland types such as String Bogs that provide island nesting sites for breeding (Minaskuat Limited Partnership 2005a; Goudie and Whitman 1987).	Common[b]	Common	Common	Common
Harlequin Duck (*Histrionicus histrionicus)*	First designated as Endangered by COSEWIC in 1990 and currently listed as a species of Special Concern (Schedule 1 of *SARA*); harlequin duck is listed as Vulnerable under the *NLESA*. Distribution of this intensively surveyed species is based on Trimper et al. (2008) and Thomas (2008). It was not possible to assign a habitat quality rating for Harlequin Duck at the mapping scale necessary for this Project as their habitat requirements are based on small-scale and localized biophysical parameters such as availability of grassy areas on the banks of clear, fast-flowing rivers with rocky substrates.	On certain rivers	On certain rivers	Present[c]	—[d]
Surf Scoter *(Melanitta perspicillata)*	Not known to breed in Newfoundland, but widespread in Labrador. Representative of the late-nesting waterfowl group and has distinct habitat associations (preferring shallow and rocky lakes) (Savard and Lamothe 1991; Goudie and Whitman 1987). It was not possible to assign a habitat quality rating for Surf Scoter at the mapping scale necessary for this Project due to the highly specific and localized nature of preferred habitat features.	Common	—	—	—
American Black Duck (*Anas rubripes*)	An early-nesting species for the Island portion of the Study Area. This dabbling duck breeds in a wide variety of wetland habitats, and winters at inland ponds but primarily along the coast in salt water.	—	Present	Present	Present

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region (continued)

Avifauna Species	Status / Habitat Use and Availability[(a)]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Ring-necked Duck (*Aythya collaris*)	A late-nesting species on the Island portion of the Study Area. This diving duck prefers shallow, freshwater wetlands with a variety of aquatic vegetation.	—	Present	Present	Present
Passerines					
Olive-sided Flycatcher *(Contopus cooperi)*	Listed as Threatened under *SARA* (Schedule 1) and the *NLESA*. Given its primary association with specific and localized riparian and edge habitats, habitat quality indices for Olive-sided Flycatcher have not been calculated and / or mapped.	Present	Present	Present	Present
Grey-cheeked Thrush *(Catharus minimus)*	Listed as Vulnerable under the *NLESA.* Grey-cheeked Thrush have declined in Newfoundland (NLDEC 2010f); reports suggest a measurable decline in numbers on the Island between 1980 and 2003 (Dalley et al. 2005). Primary habitat for this species includes Conifer Forest, Conifer Scrub and Mixedwood Forest habitats that occupy 2,489 km^2 (43%) of the Study Area in Labrador and 3,730 km^2 (33%) in Newfoundland.	Present	Present	Present	Present
Barn Swallow (*Hirundo rustica*)	Listed by COSEWIC as Threatened, it is not yet on the SARA Schedule 1. Occurs in Newfoundland although not known to occur in the Study Area.	—	—	—	—
Bobolink (*Dolichonyx oryzivorus*)	Listed by COSEWIC as Threatened, it is not yet on the SARA Schedule 1. Occurs in Newfoundland although not known to occur in the Study Area.	—	—	—	—

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region (continued)

Avifauna Species	Status / Habitat Use and Availability[(a)]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Blackpoll Warbler *(Setophaga striata)*	Common throughout the province, but has a specific habitat preference for coniferous forests. One of the most common species identified during passerine surveys along the transmission corridor in 2008. Based on analyses of the Breeding Bird Survey data set, there is a long-term decline in the population in Newfoundland (–7.0%, $p < 0.001$). This same decline is not as pronounced throughout the remainder of the range (Hunt and Eliason 1999, internet site). Primary habitat includes Conifer Scrub, Cutover and Open Conifer Forest, as well as Wetland and Scrub / Heathland / Wetland habitat in some Ecoregions, indicating a possible range of values. Primary habitat occupies 2,397 km^2 (42%) of the Study Area in Labrador and 2,671 to 6,001 km^2 (24 to 53%) in Newfoundland.	Common	Common	Common	Common
Rusty Blackbird *(Euphagus carolinus)*	Listed as a species of Special Concern under *SARA* (Schedule 1) and as Vulnerable under the *NLESA*. Not regularly found throughout the Island but an established population can be found in central Newfoundland. Primary Wetland and Scrub / Heathland / Wetland habitat for this species occupies 1,198 km^2 (21%) of the Study Area in Labrador and 3,330 km^2 (30%) in Newfoundland.	Common	Infrequent[(e)]	Present	Infrequent
Red Crossbill *(Loxia curvirostra percna)*	Listed as Endangered under *SARA* (Schedule 1) and the *NLESA*. Found only in Newfoundland and has a specific habitat preference for mature forests. Although Red Crossbills are associated with mature coniferous forests, they have an irruptive behaviour and an ability to breed throughout the year in response to cone production. As such, habitat associations are difficult to identify or infer (EC 2006b).	—	Rare[(f)]	Rare	Infrequent

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region (continued)

Avifauna Species	Status / Habitat Use and Availability[(a)]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Swamp Sparrow *(Melospiza georgiana)*	These wetland sparrows show preference for a specific and relatively limited habitat type (i.e., riparian marsh habitat). As riparian marsh habitat is difficult to discern, Wetland and Scrub / Heathland / Wetland habitat was selected to represent primary habitat for these species, which occupies 1,198 km^2 (21%) of the Study Area in Labrador and 3,330 km^2 (30%) in Newfoundland. Primary habitat would likely be less.	Common	Common	Common	Common
Song Sparrow *(M. melodia)*		Infrequent	—	Common	Common
Lincoln's Sparrow *(M. lincolnii)*		Infrequent	Common	Common	Common
Savannah Sparrow *(Passerculus sandwichensis)*		Common	Common	Common	Common
Raptors					
Osprey *(Pandion haliaetus)*	Osprey is at the top of the food chain and an indicator of the status of lower trophic levels. Specific habitat requirements include tall trees near waterbodies, on islands in streams, or along the shores of smaller tributaries. At the scale of habitat maps, important micro-habitat features such as the presence of a suitable nest site and access to open water with available fish are not distinguishable. Therefore, habitat quality indices for Osprey have not been calculated and / or mapped.	Common	Common	Common	Common
Bald Eagle *(Haliaeetus leucocephalus)*	Bald Eagle is at the top of the food chain and an indicator of the status of lower trophic levels. Habitat requirements are based on small-scale, localized biophysical parameters. It was not possible to assign habitat quality ratings for Bald Eagle at the mapping scale necessary for this Project, as their habitat requirements are based on small-scale, localized biophysical parameters, similar to Osprey.	Infrequent	Infrequent	Infrequent	Infrequent

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region (continued)

Avifauna Species	Status / Habitat Use and Availability[(a)]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Short-eared Owl *(Asio flammeus)*	Listed as Vulnerable under *NLESA* and Special Concern under *SARA* (Schedule 3). Combined, primary habitat (Alpine Vegetated, Kalmia Lichen / Heathland and Lichen Heathland habitat) occupies approximately 341 km^2 (6%) of the Study Area in Labrador and 184 km^2 (<2%) in Newfoundland.	Infrequent	Infrequent	—	Infrequent
Upland Game Birds					
Ruffed Grouse *(Bonasa umbellus)*	Relatively limited distribution and more specialized habitat requirements than other upland game species, being closely associated with aspen (*Populus* sp.) habitats. Primary habitat (hardwood forest) for this species occupies 6 km^2 (<1%) in Labrador and was not identified in the ELC for Newfoundland (Stantec 2011g), although secondary habitat (consisting of Cutover, Mixedwood Forest, Wetland and Scrub / Heathland / Wetland habitats) would exist on the Island and support this species.	Common	Common	Common	Common
Willow Ptarmigan *(Lagopus lagopus)*	Found year-round in NL, Willow Ptarmigan is generally associated with low-lying tundra, especially in thickets of willow and alder.	Common	Common	Common	Common
Other Species of Special Conservation Status					
Barrow's Goldeneye *(Bucephala islandica)*	Listed as Vulnerable under the *NLESA* and Special Concern under *SARA* (Schedule 1). Numerous sightings in northern Labrador during moulting season (Schmelzer 2006b). Several authors suggest breeding in northern Labrador and in Newfoundland, but this remains unconfirmed (Eadie et al. 2000, internet site). The winter range of Barrow's Goldeneye includes coastal areas of Newfoundland (Eadie et al. 2000, internet site), where they winter primarily in marine habitats. Only one observation of this species has been recorded within the Study Area which was recorded at Arnold's Cove on the Avalon Peninsula (ACCDC 2010, internet site).	—	—	—	—

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region (continued)

Avifauna Species	Status / Habitat Use and Availability[(a)]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Piping Plover *(Charadrius melodus)*	Listed as Endangered under the NLESA and SARA (Schedule 1). No known records of Piping Plover in Labrador. Although potential breeding habitat is present along the coast, no known breeding sites for this species occur within the Study Area (Goossen et al. 2002).	—	—	—	—
Eskimo Curlew *(Numenius borealis)*	Listed as Endangered under the *NLESA* and *SARA* (Schedule 1). Sightings have been rare and this species may be extinct (IFWD, n.d.). The last confirmed nest in Canada was found over a century ago (EC 2010k, internet site) and the last confirmed sighting in the world was in 1960 (EC 2007).	—	—	—	—
Red Knot *(Calidris canutus)*	Listed as Endangered under the *NLESA* and designated the same by COSEWIC. Red Knot are not known to breed in the province but do stop over during their southward migration in the fall. They have been recorded along coastal areas, mostly on shorelines, sandflats, and salt marshes. Within the Study Area they are known to utilize coastal areas around the isthmus of the Avalon Peninsula, particularly Bellevue Beach (Garland and Thomas 2009). Red Knot have been reported in relatively large numbers on the beaches of the Northern Peninsula in recent years (CWS unpublished data).	—	—	—	—[(g)]
Ivory Gull *(Pagophila eburnea)*	Listed as Endangered under the *NLESA* and *SARA* (Schedule 1). A coastal bird that occurs inland only accidentally for brief periods during migration (Haney and MacDonald 1995). Records of Ivory Gull in the province are rare and irregular. One observation of this species is known from the Study Area and was made at the Avondale River estuary in 1998 (ACCDC 2008, internet site).	—	—	—	—
Peregrine Falcon *(Falco peregrinus)*	Listed as Vulnerable under the *NLESA* and as Special Concern (Schedule 3) (*tundrius* subspecies) or Threatened (Schedule 1) (*anatum* subspecies) under *SARA.* The breeding range of the *tundrius* subspecies is limited to northern tundra areas and is outside of the Study Area. The *anatum* subspecies nests along the coast of Labrador, but the nearest known breeding location is >100 km from the transmission corridor, near Cartwright (Trimper 2010, pers. comm.).	—	—	—	—

Table 10.3.7-1 Selected Avifauna, Comments on Breeding Status by Region (continued)

Avifauna Species	Status / Habitat Use and Availability[(a)]	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Common Nighthawk *(Chordeiles minor)*	Listed as Threatened under the *NLESA* and *SARA* (Schedule 1). Primary habitat consists of Cutover, Burn, Open Conifer and Black Spruce Lichen habitats, and comprises 1,536 km^2 (27%) of the Study Area in Labrador and 2,441 km^2 (22%) in Newfoundland. While primary habitat is available on the Island, this species is considered extremely rare there, if present at all. Note that the actual amount of primary habitat would be lower, as only certain Cutover and Burn habitats (i.e., with regenerating forests) would be preferred.	Infrequent	—	—	—
Chimney Swift *(Chaetura pelagica)*	Listed as Threatened under the *NLESA* and *SARA* (Schedule 1). Not known to breed in Labrador (Cink and Collins 2002, internet site). Presence documented in south-western Newfoundland well outside the Study Area, but breeding has not been confirmed (Godfrey 1986).	—	—	—	—

(a) Comments are subjective, reflecting abundance in geographic region and / or associated with habitat type; they are intended to provide additional regional insight, but should not be considered as quantitative or absolute.

(b) Common – species breeds in the region and is expected to occur in areas of suitable habitat.

(c) Present – species known to breed in the area, but information on abundance may be lacking.

(d) "—"indicates that the species is not known to breed in a particular geographic region.

(e) Infrequent – confirmed to be present but infrequently observed.

(f) Rare – species known to breed in the region but few sightings recorded except during migration and then unlikely to occur.

(g) Bellevue beach is a known migratory stop-over location on the Island, but this species is not known to breed here.

COSEWIC is responsible for status assessments of wildlife species in Canada that are, in turn, taken into consideration by the Government of Canada when designating Species at Risk under *SARA* for listing in Schedule 1 (Government of Canada 2009, internet site). Wildlife species on Schedule 2 and Schedule 3 must be reassessed by COSEWIC according to *SARA* guidelines, but are not considered 'listed'. Once a species becomes listed, measures to protect and recover the wildlife species as mandated through *SARA* are implemented. As such, there is potential for additional species (e.g., species currently included in Schedule 2 and Schedule 3) to become listed over the life of the Project.

The following sections provide a general overview of the presence, abundance and distribution of select avifauna species in NL by guild and geographic region crossed by the Study Area, as well as a description of habitat use where available. Further information for each of the selected species as identified in Table 10.3.7-1 is contained in the *Avifauna Component Study* (Stantec 2012b, 2010f) and the *Avifauna Component Study Supplementary Report* (Stantec 2011g).

Waterfowl

Waterfowl in NL can be subdivided into an early-nesting group, comprising dabbling ducks and geese, and a late-nesting group, comprising sea ducks and diving ducks. Information on waterfowl occurrence in the regions crossed by the Study Area is provided in Table 10.3.7-2. This is based on professional knowledge, field work and a number of published sources including Warkentin and Newton (2009), LGL Limited (LGL) (2008), Chaulk and Turner (2002), AGRA Earth and Environmental Ltd. and Harlequin Enterprises (1999), Jacques Whitford (2003a, 1998a, 1998b, 1997b), Jacques Whitford and Minaskuat (2003a), Bateman (1992), Goudie (1991, 1987) and Goudie and Whitman (1987). The emphasis in Table 10.3.7-2 is to identify important staging and breeding habitat. Moulting habitat is not highlighted, although it should be recognized as important for some species (e.g., Black Duck (*Anas rubripes*)) that tend to concentrate in particular areas, such as Main River.

Table 10.3.7-2 Occurrence of Waterfowl Species in the Study Area by Region

Species	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
American Black Duck *(Anas rubripes)*	Present[(a)]	Present	Present	Present
American Wigeon *(Anas americana)*	Infrequent[(b)]	Present	Infrequent	Infrequent
Black Scoter *(Melanitta americana)*	Infrequent	—[(c)]	—	Infrequent
Canada Goose (*Branta canadensis*)	Present	Present	Present	Present
Common Goldeneye *(Bucephala clangula)*	Present	Present	Present	Present
Common Loon *(Gavia immer)*	Present	Present	Present	Present
Common Merganser *(Mergus merganser)*	Present	Present	Present	Infrequent
Green-winged Teal *(Anas carolinensis)*	Present	Present	Present	Present
Harlequin Duck (*Histrionicus histrionicus*)	Present	Present	Infrequent	Infrequent
Long-tailed Duck *(Clangula hyemalis)*	Infrequent	—	—	—
Mallard *(Anas platyrhynchos)*	Infrequent	Infrequent	Infrequent	Infrequent
Northern Pintail *(Anas acuta)*	Infrequent	Present	Present	Present

Table 10.3.7-2 Occurrence of Waterfowl Species in the Study Area by Region (continued)

Species	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Northern Shoveler *(Anas clypeata)*	Infrequent	—	—	—
Red-breasted Merganser (*Mergus serrator)*	Present	Present	Present	Infrequent
Ring-necked Duck *(Aythya collaris)*	Present	Present	Present	Present
Scaup Species	Present	—	—	Present
Surf Scoter (*Melanitta perspicillata*)	Present	—	—	Infrequent
White-winged Scoter *(Melanitta fusca)*	Y	—	—	—

(a) "Present" - presence of that species in that region of the province.

(b) "Infrequent" – confirmed to be present but infrequently observed.

(c) "—" indicates no known occurrence.

A discussion of waterfowl presence, abundance and distribution in the Study Area by region is provided in the following sections. Key species identified for further consideration for waterfowl are Canada Goose, American Black Duck, Ringed-neck Duck, Harlequin Duck and Surf Scoter (Table 10.3.7-1). The occurrence of these species in the regions is also highlighted in the following text. Details on each species are provided in the *Avifauna Component Study* (Stantec 2012b, 2010f) and the *Avifauna Component Study Supplementary Report* (Stantec 2011g).

Central and Southeastern Labrador

A variety of waterfowl stage, breed, and moult in Central and Southeastern Labrador, including species of geese, dabbling ducks and diving ducks, although generally at low densities (Goudie and Whitman 1987). Local areas such as the Eagle River Plateau and the St. Paul watershed likely have relatively high breeding densities of several species of waterfowl (CWS unpublished data). Many rivers are still frozen in May, when northbound migrants arrive, thereby concentrating waterfowl in the few suitable staging areas that exist (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999). The most common breeding species in the region are Canada Goose (*Branta canadensis*), American Black Duck *(Anas rubripes)*, Green-winged Teal *(Anas carolinensis)*, Ring-necked Duck *(Aythya collaris)*, Surf Scoter (*Melanitta perspicillata*), Common Goldeneye *(Bucephala clangula)* and Common (*Mergus merganser*) and Red-breasted Merganser (*Mergus serrator)* (Jacques Whitford 2003a, 1998b; Jacques Whitford and Minaskuat 2003a; AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999; Goudie and Whitman 1987). Small numbers of Lesser Scaup (*Aythya affinis*) also occur in the Study Area during the breeding season (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999) and a variety of other waterfowl also use the area, including Common Loon *(Gavia immer)*, American Wigeon *(Anas americana)*, Long-tailed duck *(Clangula hyemalis)*, White-winged Scoter *(Melanitta fusca)* and Black Scoter (*Melanitta americana*) (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999; Jacques Whitford 2003a, Jacques Whitford and Minaskuat 2003a). Surveys conducted along portions of the TLH3 to the east of the transmission corridor also detected Mallard *(Anas platyrhynchos)*, Northern Shoveler *(Anas clypeata)* and Greater Scaup (*Aythya marila*) during spring staging and / or breeding (Canadian Wildlife Service (CWS) 2011a; Jacques Whitford 1998b). Species observed moulting include Canada Goose, American Black Duck, Northern Pintail *(Anas acuta)*, Greater Scaup, Surf Scoter and Common and Red-breasted Merganser.

Harlequin Duck are known to breed in Central and Southeastern Labrador. They have repeatedly been observed on the Minipi River (Stassinu Stantec Limited Partnership 2010; Jones and Goudie 2009, 2008; Jacques Whitford 1998a; 1997b) and may occur in the St. Paul River, where a pair was observed staging in 1998 (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999). In 2010, a pair was observed outside the boundaries of the Study Area, within the Traverspine River (Stassinu Stantec Limited Partnership 2010). Individuals have also been recorded near the St. Peter Islands, along the south coast which is well outside the boundaries of the Study Area. An estimated five breeding pairs occur in south coast rivers despite the abundance of apparently suitable habitat (Trimper et al. 2008).

Most of the primary breeding habitat for Canada Goose in the Central and Southeastern Labrador Study Area occurs within the String Bog Ecoregion, where it represents 26% of its 2,010.7 km^2 area. Primary habitat is also relatively abundant (compared to elsewhere in the Study Area) in the Low Subarctic Forest Ecoregion, where it comprises 20% of its 2,385.4 km^2 area and is concentrated towards its eastern end. Canada Goose (four pairs, 11 individuals) were recorded on nests along the transmission corridor during June 1998 surveys (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999). Canada Goose were occasionally observed during passerine surveys and ELC investigations in support of the Project in 2008, including five at a single point count location within the String Bog Ecoregion and at 15 other locations within the Study Area, as defined in the Component Study (Stantec 2012b, 2010f). Waterfowl studies conducted along the TLH3 identified six Canada Goose nests along the portion of the highway route shared by the transmission corridor and found this species to be relatively common during spring staging, breeding, brood / moulting and fall staging surveys (Jacques Whitford 2003a; Jacques Whitford and Minaskuat 2003a). Concentrations of moulting Canada Geese have been observed on the Eagle River (CWS unpublished data).

Although Surf Scoter were not recorded during waterfowl surveys in the Study Area in 1998 (perhaps due to timing), incidental observations of Surf Scoter were recorded during other surveys in support of the baseline surveys for this Project, including 11 at a single point count during passerine surveys in 2008 (Stantec 2012b, 2010f). Dedicated waterfowl studies by others (Gilliland et al. 2008a; Robert and Savard 2008) have reported Surf Scoter as being widespread in portions of the military Low-Level Training Area adjacent to the Study Area. Surf Scoter have been identified by these authors as one of the most abundant and widespread waterfowl species in portions of the Low-Level Training Area surveyed that either overlaps or is adjacent to the Study Area in Labrador. Additionally, Surf Scoter were observed along portions of the TLH3 shared by the transmission corridor during waterfowl spring staging, breeding, brood / moulting and fall staging surveys, with numbers being particularly high in fall staging surveys (Jacques Whitford 2003a; Jacques Whitford and Minaskuat 2003a).

In general, Central and Southeastern Labrador supports a moderate diversity of waterfowl during staging, breeding and moulting periods. However, densities are generally low but there are areas with seasonally high waterfowl densities. Waterfowl use the headwaters of the Eagle River during spring breeding and moulting periods. Moulting waterfowl (e.g., Common Goldeneye, Scaup sp., Ring-necked Duck, American Black Duck, Canada Goose and Merganser sp.) were found using the area in relatively high concentrations on the Eagle River plateau during a reconnaissance flight in 2008 (CWS unpublished data).

Northern Peninsula

A variety of waterfowl species are found along the Northern Peninsula during staging and breeding, including Canada Goose, American Wigeon, American Black Duck, Mallard, Northern Pintail, Green-winged Teal, Ring-necked Duck, Harlequin Duck, Common Goldeneye and Common and Red-breasted Merganser (Warkentin and Newton 2009; Goudie and Gilliland 2008; Goudie 1987) (Table 10.3.7-2). Earlier studies of waterfowl in the Northern Peninsula Forest and Long Range Barrens Ecoregions found overall lower numbers of waterfowl in these areas compared to other Ecoregions in Newfoundland that overlap the Study Area, with the exception of the Maritime Barrens Ecoregion (Goudie 1987). The most frequently encountered species were American Black Duck, Common Goldeneye and Common Merganser; however, relative abundances varied among years.

Most breeding activity of Harlequin Duck on the Island of Newfoundland occurs on the Northern Peninsula but there are breeding records from southeastern Newfoundland on the Bay du Nord River (IBA 2012, internet site). The Torrent River being the most important site (Warkentin and Newton 2009; Thomas 2008). During dedicated Project surveys in 1998, one pair were recorded on this river during spring staging, with an additional four sightings (all female) during the breeding season (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999). Other observations on this river have confirmed its importance, with as many as 12 breeding pairs observed during monitoring efforts (Stassinu Stantec Limited Partnership 2010; Jones and Goudie 2009, 2008; Thomas 2006). In addition to the Torrent River, records indicate that Harlequin Duck have been observed within the Study Area at two other locations: Brian's Pond River and Castor's River (Stassinu Stantec Limited Partnership 2010; ACCDC 2008, internet site). The number of breeding pairs observed on several known rivers of occupation on the Northern Peninsula increased during the 2005 to 2009 monitoring period (35 in year 2005; 35 in 2006; 40 in 2008; and 43 in 2009), with a decline noted in 2010 (27) (Stassinu Stantec Limited Partnership 2010; Jones and Goudie 2009, 2008; Thomas 2006). Goudie and Gilliland (2008) observed increasing numbers of Harlequin Duck pairs on the Torrent River during the 1990's. These authors also stated that *"A high rate of brood production in 1997 and 1998, compared to adjacent watersheds, suggests the possibility that the Torrent River system may behave as a source population for the general region of northern Newfoundland."* It has been estimated that 20% of the known wintering population of Harlequin Duck in eastern North America breeds on the Northern Peninsula (Gilliland et al. 2008b). An estimated 128+45 male Harlequin Duck (indicated pairs) breed along the rivers of western and northern Newfoundland (Gilliland et al 2008a). Densities of 0.042 to 0.187 birds/km were estimated breeding on the Northern Peninsula (Gilliland et al. 2008a). These numbers may represent 20% of wintering Harlequin Duck in eastern North America.

Canada Goose densities are relatively low in the Northern Peninsula Forest and Long Range Barrens Ecoregions (Goudie 1987), reflecting the limited distribution of primary breeding habitat, covering 11% or less of each Ecoregion. This habitat is found in small clusters inland from Bellburns (Northern Peninsula Forest Ecoregion) and between Brian's Pond River and Parson's Pond (Long Range Barrens Ecoregion). In the Strait of Belle Isle Barrens Ecoregion, primary habitat is found only along the coast. During 2008 ELC surveys, seven sightings of Canada Goose were reported in Wetland habitat in the Northern Peninsula Study Area. During the June 1998 survey, geese (29 pairs, 33 individuals) were noted on nests or with young on Castor's River, Torrent River and Main River (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999), areas that are generally comprised of secondary and tertiary habitat. Their use of lower quality habitat is likely reflective of the low availability of primary habitat in this region. These baseline surveys suggest that the Main River is a relatively important area for staging and breeding for Canada Goose.

In general, the Northern Peninsula hosts a low to moderate variety of waterfowl species and is important in terms of supporting relatively large numbers of breeding Harlequin Duck. Rivers in higher elevations along the western side of the Long Range Mountains appear particularly important for this species (Gilliland et al. 2008b). AGRA Earth and Environmental Ltd. and Harlequin Enterprises (1999) found waterfowl on the Northern Peninsula to be relatively abundant compared with the remainder of the Study Area in Newfoundland.

Central and Eastern Newfoundland

The diversity of waterfowl in the Central and Eastern Newfoundland region is lower than in other regions of the Study Area (Table 10.3.7-2). However, there are local areas where relatively high densities of breeding waterfowl can be found such as: Upper Humber River watershed below Birchy Pond (a variety of waterfowl species); Gander (Ring-necked Duck); and in the Swift Current / Meta Ponds areas (breeding Canada Geese) (CWS unpublished data). Observations of waterfowl in the Central Newfoundland Forest Ecoregion in 1978 and 1979 found the most common species to be American Black Duck, Green-winged Teal, Ring-necked Duck and Common Goldeneye, while Canada Goose, Northern Pintail and Common and Red-breasted Merganser occurred at lower densities (Goudie 1987). AGRA Earth and Environmental Ltd. and Harlequin Enterprises (1999) recorded relatively low numbers of waterfowl during surveys in 1998. Species identified during the breeding season were Green-winged Teal, Canada Goose and Common and Red-breasted Merganser (AGRA

Earth and Environmental Ltd. and Harlequin Enterprises 1999). Other species that may occur in Central and Eastern Newfoundland include American Wigeon and Mallard (Warkentin and Newton 2009).

There is no documented evidence of breeding activity of Harlequin Duck in this region. Only isolated observations of Harlequin Duck in interior Newfoundland were reported between 1983 and 2005 (Thomas 2008).

Primary habitat for Canada Goose is discontinuous and in low proportions (13%) throughout the dominant Central Newfoundland Forest Ecoregion crossed by the Study Area, with a small cluster found west of Terra Nova National Park. A concentration of primary habitat is located in the Long Range Barrens Ecoregion, where it forms 74% of that Ecoregion. Secondary habitat is limited in this region (only 10% of the Central Newfoundland Forest Ecoregion), with the exception of an area near North West Brook, south of Clarenville. During the June 1998 surveys, Canada Goose were rarely encountered (two pairs, including one with a brood) (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999). Five sightings of Canada Goose were reported in Wetland habitat incidentally during ELC surveys (Stantec 2012b, 2010f). Near the eastern end of this region of the Study Area, protection is provided at a Canada Goose sanctuary near Clarenville-Shoal Harbour, an area where the birds stay through the winter, and leave in the summer.

Avalon Peninsula

Goudie (1987) found American Black Duck and Green-winged Teal to be most abundant in the Avalon Forest Ecoregion (>450 recorded each year in 1978 and 1979), with smaller densities of Ring-necked Duck, Common Goldeneye and Northern Pintail also being present. Only three species of waterfowl were documented during spring staging in the transmission corridor in 1998: American Black Duck, Ring-necked Duck and Common Goldeneye (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999). Environment Canada has documented relatively high densities of Canada Goose, American Black Duck, Green-winged Teal and Ring-necked Duck (CWS unpublished data). While waterfowl species diversity is relatively low, the Avalon Peninsula provides habitat for breeding greater scaup and migrating Surf and Black Scoters that are generally only found in this region of the Island (Warkentin and Newton 2009). Other species known to occur in this region include American Wigeon, Mallard, and Common and Red-breasted Merganser (Warkentin and Newton 2009). Greater Scaup has been detected on the southern part of the Avalon Peninsula (CWS unpublished data). While Harlequin Duck are not known to breed in this region, they do occur in coastal waters, including the Cape St. Mary's Ecological Reserve, during winter, staging and moulting (Thomas 2008). A small number of individuals have also been documented at the reserve in summer (Thomas 2008).

Primary Canada Goose habitat accounts for just 4% of the Maritime Barrens Ecoregion and only 1% of the Avalon Forest Ecoregion (Stantec 2012b, 2010f). Although this species was not recorded within the region during the June 1998 survey of the Study Area (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999), incidental observations of Canada Goose were made during other Project surveys. Two Canada Geese were documented in Scrub / Heathland / Wetland habitat during passerine surveys in 2008 and seven were observed together at a single location during ELC field surveys (Stantec 2012b, 2010f).

Passerines

Passerines are generally small to medium-sized 'perching' birds, with specialized vocal organs which allow them to produce a wide range of vocalizations (songs and calls) (US Fish and Wildlife Service 2002). Passerines in the Study Area include members of the flycatcher, corvid, thrush, warbler, finch and sparrow families, among others. Collectively, they occupy a wide range of terrestrial habitats from riparian areas to burns to mature forest.

During 2008 surveys of the Study Area as defined in the Component Study (Stantec 2012b, 2010f), Warblers (18 species) and Sparrows (nine species) were the most diverse families observed. Within the Study Area, passerine species diversity ranged within the Ecoregions from 6.6 species per survey point in the Long Range Barrens to 10.6 in the Forteau Barrens, and mean abundance ranged from 9.4 individuals per point in the

Maritime Barrens to 19.8 in the Forteau Barrens. Overall mean abundance and species richness per point count were 13.0 individuals and 8.5 species, respectively. The total number of species recorded in an Ecoregion ranged from 25 in the Avalon Forest Ecoregion to 58 in the Central Newfoundland Forest Ecoregion (Stantec 2012b, 2010f).

The five most abundant species recorded in each Ecoregion are presented in Table 10.3.7-3 (Stantec 2012b, 2010f). Four species were among the five most abundant birds in the majority of the nine Ecoregions surveyed: Yellow Bellied Flycatcher (*Empidonax flaviventris*) (five Ecoregions); American Robin (*Turdus migratorius*) (six Ecoregions); Blackpoll Warbler *(Setophaga striata)* (five Ecoregions); and White-throated Sparrow (*Zonotrichia albiocollis*) (eight Ecoregions). Another six species were among the top five in just a single Ecoregion: American Crow (*Corvus brachyrhynchos*) (Strait of Belle Isle Barrens); Common Raven (*Corvus corax*) (Strait of Belle Isle Barrens); Yellow-rumped Warbler (*Setophaga coronata*) (Avalon Forest); Yellow Warbler (*Setophaga petechia*) (Central Newfoundland Forest); Lincoln's Sparrow (*Melospiza lincolnii*) (Long Range Barrens); and Savannah Sparrow (*Passerculus sandwichenisis*) (Long Range Barrens).

The most abundant species overall were Yellow-bellied Flycatcher, American Robin, Northern Waterthrush (*Parkesia noveboracensis*), Fox Sparrow (*Passerella iliaca*) and White-throated Sparrow; however, the most abundant species varied by Ecoregion (Table 10.3.7-3).

To describe habitat relationships within the Study Area as defined in the Component Study (Stantec 2012b, 2010f), observations of individual passerine species were assigned to one of the 15 ELC Habitat Types, by Ecoregion. Results of this analysis confirmed that relative passerine abundance and species diversity varied among sampled Habitat Types (Table 10.3.7-4). Species diversity is represented by the mean number of species per point count, while relative species abundance refers to the mean number of birds per point count.

Table 10.3.7-3 Most Abundant Passerine Species by Ecoregion in Newfoundland and Labrador

Species	Avalon Forest	Maritime Barrens	Central Newfoundland Forest	Northern Peninsula Forest	Forteau Barrens	Strait of Belle Isle Barrens	Long Range Barrens	String Bog	Low Subarctic Forest
Yellow-bellied Flycatcher (*Empidonax flaviventris*)	1.4[(a)]	0.9	0.8	1.8	—[(b)]	1.0	—	—	—
American Crow (*Corvus brachyrhynchos*)	—	—	—	—	—	1.0	—	—	—
Common Raven (*Corvus corax*)	—	—	—	—	—	0.8	—	—	—
Ruby-crowned Kinglet (*Regulus calendula*)	—	—	—	1.1	—	—	—	1.5	1.1
Swainson's Thrush (*Catharus ustulatus*)	—	—	—	—	—	—	—	0.8	1.2
American Robin (*Turdus migratorius*)	1.2	0.7	0.9	1.1	1.4	1.3	—	—	—
Yellow Warbler (*Dendroica petechia*)	—	—	0.7	—	—	—	—	—	—
Yellow-rumped Warbler (*Dendroica coronate*)	1.1	—	—	—	—	—	—	—	—
Blackpoll Warbler *(Setophaga striata)*	0.9	0.8	—	0.8	1.7	—	2.0	—	—
Northern Waterthrush (*Parkesia noveboracensis*)	1.3	0.7	0.6	—	1.7	—	—	—	—
Savannah Sparrow (*Passerculus sandwichenisis*)	—	—	—	—	—	—	0.9	—	—
Fox Sparrow (*Passerella iliaca*)	—	—	—	—	2.2	—	1.0	1.7	2.1
Lincoln's Sparrow (*Melospiza lincolnii*)	—	—	—	—	-	—	2.7	—	—
White-throated Sparrow (*Zonotrichia albicollis*)	—	0.7	1.7	2.4	1.6	0.8	2.7	1.4	1.6
Dark-eyed Junco (*Junco hyemalis*)	—	—	—	—	—	—	—	0.9	1.3

Source: Stantec (2012b and 2010f).

(a) Numbers indicate mean number of individuals per point.

(b) "—" indicates species occurred at lower density or not observed during survey.

Table 10.3.7-4 Passerine Species Diversity and Relative Abundance in the Study Area by Habitat Type and Ecoregion

Habitat Type	Number of Points	Habitat % of Total Ecoregion	Number of Points / 100 km^2 of Habitat Type	Mean Number of Species per Point[(a)]	Mean Number of Birds per Point[(a)]
String Bog Ecoregion					
Black Spruce / Lichen Forest	3	6.9	2.2	7.67	14.67
Conifer Forest	2	8.6	1.2	4.50	5.00
Conifer Scrub	1	12.7	0.4	6.00	10.00
Mixedwood Forest	3	0.8	18.8	7.00	11.67
Open Conifer	7	30.8	1.1	5.57	8.14
Wetland	15	35.4	2.1	9.60	17.60
Other / Unclassified Habitat[(b)]	1	3.3	1.5	9.00	14.00
TOTAL	**32**			**7.84**	**13.56**
Forteau Barrens Ecoregion					
Conifer Scrub	10	29.6	2.9	11.40	22.10
Lichen Heathland	6	26.9	1.9	9.17	16.17
Wetland	2	13.3	1.3	11.00	19.00
TOTAL	**18**			**10.61**	**19.78**
Low Subarctic Forest Ecoregion					
Black Spruce / Lichen Forest	1	2.4	1.3	10.00	16.00
Burn	4	2.1	6.2	8.25	14.00
Conifer Forest	3	28.9	0.3	7.00	15.67
Hardwood Forest	3	0.1	88.2	8.33	14.33
Mixedwood Forest	1	0.5	6.1	8.00	14.00
Open Conifer Forest	3	28.5	0.3	6.67	12.33
Wetland	3	19.5	0.5	8.67	18.00
TOTAL	**18**			**7.94**	**14.83**
Strait of Belle Isle Barrens Ecoregion					
Open Conifer Forest	8	25.2	7.1	11.5	15.38
Wetland	13	8.9	32.7	8.00	10.15
Other / Unclassified Habitat [(b)]	3	43.1	1.6	9.67	13.67
TOTAL	**24**			**9.38**	**12.33**
Northern Peninsula Forest Ecoregion					
Conifer Forest	5	26.9	0.9	7.80	10.00
Cutover	6	5.2	5.7	8.83	14.00
Mixedwood Forest	2	13.6	0.7	7.50	13.00
Open Conifer	12	16.5	3.5	8.92	13.42

Table 10.3.7-4 Passerine Species Diversity and Relative Abundance in the Study Area by Habitat Type and Ecoregion (continued)

Habitat Type	Number of Points	Habitat % of Total Ecoregion	Number of Points / 100 km^2 of Habitat Type	Mean Number of Species per Point[(a)]	Mean Number of Birds per Point[(a)]
Scrub / Heathland / Wetland	8	15	2.6	12.63	21.25
Wetland	12	6	9.8	10.67	20.00
Other / Unclassified Habitat[(b)]	1	14.2	0.3	13.00	22.00
TOTAL	**46**			**9.91**	**16.37**
Long Range Barrens Ecoregion					
Kalmia Lichen Heathland	1	0.7	7.3	9.00	24.00
Scrub / Heathland / Wetland	8	34.8	1.2	7.38	20.50
Wetland	1	10.1	0.5	6.00	16.00
Other / Unclassified Habitats[(b)]	7	8.3	4.4	5.43	9.14
TOTAL	**17**			**6.59**	**15.76**
Central Newfoundland Forest Ecoregion					
Conifer Forest	3	5.3	1.2	9.00	11.30
Conifer Scrub	1	2.6	0.8	4.00	6.00
Cutover	47	16.8	6.2	9.30	13.26
Mixedwood Forest	36	30.6	2.6	7.34	8.92
Open Conifer Forest	3	13.2	0.5	7.00	9.00
Scrub / Heathland / Wetland	4	9.5	0.9	8.25	11.50
Wetland	5	13.3	0.8	10.20	13.00
Other / Unclassified Habitat[(b)]	5	7.3	1.5	5.40	7.60
TOTAL	**104**			**8.55**	**11.40**
Maritime Barrens Ecoregion					
Conifer Forest	1	3.9	1.2	7.00	7.00
Conifer Scrub	1	0.9	5.3	5.00	6.00
Cutover	4	4.4	4.4	8.00	9.50
Kalmia Lichen Heathland	2	4.5	2.2	5.00	5.50
Mixedwood Forest	11	16.3	3.3	8.73	9.73
Rocky Barren	1	3.9	1.3	10.00	10.00
Scrub / Heathland / Wetland	26	35.1	3.6	7.61	9.50
Wetland	1	6.1	0.8	9.00	11.00
Other / Unclassified Habitat[(b)]	4	22.9	0.9	9.00	10.75
TOTAL	**51**			**7.90**	**9.41**
Avalon Forest Ecoregion					
Cutover	1	11.6	3.7	10.00	15.00

Table 10.3.7-4 Passerine Species Diversity and Relative Abundance in the Study Area by Habitat Type and Ecoregion (continued)

Habitat Type	Number of Points	Habitat % of Total Ecoregion	Number of Points / 100 km^2 of Habitat Type	Mean Number of Species per Point[(a)]	Mean Number of Birds per Point[(a)]
Mixedwood Forest	2	37.7	2.3	7.00	9.00
Scrub / Heathland / Wetland	6	28	9.2	9.00	10.17
Other / Unclassified Habitats[(b)]	2	14.3	6.0	9.50	12.00
TOTAL	**11**			**8.82**	**10.73**

(a) Above average values are shaded in black, near average in white (within ± one from the average) and below average in gray.

(b) Other / Unclassified Habitat includes habitat that did not fit any ELC descriptions, habitats that were originally classified as 'Exposed Earth' or as 'open water' based on satellite imagery.

Habitat with an above-average number of species per point (indicated in black) (Table 10.3.7-4) were: Cutover habitat in the Avalon Forest and Central Newfoundland Forest Ecoregions; Wetland and / or Wetland complexes in the Low Subarctic Forest, Northern Peninsula Forest and Central Newfoundland Forest Ecoregions; Kalmia Lichen Heathland habitat in the Long Range Barrens Ecoregion; Open Conifer Forest in the Strait of Belle Isle Barrens Ecoregion; and Black Spruce / Lichen Forest in the Low Subarctic Forest Ecoregion. Relative species abundance in these habitats was generally, but not consistently, also above average (Table 10.3.7-4). Note that some of these relationships were based on only a few points per habitat type.

In terms of the total number of species observed, Conifer Scrub habitat in Newfoundland had the lowest species richness (seven species observed), while Cutover had the greatest (51 species). The second most common habitat (in terms of the total number of species) was Wetland in Newfoundland (45 species). The high number of species recorded in Cutover habitat likely reflects a range in age of cutovers and / or harvesting methods (e.g., clear-cut, selective logging) that were surveyed. Habitat diversity created within cutovers may result in the provision of suitable habitat for early successional species (Simon et al. 2000), ground nesters, shrub nesters, ground gleaners and aerial feeders (Artman 1990).

The following provides an overview of the abundance, distribution and habitat associations of passerines in the various regions of the Study Area. Key species and species groups identified for further consideration for passerines were Olive-sided Flycatcher *(Contopus cooperi)*, Grey-cheeked Thrush (*Catharus minimus*), Blackpoll Warbler, wetland sparrows (including Swamp Sparrow (*Melospiza Georgiana*), Song Sparrow (*Melospiza melodia*), Lincoln's Sparrow and Savannah Sparrow), Rusty Blackbird and Red Crossbill (*Loxia curvirostra percna*) (Table 10.3.7-1). The occurrences of these species in the regions are also highlighted in the following text. Details on each species are provided within the *Avifauna Component Study* (Stantec 2012b, 2010f) and the *Avifauna Component Study Supplementary Report* (Stantec 2011g).

Central and Southeastern Labrador

Passerine surveys conducted for the Project in 2008 in the Study Area as defined in the Component Study (Stantec 2012b, 2010f) identified 39 species associated with the Forteau Barrens Ecoregion, 36 with the Low Subarctic Forest Ecoregion and 44 with the SB Ecoregion (Stantec 2012b, 2010f). The most abundant species was Fox Sparrow. Other commonly recorded species were Northern Waterthrush, White-throated Sparrow, Ruby-crowned Kinglet (*Regulus calendula*), American Robin, Blackpoll Warbler, Dark-eyed Junco (*Junco hyemalis*) and Swainson's Thrush (*Catharus ustulatus*). Species abundance was higher than the overall 2008 survey average of 13.0 individuals per point count in all three Ecoregions (19.8 in the Forteau Barrens, 14.8 in the Low Subarctic Forest and 13.6 in the String Bog Ecoregion), while species richness was higher than average only in the Forteau Barrens Ecoregion (10.6 versus 8.5 species per point count) (Table 10.3.7-4).

Passerine surveys along the TLH3 established survey blocks within representative Ecoregions traversed by the proposed highway route and identified 39 species in the High Boreal Forest Ecoregion, 45 species in the Low Subarctic Forest Ecoregion, 51 species in the String Bog Ecoregion and 41 species in the Mid Boreal Forest Ecoregion (Jacques Whitford 2003b). Fourteen of 71 species were confirmed breeders, 23 were considered probable breeders and the remainder were considered to be possibly breeding. The most abundant species encountered during this survey was Ruby-crowned Kinglet, whereas other commonly recorded species included Fox Sparrow, Northern Waterthrush, Yellow-rumped Warbler and Dark-eyed Junco (Jacques Whitford 2003b).

Olive-sided Flycatcher was not observed in the Study Area in this region during either passerine or ELC surveys in 2008 (Stantec 2012b, 2010f), nor were they observed during surveys conducted for the TLH3 (Jacques Whitford 2003b). The Olive-sided Flycatcher was observed in the lower Churchill River valley during surveys in 2006 and 2007 (Minaskuat Inc. 2008e). Altman and Sallabanks (2000, internet site) indicate that the breeding range of this species extends into a portion of the Central and Southeastern Labrador region.

Dalley et al. (2005) indicated that Grey-cheeked Thrush occur throughout much of Labrador (i.e., south and central areas). During passerine surveys in 2008, four Grey-cheeked Thrush were recorded, all in the Forteau Barrens Ecoregion, where primary habitat comprises 45% of the area. Primary habitat is also relatively abundant (compared to elsewhere in the Study Area) in the Low Subarctic Forest Ecoregion (47%), which accounts for nearly 50% of the Study Area. Passerine surveys conducted in support of the TLH3 identified nine Grey-cheeked Thrush (eight in the Mid Boreal Forest Ecoregion and one in the String Bog Ecoregion) and it was classified as a possible breeder in the region (Jacques Whitford 2003b).

Primary habitat for Blackpoll Warbler is common throughout the Central and Southeastern Labrador portion of the Study Area. Most of this habitat occurs within the String Bog and Low Subarctic Forest Ecoregions, where it accounts for 49% and 39% of these areas, respectively. A total of 41 Blackpoll Warbler were recorded during the 2008 passerine surveys, in the String Bog (10), Low Subarctic Forest (one) and Forteau Barrens (30) Ecoregions. This species was one of the most abundant species recorded in the Forteau Barrens Ecoregion, where primary habitat accounts for 37% of the area. Blackpoll Warbler were found to be relatively common during passerine surveys conducted in support of the TLH3, with 24 recorded, the majority of which were observed within the Low Subarctic Forest Ecoregion (19) and the remainder within the Mid Boreal Forest Ecoregion (Jacques Whitford 2003b).

Primary habitat for wetland sparrows is scattered throughout the Study Area, but is most abundant in the String Bog and Low Subarctic Forest Ecoregions, where it accounts for 25% and 20% of these areas, respectively. Surveys within the region have found Lincoln's Sparrow and Savannah Sparrow to be relatively common and have infrequently recorded Swamp Sparrow (Stantec 2012b, 2010f; Jacques Whitford 2003b). Although Song Sparrow was not documented during the 2008 field program, this species was encountered during the breeding season along the lower Churchill River during 2006-2007 field studies. Prior to this, Song Sparrow was not known to breed in Labrador (Nalcor 2009). If present in the Study Area (and undetected during the surveys), Song Sparrow is likely to be uncommon.

Primary habitat for Rusty Blackbird is most abundant in the String Bog Ecoregion (26%). Eighteen observations of Rusty Blackbird were recorded in this Ecoregion during passerine surveys in 2008 (Stantec 2012b, 2010f). Four other observations were recorded in the Low Subarctic Forest Ecoregion, an Ecoregion that contains relatively high amounts of primary habitat (20% of the Ecoregion within the Study Area). Another observation was made in Wetland habitat during the ELC surveys for the Project. In addition, surveys conducted in support of the TLH3 recorded 32 Rusty Blackbird during point counts (28 in the String Bog Ecoregion and two each in the High Boreal Forest and Low Subarctic Forest Ecoregions) and confirmed it as a breeder within the region.

Northern Peninsula

The 2008 passerine surveys for this Project (Stantec 2012b, 2010f) represent one of the most comprehensive studies available for the Northern Peninsula. It identified a total of 47 species in the Northern Peninsula Forest

Ecoregion and 28 in the Long Range Barrens Ecoregion. Among the most abundant species were White-throated Sparrow, Yellow-bellied Flycatcher, Ruby-crowned Kinglet, American Robin, Blackpoll Warbler, Fox Sparrow, Swainson's Thrush, Lincoln's Sparrow and Northern Waterthrush. Of these, Lincoln's Sparrow and Savannah Sparrow (both in the Long Range Barrens Ecoregion) were among the top five species, but did not occur in the top five in any other Ecoregion in Newfoundland.

Species abundance was higher than the overall average of 13.0 individuals per point count in the Northern Peninsula Forest Ecoregion (average 16.4 individuals per point count) and Long Range Barrens Ecoregion (average 15.8 individuals per point count). Species richness was above the average of 8.5 species per point count in the Northern Peninsula Forest Ecoregion (average 9.9 species per point count) and Strait of Belle Isle Barrens Ecoregion (average 9.4 species per point count) Ecoregions (Table 10.3.7-4). Overall, the Northern Peninsula Forest Ecoregion appears to support both the highest diversity and abundance of passerine species in the Northern Peninsula region of the Study Area.

Eight Olive-sided Flycatcher were recorded on the Northern Peninsula during the 2008 passerine surveys (Stantec 2012b, 2010f), including six birds from four point counts within Scrub / Heathland / Wetland habitats and an individual in each of the Wetland and Cutover habitats. All eight observations were within the Northern Peninsula Forest Ecoregion.

In Newfoundland, Grey-cheeked Thrush is most common on the Northern Peninsula (where primary habitat comprises up to 43% of the Ecoregions) and the north-east coast, and less common on the west coast and in the interior (Peters and Burleigh 1951). During the 2008 passerine surveys in the Study Area, 14 Grey-cheeked Thrush were observed primarily in Wetland and Scrub / Heathland / Wetland habitats. Secondary habitat is common and widespread.

Along the Northern Peninsula, Blackpoll Warbler were frequently recorded during the 2008 surveys, with 34 observations in the Long Range Barrens Ecoregion, 39 in the Northern Peninsula Forest Ecoregion and 18 in the Strait of Belle Isle Barrens Ecoregion (Stantec 2012b, 2010f). Blackpoll Warbler was one of the most abundant species in the Long Range Barrens Ecoregion, where primary habitat for this species comprises 58% of the Study Area. Secondary habitat is also widely distributed, with tertiary habitat comprising <2% of the entire Study Area in this region.

Primary habitat for wetland sparrows is available throughout the Northern Peninsula region, with the highest proportion associated with the Long Range Barrens Ecoregion, where it comprised 43% of the Study Area. A total of 98 Wetland Sparrows comprising Lincoln's Sparrow (68), Savannah Sparrow (25) and Swamp Sparrow (five) were recorded during the 2008 surveys, 61% of which occurred within the Long Range Barrens Ecoregion. Observations of Lincoln's Sparrow in this region account for 76% of the total records for this group. Song Sparrows are not known to breed on the Northern Peninsula (Warkentin and Newton 2009). During the ELC fieldwork for the Project (Stantec 2012b, 2010f), one Savannah Sparrow and one Lincoln's Sparrow were recorded in primary Wetland habitat.

Although primary habitat for Rusty Blackbird accounts for between 20 and 50% of the Ecoregions in the Study Area on the Northern Peninsula, this species is considered uncommon on the Island and often transient (Warkentin and Newton 2009). Rusty Blackbird were not observed in the region during 2008 surveys associated with the Project (Stantec 2012b, 2010f), but have been recorded in the region at the Mistaken Point Ecological Reserve (ACCDC 2010, internet site).

Central and Eastern Newfoundland

The 2008 passerine survey documented 58 species in the Central Newfoundland Forest Ecoregion, with the five most common species being White-throated Sparrow, American Robin, Yellow-bellied Flycatcher, Yellow Warbler and Northern Waterthrush (Stantec 2012b, 2010f). The Central Newfoundland Forest Ecoregion was the only Ecoregion where the Yellow Warbler was among one of the top five species. The Central Newfoundland Forest Ecoregion comprises the majority (92%) of the Central and Eastern Newfoundland region. Yellow-rumped Warbler was also recorded in this Ecoregion, but in lower numbers.

Species abundance and species richness were 11.4 individuals and 8.6 species per point count, respectively, within the Central Newfoundland Forest Ecoregion of the Study Area (Table 10.3.7-4) (Stantec 2012b, 2010f). The Central Newfoundland Forest Ecoregion has the highest species richness of all Ecoregions surveyed on the Island, although both the mean number of species and mean number of individuals per point count were below the overall average.

In 1995, passerine surveys were carried out in Terra Nova National Park, in the far eastern portion of this region, adjacent to the Study Area. Although the park is outside of the transmission corridor, similar species would be expected in the Central and Eastern Newfoundland region of the Study Area, as a large portion of the park lies in the Central Newfoundland Forest Ecoregion. Twenty-one passerine species were identified in the park, with higher numbers associated with fir and mixed fir-spruce stands (Jacques Whitford 1996a). White-throated Sparrow, Yellow-rumped Warbler and Yellow-bellied Flycatcher were the most abundant species.

Three Olive-sided Flycatcher were documented in the Central and Eastern Newfoundland region during the 2008 passerine surveys (Stantec 2012b, 2010f). These were recorded from three separate point counts within the Central Newfoundland Forest Ecoregion. An additional five Olive-sided Flycatchers were heard in this region during the 2008 ELC field program (Stantec 2012b, 2010f).

During the 2008 ELC field program (Stantec 2012b, 2010f), two Red Crossbills were recorded incidentally in primary habitat (i.e., mature Coniferous Forest) in this region. ACCDC records indicate another observation of this species within the Study Area close to Port Blandford (ACCDC 2010, internet site).

Primary habitat for Grey-cheeked Thrush represents 39% of the Study Area within the Central Newfoundland Forest Ecoregion; secondary habitat is also common and widespread. Two Grey-cheeked Thrush were encountered in Mixedwood Forest habitat in this region during the 2008 passerine surveys (Stantec 2012b, 2010f) and an additional observation was made in Cutover habitat during ELC surveys (Stantec 2012b, 2010f).

While primary Blackpoll Warbler habitat is abundant in this region of the Study Area (approximately 34%), only six observations of this species were recorded during the 2008 surveys (Stantec 2012b, 2010f). During the ELC field program (Stantec 2012b, 2010f), one pair of blackpoll warbler was documented in Conifer Forest habitat.

Although higher proportions of primary wetland sparrow habitat were found in the other two Ecoregions crossed by the Central and Eastern Newfoundland portion of the Study Area, the total amount of primary habitat available was highest in the Central Newfoundland Forest Ecoregion. Passerine surveys in 2008 recorded Lincoln's sparrow (10), Savannah Sparrow (6) and Swamp Sparrow (10) within the Central and Eastern Newfoundland Region (Stantec 2012b, 2010f). Although not observed during this survey, it is also likely that Song Sparrow breeds in this portion of the Study Area. During the 2008 ELC surveys (Stantec 2012b, 2010f), one Lincoln's Sparrow and two Savannah Sparrow were recorded in primary Wetland habitat in this region.

Although the amount of primary habitat for Rusty Blackbird is as high as 78% for specific Ecoregions within Central and Eastern Newfoundland (i.e., the Long Range Barrens Ecoregion), this species is considered uncommon on the Island and often transient (Warkentin and Newton 2009). It was not observed during 2008 passerine of ELC surveys (Stantec 2012b, 2010f).

Avalon Peninsula

Vassallo and Rice (1981) examined passerine diversity near South Head, along the east coast inland from Gull Island, and identified 22 species of passerines, including Red Crossbill and Rusty Blackbird. Among the more common species observed were Fox Sparrow, Northern Waterthrush and Blackpoll Warbler (Vassallo and Rice 1981). In comparison, the 2008 passerine survey (Stantec 2012b, 2010f) found a total of 25 species in the Avalon Forest Ecoregion and 41 in the Maritime Barrens Ecoregion. The most common species observed by this survey within the region were Yellow-bellied Flycatcher, Northern Waterthrush, American Robin, Yellow-rumped Warbler, White-throated Sparrow and Blackpoll Warbler.

Species abundance was 10.7 individuals per point count in the Avalon Forest Ecoregion and species richness was 8.8 species per point count and considered above average (Table 10.3.7-4). In the Maritime Barrens Ecoregion, species abundance and richness were 9.4 individuals and 7.9 species per point count, respectively.

Olive-sided Flycatcher was not recorded in this region during the 2008 passerine surveys (Stantec 2012b, 2010f). However, the known breeding range for this species includes the Avalon Peninsula (Altman and Sallabanks 2000, internet site).

Although Red Crossbill were not recorded in the region by surveys conducted for the Project, ACCDC records indicate that there have been 23 observations of this species within the Avalon Peninsula region of the Study Area since 2003 (ACCDC 2010, 2008, internet sites). A number of relatively recent sightings of Red Crossbill have been reported near Whitbourne, suggesting successful nesting of this species in that area (EC 2006b).

Primary habitat for Grey-cheeked Thrush represents 24% of the Maritime Barrens and 44% of the Avalon Forest Ecoregions within the Study Area. Secondary habitat is also common and widespread. However, no Grey-cheeked Thrush were observed during 2008 surveys (Stantec 2012b, 2010f).

Fifty observations of Blackpoll Warbler were documented in this region of the Study Area in 2008 (Stantec 2012b, 2010f), the majority of which (40) were within the Maritime Barrens Ecoregion, where the highest proportion of primary habitat was found (49%). An additional eight individuals were recorded during ELC field surveys (Stantec 2012b, 2010f).

Primary and tertiary habitat for wetland sparrows is distributed throughout the Avalon Peninsula region, but secondary habitat was not identified. Observations of wetland sparrows within the region during 2008 surveys (Stantec 2012b, 2010f) were of Savannah Sparrow (16), Swamp Sparrow (23) and Song Sparrow (three), and were primarily made within the Maritime Barrens Ecoregion. Although Lincoln's Sparrow was not recorded in the region during 2008 surveys, the area is within the breeding range of this species (Warkentin and Newton 2009). During the 2008 ELC surveys (Stantec 2012b, 2010f), six wetland sparrows were recorded in Wetland (four) and Kalmia Lichen / Heathland (two) habitats in this region.

The only observation of Rusty Blackbird during the 2008 surveys on the Island of Newfoundland was in the Maritime Barrens Ecoregion of the Avalon Peninsula (Stantec 2012b, 2010f). ACCDC (2010, 2008, internet site) records indicate that this species has been observed twice within the Study Area near Whitbourne.

Raptors

Raptors capture prey, including reptiles, mammals, other birds, fish and amphibians, using large talons adapted to capture and kill prey (Burton 1998). Hawks, eagles, vultures and falcons and their allies (day-active birds of prey) are grouped in the order Falconiformes, while owls, which are generally nocturnal, are members of the order Strigiformes (Burton 1998).

The following provides a general overview of the presence, abundance and distribution of raptors in the regions that comprise the Study Area. Presence of raptors in the Study Area is based on fieldwork, professional experience, and the following sources: LGL (2008); Minaskuat Inc. (2008e, f); Jacques Whitford (2003c, 1999, 1996b); Jacques Whitford and Minaskuat (2003b); AGRA Earth and Environmental Ltd. and Harlequin Enterprises (1999); DND (1994); Northland Associates Limited (1980d); and Todd (1963) and is indicated in Table 10.3.7-5.

Key raptor species identified for further review include Osprey, Bald Eagle and Short-eared Owl (Table 10.3.7-1). The occurrence of these species in the various regions is also discussed in the following text. Details on each species are provided within the *Avifauna Component Study* (Stantec 2012b, 2010f) and the *Avifauna Component Study Supplementary Report* (Stantec 2011g).

Table 10.3.7-5 Occurrence of Raptors in the Study Area by Region

Species	Central and Southeastern Labrador	Newfoundland
Sharp-shinned Hawk *(Accipiter striatus*)	Y[(a)]	Breeding
Northern Goshawk *(Accipiter gentilis*)	Breeding	Breeding
Northern Harrier (*Circus cyaneus*)	Breeding	Breeding
Red-tailed Hawk (*Buteo jamaicensis*)	Breeding	Breeding
Rough-legged Hawk (*Buteo lagopus*)	Y	Y
Bald Eagle (*Haliaeetus leucocephalus*)	Breeding	Breeding
Golden Eagle (*Aquila chrysaetos*)	Y	—[(b)]
Osprey (*Pandion haliaetus*)	Breeding	Breeding
American Kestrel (*Falco sparverius*)	Y	Breeding
Merlin (*Falco columbarius*)	Breeding	Breeding
Peregrine Falcon (*Falco peregrines anatum*)	Y	—
Gyrfalcon (*Falco rusticolus*)	Y	—
Short-eared Owl (*Asio flammeus*)	Y	Y
Great Horned Owl (*Bubo virginianus*)	Y	Y
Snowy Owl (*Bubo Scandiacus*)	Y	Y
Boreal Owl (*Aegolius funereus*)	Breeding	Breeding
Northern Hawk Owl (*Surnia ulula*)	Breeding	Breeding

(a) "Y" indicates occurrence known in the region, may breed.

(b) "—" indicates unlikely occurrence except as migrant.

Central and Southeastern Labrador

Seventeen raptor species are known to occur in Central and Southeastern Labrador, eight of which are known to breed within the region (Table 10.3.7-5). Surveys in 1998 identified Rough-legged Hawk (*Buteo lagopus*) as relatively "numerous" in the Study Area, with 10 observations being made, and also found one active (successful) nest of this species (Jacques Whitford 1999). During this same survey, three active Osprey nests were found and Red-tailed Hawk (*Buteo jamaicensis*), Merlin (*Falco columbarius*), Northern Hawk Owl (*Surnia ulula*) and Short-eared Owl were observed with no associated nest or young. In addition to these species, studies conducted for the TLH3 identified Bald Eagle, Northern Goshawk (*Accipiter gentilis*), Northern Harrier (*Circus cyaneus*), American Kestrel (*Falco sparverius*), Great Horned Owl and Boreal Owl (*Aegolius funereus*) within the region (Jacques Whitford 2003b, 2003c; Jacques Whitford and Minaskuat 2003b).

Osprey are relatively abundant and well-studied in Central and Southeastern Labrador. Raptor surveys conducted in 1998 found 17 Osprey nests along the survey route (Figure 10.3.7-2), with several of these being active (Jacques Whitford 1999). Similarly, Osprey were found to be relatively abundant in the region during surveys conducted for the TLH3. For example, 33 of 35 raptor nests identified during a survey of the proposed highway route were of Osprey (Jacques Whitford 2003c). Eight Osprey nests were found along the portion of the highway corridor shared by the transmission corridor, primarily in complexes of wetlands and waterbodies associated with a tributary of the Kenamu River (Jacques Whitford 2003c; Jacques Whitford and Minaskuat 2003b).

Although Bald Eagle nests were not observed during 1998 surveys in support of this Project (Jacques Whitford 1999), the breeding range for this species is known to include the area south of the treeline in Labrador (Todd 1963) and they have been observed in or adjacent to the Study Area during other studies. In particular, raptor studies performed for the TLH3 found an active Bald Eagle nest within the portion of the highway corridor shared with the transmission corridor (Jacques Whitford and Minaskuat 2003c) and this species was encountered during point counts conducted for this Project (Jacques Whitford 2003a). Outside of the Study Area, 36 known Bald Eagle nest sites were surveyed in central Labrador in 2005 (Minaskuat Limited Partnership 2005b). Nine (25.0%) of these sites were active, eight were empty (22.2%), two (5.6%) were occupied by another species, two (5.6%) were collapsed and no evidence of a nest structure could be located at 15 (41.7%) other locations.

Primary habitat for Short-eared Owl is mainly found in the Forteau Barrens Ecoregion, where it accounts for 31% of the Study Area within the region. This species is frequently reported in the coastal barrens between L'Anse au Clair and Red Bay (Schmelzer 2005) and ACCDC records show a concentration of Short-eared Owl observations within the Study Area in this location (ACCDC 2010, 2008, internet sites). Two Short-eared Owl were incidentally recorded during waterfowl surveys in the Study Area near Forteau in 1998 (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999), one during raptor surveys in 1998 (Jacques Whitford 1999) and two during surveys along the TLH2, east of the Study Area (Jacques Whitford 1998b). This species has been observed in large bogs within Labrador's open coniferous mid-subarctic forests, which contrasts with breeding information from Ontario and Québec, where few nests are located inland or in the boreal forests (Schmelzer 2005).

Newfoundland

Diurnal raptors in Newfoundland include Osprey, Bald Eagle, Northern Harrier, Sharp-shinned Hawk (*Accipiter striatus*), Northern Goshawk, Rough-legged Hawk, American Kestrel, Merlin and Gyrfalcon (*Falco rusticolus*) (Warkentin and Newton 2009; Whitaker et al. 1996; Montevecchi 1993). While Osprey is considered the most common of these, most species nest on the Island and are widely distributed (Warkentin and Newton 2009). The exceptions to this are American Kestrel and Gyrfalcon, which are considered very uncommon, the latter occurring only in migration and over winter (Warkentin and Newton 2009). Owls breeding in Newfoundland include Great Horned Owl, Northern Hawk Owl, Short-eared Owl and Boreal Owl (Warkentin and Newton 2009). All species are found throughout the Island; however, Northern Hawk Owl shows a preference for colder, more northern areas and is considered relatively uncommon (Warkentin and Newton 2009). Snowy Owl (*Bubo scandiacus*) is also found on the Island, although like the Gyrfalcon, only during migration and over winter (Warkentin and Newton 2009).

Osprey, Bald Eagle and American Kestrel were the only three raptor species documented during field surveys along the proposed transmission corridor on the Island in 1998 (Jacques Whitford 1999). Two active Osprey nests were identified and both were successful as young were produced (Jacques Whitford 1999). AGRA Earth and Environmental Ltd. and Harlequin Enterprises (1999) incidentally recorded Osprey, Bald Eagle, Merlin and Great Horned Owl during waterfowl breeding surveys in June 1998.

As in Labrador, Osprey is considered to be the most abundant raptor; however, nesting habitat on the Island is considered to be of below-average quality for this species (Jacques Whitford 1999). Surveys in support of the Project in June and early July 1998 found a total of 20 nests (active and inactive), of which only three were on the Island (Jacques Whitford 1999).

Bald Eagle nests were not observed during 1998 raptor surveys of the Study Area (Jacques Whitford 1999) or during passerine surveys in 2008 (Stantec 2012b, 2010f). However, Bald Eagles are year-round residents on the Island, where they are found in association with coasts and forested areas with lakes and ponds (Warkentin and Newton 2009). Relatively high numbers of Bald Eagles are observed in parts of Placentia Bay and Trinity Bay (ACCDC 2010, internet site; Newfoundland and Labrador Tourism 2009, internet site) but relatively few nests are located on inland portions of the Avalon Peninsula (Department of Forest Resources and Agrifoods 2002, internet site).

Habitat potential for Short-eared Owl on the Island is comprised largely of secondary quality habitat, with only marginal amounts (5% or less) of primary habitat available per region. Schmelzer (2005) compiled records of Short-eared Owl for the Island, showing a concentration of observations along coastal Newfoundland (western, north-eastern and eastern) and throughout the Avalon Peninsula. Between 2000 and 2005, there were 10 reports of Short-eared Owls between January and March on the Avalon Peninsula (Schmelzer 2005), and a total of three Christmas Bird Count sightings at St. John's, Cape Race and Stephenville. Within the Newfoundland portion of the Study Area, ACCDC records show one observation of the Short-eared Owl on the Avalon Peninsula and a concentration of records in close proximity to the coastline along the Strait of Belle Isle (ACCDC 2010, 2008, internet site).

Upland Game Birds

The term "Upland Game Bird" refers to non-waterfowl species that are hunted for subsistence and include species such as grouse, ptarmigan and snipe that are not necessarily associated with upland sites. Within the Province of NL, the main species that are hunted include Ruffed Grouse, Spruce Grouse, Willow Ptarmigan and Rock Ptarmigan (NLDEC 2009b). Both species of grouse were introduced to the Island of Newfoundland in the 1960s and 1970s (Warkentin and Newton 2009).

The following provides a general overview of the presence, abundance and distribution of upland game birds in the Study Area, with particular emphasis on Ruffed Grouse (*Bonasa umbellus*) and Willow Ptarmigan (*Lagopus lagopus*). Ruffed Grouse was identified as a key species representing upland game birds because it has a relatively limited distribution and more specialized habitat requirements than other upland game species, being closely associated with aspen habitats that are comparatively limited in the Study Area (Table 10.3.7-1).

Willow Ptarmigan was also considered for more detailed review as identified in the *Environmental Impact Statement Guidelines and Scoping Document* issued by the GNL and the Government of Canada (2011). Habitat mapping for this species was not completed because of seasonal movements and variation in its habitat requirements (i.e., this species undergoes seasonal movements of considerable distance to satisfy food and breeding requirements).

Details on upland game species within the Study Area are provided within the *Avifauna Component Study* (Stantec 2012b, 2010f) and the *Avifauna Component Study Supplementary Report* (Stantec 2011g).

Central and Southeastern Labrador

Few sightings of upland game birds have been recorded during avifauna surveys in this region. Willow Ptarmigan and Spruce Grouse (*Falcipennis canadensis*) would be expected to occur in higher numbers compared to Ruffed Grouse, based on availability of preferred habitat.

During passerine surveys in 2008, one observation of Ruffed Grouse was made in Wetland habitat in the Low Subarctic Forest Ecoregion (Stantec 2012b, 2010f). This species was also incidentally documented in the Central and Southeastern Labrador region during 2008 ELC surveys (one record) (Stantec 2012b, 2010f), where it was recorded in Hardwood Forest habitat. Ruffed Grouse were not encountered during passerine surveys conducted in support of the TLH3 (Jacques Whitford 2003b). Preferred Hardwood Forest habitat for this species occurs in <1% of the Study Area in Central and Southeastern Labrador.

One Willow Ptarmigan was recorded during each of the May and June waterfowl surveys in 1998 (AGRA Earth and Environmental Ltd. and Harlequin Enterprises 1999) and 15 observations of Willow Ptarmigan were made in the region during a May waterfowl survey conducted for the TLH3 (Jacques Whitford 2003a). Four Willow Ptarmigan were incidentally recorded east of the Study Area during surveys along the TLH2 in 1998 (Jacques Whitford 1998b).

Both Spruce and Ruffed Grouse were detected in southern Labrador (west of the transmission corridor) during the River Valley Ecosystem research in 2002 (IEMR 2003, internet site), along the Little Mecatina and St. Augustine River valleys (west of the Study Area).

While a relatively rare species in this area, Todd (1963) documented three records of Rock Ptarmigan on the south coast of Labrador (along the Strait of Belle Isle), within or adjacent to the Project Study Area.

Newfoundland

Ruffed Grouse, Spruce Grouse, Rock Ptarmigan and Willow Ptarmigan are resident species on the Island of Newfoundland (Warkentin and Newton 2009). Spruce Grouse are particularly associated with coniferous forests in Central Newfoundland, where they were first introduced, but have expanded their range to include the Northern Peninsula (Warkentin and Newton 2009).

Ruffed Grouse are resident throughout the Island, with the exception of the south coast (Warkentin and Newton 2009). Primary Hardwood Forest habitat for Ruffed Grouse does not occur in the Study Area in Newfoundland. However, this species is a year-round resident on most of the Island, the exception being the south coast (Warkentin and Newton 2009). Only one observation of Ruffed Grouse was recorded during passerine surveys in 2008, in Mixedwood Forest habitat in the Central Newfoundland Forest Ecoregion. One other Ruffed Grouse was documented in the Study Area, in Conifer Forest habitat, during the ELC field study (Stantec 2010a).

Willow Ptarmigan are found throughout the Island but they are most common on the Avalon Peninsula, along the Maritime Barrens, near the tips of large peninsulas and in association with open upland sites (Warkentin and Newton 2009). Because winter shelter for this species is relatively close at hand for some areas of Newfoundland, movements of Willow Ptarmigan on the Island are generally less than in Labrador, where they are often suspected of migrating many hundreds of kilometres.

Rock Ptarmigan are restricted to high, barren rocky habitats along the south coast (Cape Ray to Fortune Bay), in the Long Range Mountains of the west coast and on the highest plateaus of the interior uplands (Skinner and McGrath 1994, internet site).

Other Species of Special Conservation Status

Of the other species of special conservation status known to potentially occur in the province, Common Nighthawk and Red Knot are the only ones that occur in the vicinity of the Study Area (Table 10.3.7-1). Details on species of special conservation status are provided in the *Avifauna Component Study* (Stantec 2012b, 2010f) and the *Avifauna Component Study Supplementary Report* (Stantec 2011g).

Central and Southeastern Labrador

Red Knot is not known to breed in Labrador but is expected to occur along the coast during migration. However, there is a lack of data relative to the area and as a result there are few records of Red Knots from locations where they may be expected to occur during migration along the Labrador coastline (Mactavish, pers. comm., cited in Garland and Thomas 2009). There were approximately 5 to 10 historical Red Knot sightings reported in Labrador between 1860 and 1950, the majority of which were during fall migration along the east and south coasts (Todd 1963). Although this species has been observed along the coast of the Strait of Belle Isle, records do not indicate any sightings within the Central and Southeastern Labrador region of the Study Area (ACCDC 2010, internet site; Garland and Thomas 2009).

Although known to breed in Labrador, Common Nighthawk was not observed during baseline surveys in support of this Project (Stantec 2012b, 2010f) and were not recorded during 13 years of the operation of the Happy Valley Breeding Bird Survey (Sauer et al. 2007), although this likely reflects the nocturnal behaviour of this species. One incidental observation of Common Nighthawk was made (while walking between point count locations) during 2006 passerine surveys (Minaskuat Inc. 2008e). Primary habitat for this species comprises Cutover, Burn, Open Conifer and Black Spruce / Lichen Forest habitats and accounts for approximately 27% of the Study Area in Central and Southeastern Labrador. The majority of this habitat is found in the String Bog (38%) and Low Subarctic Forest (29%) Ecoregions. Primary habitat is also relatively high in the High Boreal Forest Ecoregion (23%), but this Ecoregion only comprises approximately 6% of the Study Area. Secondary habitat includes Wetland and Scrub / Heathland / Wetland habitats.

Newfoundland

Red Knot sightings have been reported on almost the entire coast of Newfoundland, but the majority have been at several locations on the west coast and at Bellevue Beach in Trinity Bay (Garland and Thomas 2009 and references therein). Bellevue Beach, along with two other locations where Red Knot has been observed (Arnold's Cove and Come by Chance), is located within the Study Area at the western end of the Avalon Peninsula. Records indicate that these sightings are of fall migrants, primarily observed during September and October (ACCDC 2010, internet site). Although also observed along the coast of the Strait of Belle Isle (Garland and Thomas 2009), ACCDC records do not indicate any sightings within the Study Area on the Northern Peninsula (ACCDC 2010, internet site).

Common Nighthawk are extremely rare, if present at all, on the Island of Newfoundland (EC 2010k, internet site). Earlier studies did not observe Common Nighthawk in Newfoundland (Todd 1963) and it is considered only a rare visitor on the Island (COSEWIC 2007b, internet site).

In addition to the aforementioned species, isolated records of Barrow's Goldeneye (*Bucephala islandica*) and Ivory Gull (*Pagophila eburnea*) have been recorded within the Newfoundland portion of the Study Area. A 1993 record of Barrow's Goldeneye was made at Arnold's Cove on the Avalon Peninsula (ACCDC 2010, internet site) but this species is not known to breed on the Island. However, Barrow's Goldeneye does winter in coastal areas of Newfoundland where they are considered uncommon, with <15 individuals observed near Terra Nova National Park (Eadie et al. 2000, internet site). Observations were also reported in Labrador during the winter on three occasions up to 325 km inland from open coastal water (Chubbs and Phillips 2007). Ivory Gull was recorded at the Avondale River estuary in 1998 (ACCDC 2008, internet site). This species breeds in high-Arctic coastal areas in Nunavut and winters primarily in Arctic seas, but is occasionally seen along the coast of Newfoundland (Stenhouse 2004). Although these records demonstrate that these species may very infrequently be observed within the region, they do not typically utilize the habitat within the Study Area.

Aboriginal Ecological Knowledge

AEK regarding avifauna in parts of the Study Area was obtained through interviews completed with the Labrador Innu, and land and resource use interviews with members of the NunatuKavut Community Council, and Pakua Shipi. This is listed below (Table 10.3.7-6) and includes information on habitat, diet, nesting, behaviour, their predators, their prey, mating rituals, migration patterns, and their presence in the proposed transmission line corridor. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.3.7.2).

Table 10.3.7-6 Aboriginal Ecological Knowledge of Avifauna in the Study Area

Group	Source	Quote (Direct and / or Indirect)
Labrador Innu	Labrador Innu Traditional Knowledge Committee Members, January 26, 2007 (p. 47)[(a)]	*Direct/Indirect* *Ushatshissu* – 'where there is always geese'. These include muddy flats near the mouths of brooks, as well as grassy areas, marshes with small ponds, and also barren hill areas with berries (P1, P6.26.1.07).
	Labrador Innu Traditional Knowledge Committee Member, November 28, 2006 (p. 60)[(a)]	*Indirect* *Shiship* (duck) and *nishk* (Canada goose) eat different types of berries (P1.28.11.06).
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Indirect* Only *nishk* (Canada goose) and *inniship* (black duck) have nests in marshes (P1, P5.6.12.06).

Table 10.3.7-6 Aboriginal Ecological Knowledge of Avifauna in the Study Area (continued)

Group	Source	Quote (Direct and / or Indirect)
	Labrador Innu Traditional Knowledge Committee Member, December 8, 2006 (p. 47)[(a)]	*Direct* "The innineu (spruce grouse) are in the tall fir trees in sheltered areas along the sides of rivers. On the points where there are lots of fir trees, that's where you find lots of innineu" (P1.8.12.06).
	Labrador Innu Traditional Knowledge Committee Member, December 6, 2006 and January 25, 2007 (p. 53)[(a)]	*Indirect* *Nutshipaushtikueshish* (harlequin duck) are generally not seen on the calm sections of rivers, and are rarely seen on Mishta-shipu anywhere. They are found in rapids. They have not been seen at Tshiashku-paushtik^{u} but are known to frequent a river that empties into Mishta-shipu. This river is called Kaku-shipiss (Fig River) (P1.6.12.06; 25.1.07).
	Labrador Innu Traditional Knowledge Committee Member, December 6, 2006 and January 25, 2007 (p. 53)[(a)]	*Indirect* The baby *Nutshipaushtikueshish* can follow their mothers up the rapids six or seven of them in a line. There were a lot of them at Kakuetipapukunanut ('where someone capsized in the current') in the old days before Meshikamau-shipu was dammed (P1.6.12.06; 25.1.07)
	Labrador Innu Traditional Knowledge Committee Member, December 6, 2006 (p. 58)[(a)]	*Indirect* *Nutshipaushtikueshish* (harlequin duck) nests on grassy islands on rivers (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Indirect* *Shashteship* (black scoter) nests inland, on small islands in lakes that are moss/grass covered and have alders. They have nests in the grassy areas, outside the alder (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Direct/Indirect* *Inniship* (black duck) nests in marsh areas close to trees (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Indirect* *Uapinnishipiss* (green-winged teal) nest inland. They have their nests close to the woods, in marshy areas, beside the ponds. They lead their chicks to lakes as soon as they can walk to avoid the predators (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Indirect* *Mitshikutan* (surf scoter) nests in the vicinity of *uauak^{u}* (kettle hole). Some *uauak^{u}* have small islands that the surf scoters nest on because they are afraid of *matsheshu* (fox), *atshikash* (mink), and *uapishtan* (marten). Sometime *tshiashk^{u}* (gull) eat their eggs (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Indirect* The male *mitshikutan* (surf scoter) abandons his wife and chicks and returns to salt water by himself (P1, P5, P6.6.12.06).

Table 10.3.7-6 Aboriginal Ecological Knowledge of Avifauna in the Study Area (continued)

Group	Source	Quote (Direct and / or Indirect)
	Labrador Innu Traditional Knowledge Committee Members, December 6, 2006 (p. 58)[(a)]	*Indirect* *Mishikushk*^{u} (common goldeneye) nests in rotten trees. The female lays 12 to 15 eggs (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Member, January 25, 2007 (p. 59)[(a)]	*Indirect* *Pashpassu* (ruffed grouse) are heard beating their wings in the spring when they are mating. Only *pashpassu* beats its wings when mating (P1.25.1.07).
	Labrador Innu Traditional Knowledge Committee Member, November 24, 2006 (p. 60)[(a)]	*Indirect* *Uhu* (great horned owl) can kill *kak*^{u} porcupine and swallow a porcupine head (P3.24.11.06).
	Labrador Innu Traditional Knowledge Committee Members, December 12, 2006 (p. 60)[(a)]	*Indirect* *Nutshineueshu* (gyrfalcon) eat *uapineu* (willow ptarmigan), *innineu* (spruce grouse), and *uapush* (snowshoe hare) (P1, P5.6.12.06).
	Labrador Innu Traditional Knowledge Committee Member, November 24, 2006 (p. 60)[(a)]	*Direct* "The reason animals are attracted to *akushamesheu* (osprey) nests, is because the osprey drop fish sometimes, and the animals smell these 'scraps'. As soon as the osprey feeds its young, it drops scraps and the *uapishtan* (marten) and *atshikash* (mink) feed on these scraps" (P3.24.11.06).
	Labrador Innu Traditional Knowledge Committee Member, November 24, 2006 (p. 60)[(a)]	*Indirect* *Akushamesheu* (osprey) is different than *mitshishu* (eagle) because they only eat fish. They build their nests close by fish concentrations (P3.24.11.06).
	Labrador Innu Traditional Knowledge Committee Member, January 25, 2007 (p. 60)[(a)]	*Indirect* *Pipitshish* (merlin) eats small birds like *pipitsheu* (American robin), *uishkatshan* (gray jay), etc. (P1.25.1.07).
	Labrador Innu Traditional Knowledge Committee Members, April 26, 2007 (p. 63)[(a)]	*Indirect* *Shiship* (ducks) and *nishk* (Canada goose) arrive at different times in the spring. In general, the order of arrival is as follows: (1) *mishikushk*^{u} (common goldeneye); (2) *inniship* (American black duck), *uapinniship* (northern pintail), *uapinnishipiss* (green-winged teal); (3) *ushuk*^{u} (red-breasted merganser), *mishtishuk*^{u} (common merganser), *nutshipaushtikueshish* (harlequin duck), *kaiashinikanikutesht* (lesser scaup), *aiakuss* (greater scaup); (4) *nishk* (Canada goose); (5) *mitshikutan* (surf scoter), *shashteship* (black scoter), *umamuk*^{u} (white-winged scoter), *auiu* (long-tailed duck); and (6) *ashu-muak*^{u} (red-throated loon), *muak*^{u} (common loon) (ITKC.26.04.07).

Table 10.3.7-6 Aboriginal Ecological Knowledge of Avifauna in the Study Area (continued)

Group	Source	Quote (Direct and / or Indirect)
NunatuKavut Community Council	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* There are land birds in the proposed transmission corridor area.
	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* Ducks and geese nest in the transmission line area, especially where the proposed corridor branches off the highway to the south. They would nest mainly in marshlands or big lakes with islands in them.
	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* Geese migrate and white partridge are found along the transmission area. The coast is a nesting area for white partridge.
	NunatuKavut Land and Resource Use Interview, May 2011	*Indirect* Many birds are migrating through the proposed corridor area in the spring.
	NunatuKavut Land and Resource Use Interview, 2011	*Indirect* Some areas such as marshlands and lakes would be better than others for geese and black duck.
	NunatuKavut Land and Resource Use Interview, 2011	*Indirect* Birds have been seen around St. Augustine River.
	NunatuKavut Land and Resource Use Interview, 2011	*Indirect* Every other bird that is in Labrador is in the transmission line route. While flying in that country, every type of bird (except seabirds) seen everywhere else in Labrador was seen there (e.g., osprey, bald eagles, songbirds, inland ducks, etc.).
Pakua Shipi	Pakua Shipi Land and Resource Use Interviews conducted as part of the Phase II Community Engagement Agreement, June 6, 2011	*Indirect* Uauak is the Innu term used to designate a lake without fish. The Québec Innu identify it as being biologically important because such a type of lake would be an important habitat for the goldeneye duck, which is a species at risk.

(a) Source: *Innu Environmental Knowledge of the Mishta-shipu (Churchill River) Area of Labrador in Relation to the Proposed Lower Churchill Project* (Armitage 2007). Refer to Appendix 10-1.

Local Ecological Knowledge

Local Ecological Knowledge regarding avifauna in parts of the Study Area was obtained through participants of the 2010 Open House in Hawke's Bay. This is listed below (Table 10.3.7-7), and includes information on the absence of Harlequin Duck in the Torrent River. The information provided differs from scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.3.7.2). The difference can be attributed to the locational data of the sightings which are several kilometres upstream from the community.

Table 10.3.7-7 Local Ecological Knowledge of Avifauna in the Study Area

Community	Source	Indirect Quote
Hawke's Bay, NL	Labrador-Island Transmission Link Open House participant, Hawke's Bay, April 29, 2010	There are no Harlequin Duck in the Torrent River.

10.4 Freshwater Environment

The total area of NL is 405,720 km^2 of which 7.7% or 31,240 km^2 is freshwater (NRCan 2009, internet site). In general, the Freshwater Environment is comprised of two freshwater sources, flowing watercourses and lentic waterbodies. Watercourses are a natural or artificial channels through which water flows, such as rivers, streams, and brooks. Waterbodies are any significant accumulation of water, such as lakes and ponds. Both watercourses and waterbodies were created by glacial action, and are now inhabited by various species of flora and fauna.

Water flow within all features of the Freshwater Environment functions to provide plant and animal habitat, nutrient cycling, and connectivity between watercourses, waterbodies and other aquatic ecosystems such as wetlands and the Marine Environment. Fish species such as Atlantic salmon (*Salmo salar*) and American eel (*Anguilla rostrata*) migrate between marine and freshwater environments to complete certain life cycle stages (e.g., spawning). Suitable fish habitat within watercourses and waterbodies can be specific to individual life cycle stages of resident and migratory fish species. Morphology, gradient and substrate composition are the primary determinants of watercourse habitat characterization.

Water quality and quantity also influence freshwater environments and fish species presence. Water quality, as determined by physical and chemical parameters, is typically used as an indicator of freshwater ecosystem health.

10.4.1 Study Area

Existing baseline conditions for the freshwater environment are presented in relation to the proposed transmission corridor from Central Labrador to the Island of Newfoundland's Avalon Peninsula as well as considering the location of other Project-related components and activities. The information provided in this chapter has been organized according to regions within the province, namely, Southeastern and Central Labrador, Northern Peninsula, Central and Eastern Newfoundland, and the Avalon Peninsula.

10.4.2 Watersheds

Watersheds are regions drained by one or more bodies of water through a single watercourse. Watershed delineations are dependent upon the local topography whereby a ridge or highland separates each watershed. Watershed characteristics are important in describing available freshwater fish habitat.

10.4.2.1 Information Sources and Data Collection

The freshwater environment described in the *Freshwater Environment: Fish and Fish Habitat, Water Resources Report* identifies representative freshwater resources and fish and fish habitat within the proposed transmission corridor (AMEC 2010a). A portion of the corridor in the Labrador Region starting at Muskrat Falls was assessed in a separate document: *Freshwater Environment Supplementary Report* (AMEC 2011a). The information collected for these reports included aerial photograph interpretation and field programs.

Field work, such as electrofishing and water sampling took place within this corridor or as close to it as possible, depending on the field conditions. The selected electrofishing and sampling sites are representative

of the watercourses within the Study Area. The field work served to collect new information where data gaps existed and confirmed data obtained during the desktop and literature reviews.

Information for the corridor was also obtained from desktop reviews and literature reviews, including baseline information on the existing Freshwater Environment collected for the TLH3 (Jacques Whitford and Innu 2003).

Watershed characteristics that would be considered important in its classification are primarily related to the upstream area and gradient features of its catchment, or drainage basin, as these features largely determine the potential range of flows at a given point within the associated watercourse. Water flow, or discharge, and its depth and velocity are the principal shaping forces of the freshwater aquatic ecosystem. They influence the shape and size of the channel, and sort and transport bottom substrates and suspended sediments. To characterize the watersheds within NL, and specifically those within the transmission corridor, several sources of spatial imagery were used to identify and classify watershed information. With other provincially-regulated activities (e.g., forest harvesting) all watercourses identified on provincial 1:50,000 topographical maps are considered to have watersheds large enough to generate flows and provide aquatic habitat (Scruton et al. 1997). Therefore, this criterion was also adopted for this description of the freshwater existing environment.

Following identification of all watercourses within the transmission corridor, a GIS system was used to calculate watershed sizes for each watercourse. Watershed sizes of identified watercourses were calculated using GIS applications (Argos 9.2 with Arc hydro tool within the Spatial Analyst extension). The watershed area, or drainage basin, is based on elevation contours generated using digital elevation models. The drainage basin is considered to be the defined upstream unified watercourse system, oriented by the slope of the land or natural landform barriers such as hills and valleys (Bain and Stevenson 1999; Scruton et al. 1997). Therefore, the generated watershed sizes are those drainage basins up-gradient of the proposed transmission corridor.

The measurement of watershed areas was completed for each watercourse within the Study Area. This measurement allowed the classification of each watercourse based on watershed size. These categories are described in Table 10.4.2-1.

Table 10.4.2-1 Watershed Size Categories of Watercourses within the Study Area

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

Source: AMEC (2010a).

10.4.2.2 Description of Watersheds

Figure 10.4.2-1, Figure 10.4.2-2 and Figure 10.4.2-3 illustrate the watercourses that were identified through aerial photo interpretation and those that were surveyed within the Study Area.

The upstream drainage area of each watershed was delineated and described in the component study (AMEC 2010a). A summary of the number of each watershed size crossed by the Project by region is provided in Table 10.4.2-2. The sizes of the watersheds were subsequently linked to a watercourse type, as described in Table 10.4.2-1.

Table 10.4.2-2 Summary of the Watershed Size and Watercourse Type within the Study Area

Watershed Size (km^2)	Watercourse Type	Number of Watercourses Identified Within Each Region			
		Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
<2.6	Intermittent (N)	113	77	85	65
2.6-50	Small (S1)	64	38	59	32
50-200	Small (S2)	9	3	17	2
200-500	Small (S3)	5	5	2	–
500-1,000	Intermediate (I1)	1	–	5	–
1,000-10,000	Intermediate (I2)	2	–	2	–
>10, 000	Large (L)	–	–	–	–
Total		**194**	**123**	**170**	**99**

Source: AMEC (2011a; 2010a).

10.4.3 Watercourses and Waterbodies

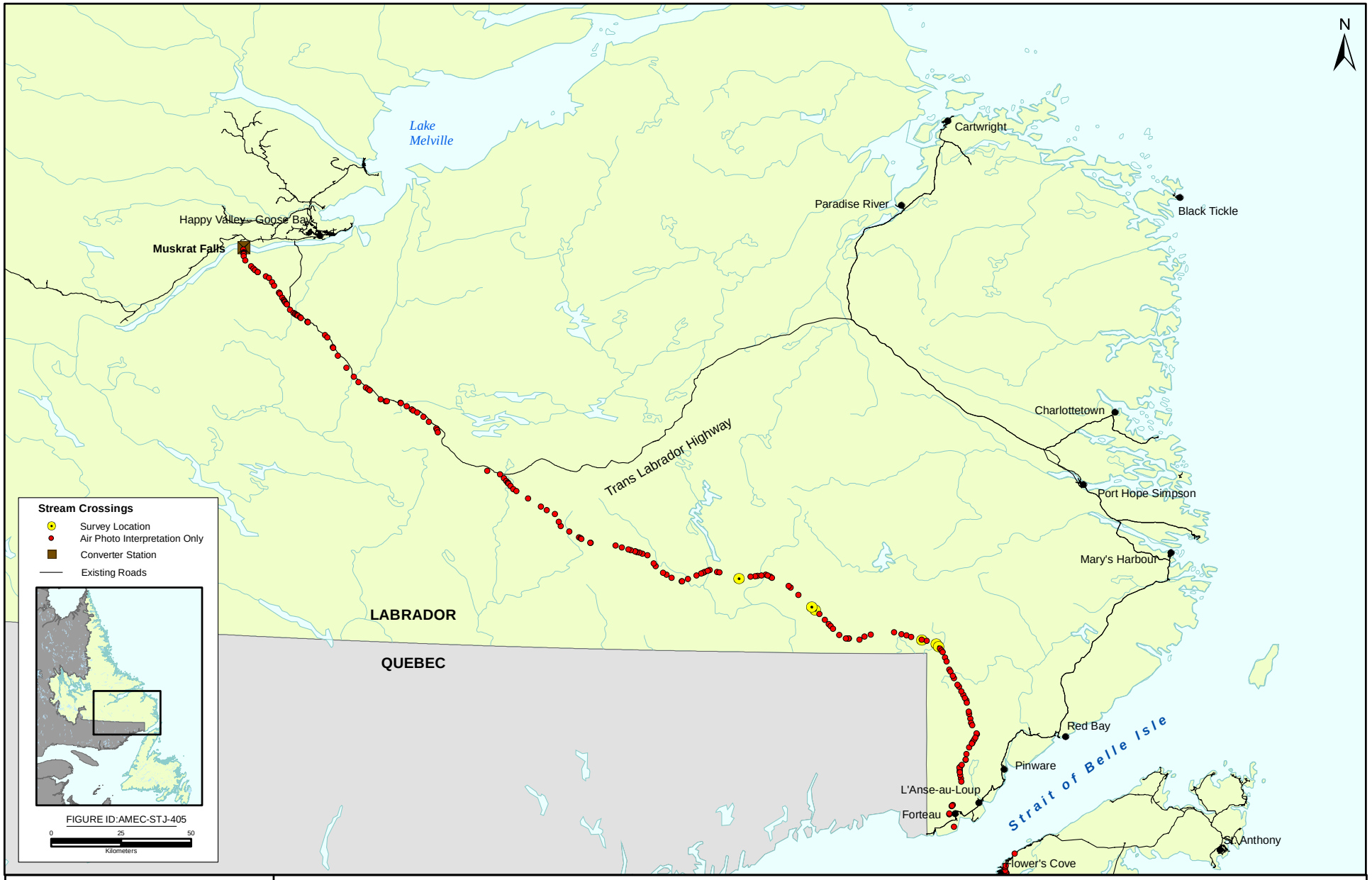
Watercourses and waterbodies are the two components of watersheds. Watercourses refer to faster flowing channels such as rivers and streams, and waterbodies refer to larger catchments of water such as lakes and ponds with slower moving water. Watercourses and waterbodies are addressed in this section.

10.4.3.1 Information Sources and Data Collection

Watercourse information for the transmission corridor was obtained from desktop reviews, literature reviews and field work. The field work served to collect new information where data gaps existed and to confirm data obtained during the desktop and literature reviews. Due to the large number of watercourses within the transmission corridor, a representative sample, based on watershed size, was field surveyed. The information collected is summarized in *Freshwater Environment: Fish and Fish Habitat, Water Resources* (AMEC 2010a) and the supplementary report for the corridor alignment from Muskrat Falls (AMEC 2011a).

Several sources of spatial imagery were used in the identification and classification of watercourses within the Study Area, including topographic maps, aerial photographs, and satellite imagery. All available aerial imaging was collected and incorporated into a GIS system for analysis.

Topographic maps (1:50,000) were available for the entire Study Area and were primarily used in the identification of watercourses, whereas aerial photographs and satellite imagery provided a means of assessing watercourses over a large area more efficiently and accurately than through the use of topographic maps alone.



nalcor energy

FIGURE 10.4.2-1

Identified Watercourses within the Central and Southeastern Labrador Region

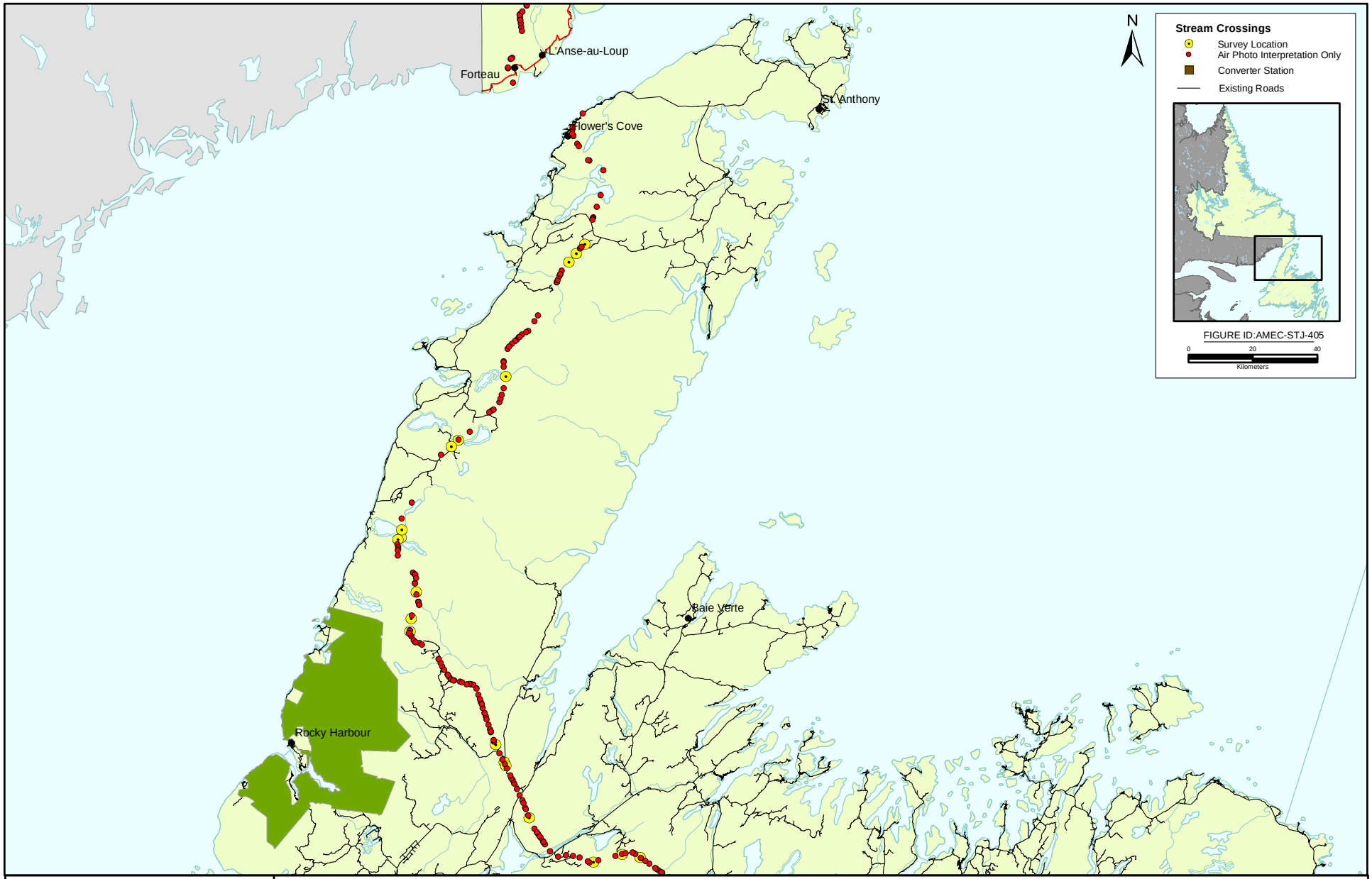


FIGURE 10.4.2-2

Identified Watercourses within the Northern Peninsula Region

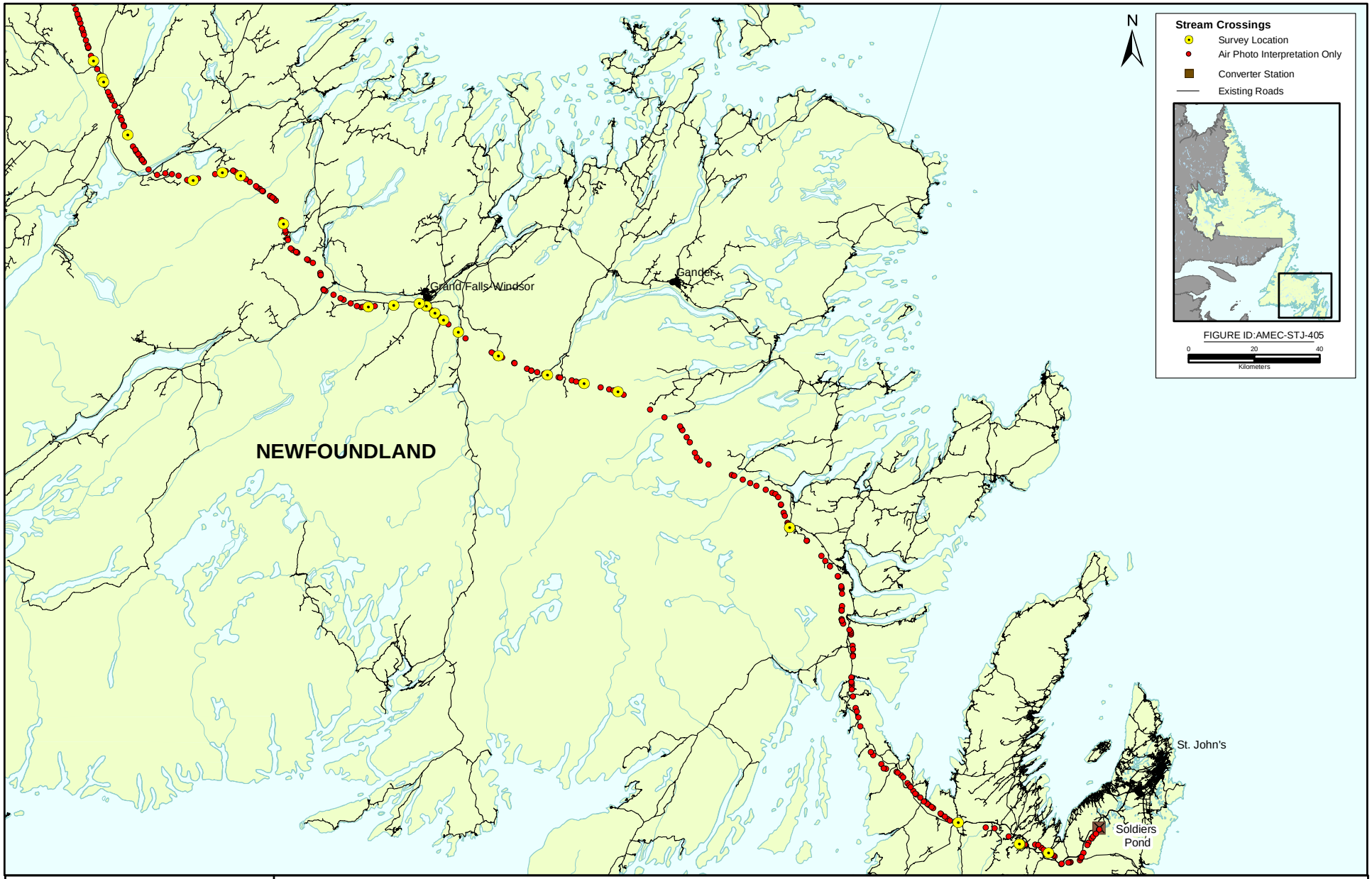


FIGURE 10.4.2-3

Identified Watercourses within the Central and Eastern Newfoundland and the Avalon Peninsula Regions

There are waterbodies (i.e., ponds and lakes) located within and along the Study Area. The aerial photograph and satellite imagery interpretation delineated all waterbodies. Since Nalcor will be avoiding these larger waterbodies, detailed habitat characterization was not required and, consequently, is not completed or discussed further in this section.

Aerial photography (1:30,000), with a spatial resolution of 60 cm, was provided by the NLDEC Lands Branch, Surveys and Mapping Division. Coverage included a 15 km wide corridor from near Hampden, east to the Isthmus of Avalon, but was unavailable for the Northern Peninsula and Labrador regions. The vintage of the digital aerial photography obtained and used ranged from 1999 to 2006.

To supplement the available air photos and fill in the above noted spatial gaps, SPOT 5 satellite imagery was purchased through a Canadian distributor, Lunctus Geomatics Corporation. Satellite imagery, with a spatial resolution of 2.5 m (panchromatic) and 5 m (multispectral), was acquired to cover an area that encompassed the proposed transmission corridor and adjacent areas. The 2.5 m panchromatic (greyscale) imagery was coloured using both SPOT 5 multispectral (colour) imagery and Landsat 7 (colour) imagery, and all products were ortho-corrected. The most recent imagery that met the criteria of <10% cloud cover and acquisition during snow free conditions (between the months of June and October) was used. The vintage of the imagery ranged from 2005 to 2008.

In addition, in the fall of 2010, Nalcor augmented available imagery by collecting high quality spatial imagery covering the areas along the proposed transmission corridor for eventual use in detailed Project planning and design. This included undertaking Light Detection and Ranging and ortho-photo surveys within the proposed transmission corridor. The digital aerial photography had a spatial resolution of 20 cm at the 1:30,000 scale.

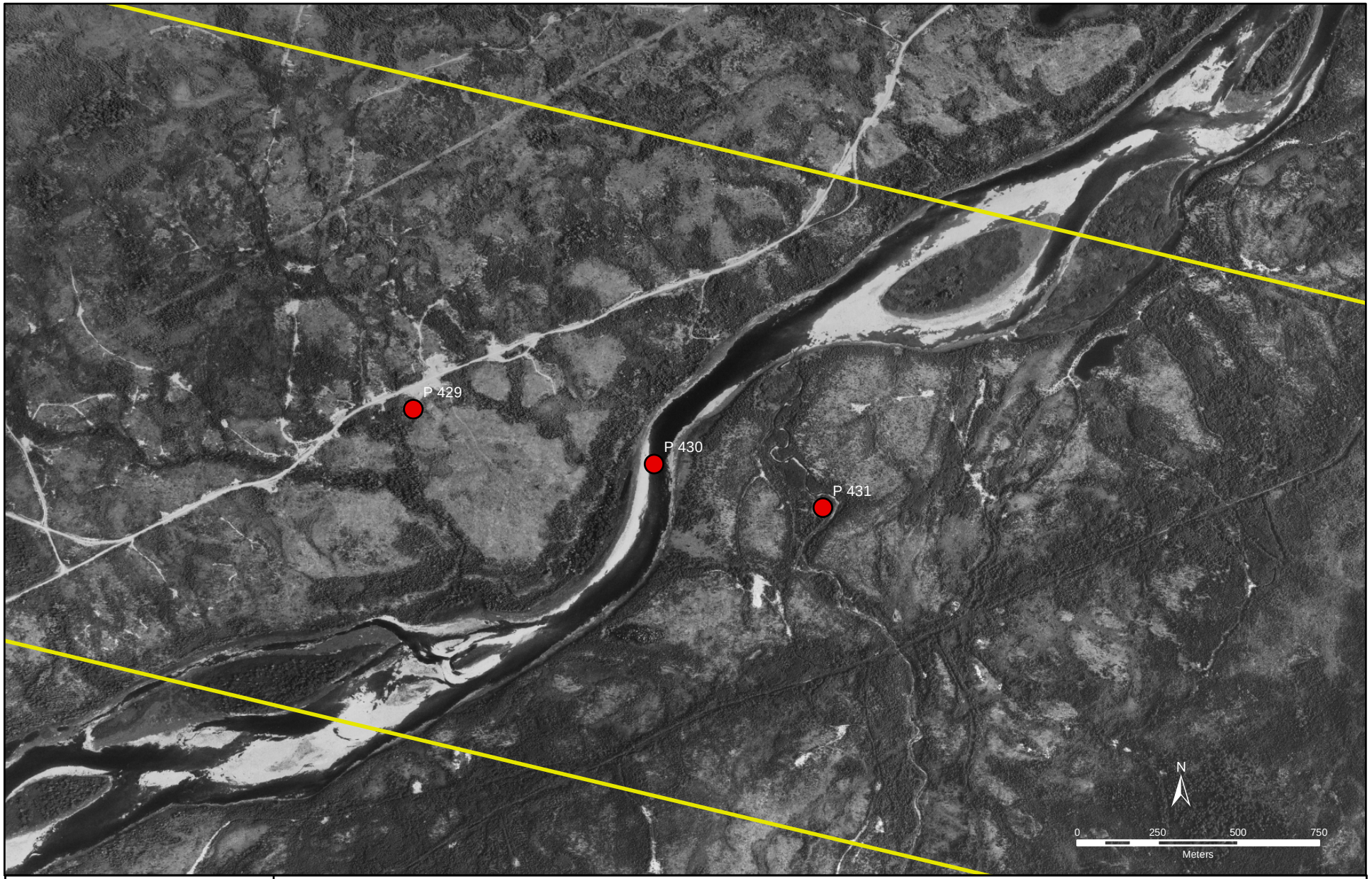
For the identification of watercourses within the Study Area, a watercourse was defined as any flowing body of water which could be discerned on a 1:50,000 topographic map. This definition is consistent with that used in NL for identification of watercourses requiring buffer zones for the protection of fish and fish habitat (Scruton et al. 1997).

GIS analysis identified watercourses within the Study Area, each of which was given a unique identification number. This was completed to assist in field data collection.

Characteristics of the identified watercourses were collected via interpretation of aerial photography and satellite imagery. An example of an aerial photograph used to interpret watercourse transmission characteristics (i.e., fish habitat) is provided in Figure 10.4.3-1. The yellow line depicts the corridor boundaries and the red dots identify the sample locations for watercourse characterization. Data collected from the image analysis included dominant substrate type, flow morphology, riparian vegetation, and measured wetted and bank full widths. The parameters of these characteristics are summarized in Table 10.4.3-1. These data were collected to provide information on the habitat characteristics of the watercourses within the Study Area.

Watercourse field sampling locations within the transmission corridor were pre-selected and identified on field maps. Watercourses representing the various watershed size classes (described in the section 10.4.2.2 Watersheds) within each region were chosen for the field survey.

Additional habitat information was collected for 53 watercourses during a field survey program in 2008 (Figure 10.4.2-1, Figure 10.4.2-2 and Figure 10.4.2-3). At each watercourse physical parameters of habitat were collected including channel dimensions, substrate composition, slope, instream features, riparian vegetation, water depth and velocity and a general habitat description. In addition, general notes on the weather were collected, upstream and downstream photographs were taken and Global Positioning System coordinates of each site were recorded.



nalcor energy

FIGURE 10.4.3-1

Sample Aerial Photograph used to Interpret Characteristics within the Study Area

Table 10.4.3-1 Watercourse Habitat Characteristics

Category	Code	Name	Description
Flow Morphology	RA	Rapid	Large amount of white water visible
	RI	Riffle / run	Some white water visible; small areas of white mixed with black (calmer water)
	FL	Flat / steady	No white water visible; black and calm
	DS	Discontinuous	Discontinuous watercourse; unable to follow entire watercourse, disappears within vegetation
Dominant Substrate	LC	Coarse	>50% boulder visible
	LF	Fine	>50% gravel / sand / silt / mud visible (i.e., <50% boulder)
Riparian Vegetation	CT	Conifer tree	White or black spruce, balsam fir, tamarack (*Larix laricina*); usually darker in contrast
	CS	Conifer shrub	Dwarf spruce, balsam fir, tamarack; shorter shadows and / or little shadow, darker in contrast
	DT	Deciduous tree	Yellow (*Betula alleghaniensis*) or white birch (*Betula papyrifera*), aspen; lighter in contrast
	DS	Deciduous shrub	Alder, Labrador tea, sweet gale, dogwoods; fine detail, short / stocky vegetation usually associated with bog areas
	GR	Grass	Grasses or sedges; fine detail, lighter in contrast
	LI	Lichen	Reindeer or other lichens; white patches or speckles on the ground between trees or larger patches in more open areas
	BO	Bog	Saturated areas with shrubs, mosses, lichens, and / or grasses / sedges; open area with little to no mature (tall) trees, open water seen as black areas (ponds) or white “reflections”
	TB	Treed bog	Bog with trees

Source: AMEC (2010a).

Field-collected data were also used to assess the accuracy of the air photo analysis and assesses whether the air photo interpreted is a reasonable reflection of field surveyed habitat classifications. The Congalton and Mead (1983) method for assessing the accuracy of remote sensed data was applied using error matrices to compare the interpreted data against reference data. The results of the error analysis are presented in detail in AMEC (2010a).

AEK has been collected from consultation initiatives with Aboriginal groups in the Study Area (a summary of all Aboriginal consultation initiatives conducted for the Project can be found in Chapter 7 of the EIS). Sources of AEK include, but are not limited to, land use surveys and interviews, reviews of existing published and unpublished literature and through the provision of information to Nalcor by an Aboriginal group or organization.

10.4.3.2 Description of Watercourses

Watercourses within the Study Area range in size, flow morphology, riparian vegetation and dominant substrate type throughout the province (AMEC 2011a, 2010a). Habitats were classified based on a range of specific parameters such as water velocity, depth, and substrate. The total number of watercourses identified within each region is presented in Table 10.4.3-2.

Table 10.4.3-2 Summary of the Number of Watercourses in the Study Area by Region

Region	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Total number of watercourses identified per region	194	123	170	99

Source: AMEC (2011a; 2010a).

Table 10.4.3-3 summarizes the habitat parameters acquired from the interpretation of aerial photographs and satellite imagery. The flow morphology in all regions was dominated by flats and riffles, accounting for over 80% of all identified watercourses. Flat flows were more prevalent in the Central and Southeastern Labrador and Northern Peninsula regions whereas riffles were more prevalent in the Central and Eastern Newfoundland and Avalon Peninsula regions. Some watercourses were not able to be characterized due to cloud cover, no visible watercourse, or no available imagery. These watercourses are labelled as unclassified and account for approximately 9.0% of the total.

Table 10.4.3-3 Summary of Habitat Parameters of Watercourses within the Study Area by Region

Region	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Flow Morphology				
Flat	109	55	40	24
Riffle	33	42	113	68
Rapid	5	7	5	2
Discontinuous	11	12	1	5
Unclassified	36	7	11	0
Slope (%)	5.19	4.07	2.10	3.37
Substrate				
Fine	122	80	84	65
Coarse	37	34	74	34
Unclassified	35	9	12	0
Riparian Vegetation				
Coniferous Trees	61	22	60	30
Tree Bog	42	27	70	26
Bog	45	35	15	16
Deciduous Shrub	20	9	11	25
Deciduous Trees	6	3	–	-
Coniferous Shrub	9	19	2	2
Grass	–	–	–	–
Lichen	–	1	1	–
Unclassified	11	7	11	0

Source: AMEC (2011a; 2010a).

Fine substrate was the dominant bottom type observed in each of the regions and was noted in approximately 60% of the watercourses. Coarse substrate was identified in approximately 30% of the identified watercourses.

Riparian vegetation was varied in each of the regions with no type accounting for more than 40% of the total within any one region. Coniferous trees and treed bogs were the predominant types across all the regions, followed by bog riparian areas.

The 2008 field surveys documented habitat parameters including flow morphology (e.g., riffle, run) and depth and velocity at select watercourses throughout the Study Area (AMEC 2010a). As expected, no trend in depth or water velocity was apparent in the results, with parameters being generally consistent between the regions (Table 10.4.3-4).

Table 10.4.3-4 Summary of the Habitat, Water Depth, and Velocity of Watercourses within the Study Area by Region

Habitat Type	Mean Depth Range (m)	Mean Velocity Range (m/s)
Central and Southeastern Labrador[(a)]		
Riffle	0.25	0.71
Riffle / Run	0.33 – 0.53[(b)]	0.06 – 0.35[(b)]
Steady	0.26 - 0.59	0 – 0.15
Run	–	–
Northern Peninsula		
Riffle	0.05 – 0.31	0.04 – 0.38
Riffle / Run	–	–
Steady	0.13 – 0.46[b]	0.00 – 0.32[b]
Run	0.09 – 0.26	0.19 – 0.4
Central and Eastern Newfoundland		
Riffle	0.09 – 0.47	0.13 – 0.51
Riffle / Run	0.19	0.37
Steady	0.16 – 0.44	0.01 – 0.48
Run	0.14 – 0.49	0.17 – 0.61
Avalon Peninsula		
Riffle	0.28	0.18
Riffle / Run	–	–
Steady	–	–
Run	0.10 – 0.28	0.11 – 0.49

Source: AMEC (2010a).

(a) Does not include the Muskrat Falls / TLH3 portion.

(b) Velocities and depths of all transects could not be measured due to watercourse conditions at the time of sampling.

Field surveys collected habitat information on substrate size and flow morphology from each region that was more detailed than that estimated through image analysis. Other field collected water quality parameters such as temperature, dissolved oxygen, and turbidity are discussed in Section 10.4.4.

A total of 53 watercourses were surveyed and classified during the field program (Table 10.4.3-5). The Northern Peninsula, Central and Eastern Newfoundland, and Avalon Peninsula regions all showed a predominance of medium sized substrate (e.g., gravel, cobble, rubble) with the Central and Southeastern Labrador region showing a higher degree of fine material. The Northern Peninsula and the Central and Eastern Newfoundland regions showed a high degree of medium and coarse material, and, as would be expected, a higher degree of riffle habitat was present.

Table 10.4.3-5 Summary of Watercourse Habitat Parameters Collected during Field Surveys

Region	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Flow Morphology				
Riffle	1	7	9	1
Riffle / Run	2	–	1	–
Steady	3	4	3	–
Run	–	2	7	3
Substrate				
Fine	3	3	2	–
Medium	1	7	9	4
Coarse	2	3	9	0

Source: AMEC (2010a).

The portion of the transmission corridor from Muskrat Falls to and along the TLH3 was not included in the field survey. However, this area was surveyed for the development of the TLH3 (Jacques Whitford and Innu 2003). Collected watercourse habitat information included maximum depth, surface velocity, habitat type, and substrate type. Jacques Whitford and Innu (2003) assessed 41 watercourses that lie within the Project Study Area. Almost half (17) of the watercourses were identified as having 'unknown' habitat while the remainder are a mix of riffle / run and steady habitats with a small number identified as rapids. The substrates of these watercourses were a mixture of fine and coarse material. Bedrock was found in several watercourses, a substrate that was not identified in the 2008 field survey in watercourses along the remainder of the Study Area (AMEC 2010a). The maximum depths of the watercourses surveyed TLH3 ranged from 0.3 m to 1.0 m and the surface velocities ranged from 0.14 m/s to 0.49 m/s (Jacques Whitford and Innu 2003).

Aboriginal Ecological Knowledge

AEK regarding freshwater watersheds / waterbodies, water quality and quantity in parts of the Study Area was obtained through interviews with Labrador Innu and published literature. This is listed below (Table 10.4.3-6) and includes information on ice formations on lakes and rivers, ice jams, productivity of rivers, and waterbodies that provide habitat for fish and birds. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.4.3.1).

Table 10.4.3-6 Aboriginal Ecological Knowledge of Watercourses in the Study Area

Group	Source	Quote (Direct and / or Indirect)
Labrador Innu	Pian Penashue, Report on the 2001 Community Consultation on Hydroelectric Development in Nitassinan, December 2001 (Penashue 2001)	*Direct* "There is a river at mile 41 (on the Mishta Shipu) up in the hills, where there is a falls. The river there goes straight into a tunnel in the rock. It is a natural thing. I never saw anything like this anywhere else. A very interesting place."
	Labrador Innu Traditional Knowledge Committee Member, November 30, 2007 (p. 43)[(a)]	*Indirect* Uinukapau (Winokapau Lake) is a difficult place to live in the fall because the prevailing high winds jumble the ice, producing large, protruding chunks, which are hard to travel across (P4.30.11.07).
	Labrador Innu Traditional Knowledge Committee Member, December 7, 2006 (p. 43)[(a)]	*Indirect* On occasion, ice jams on a shoal near the outlet of the channel flowing from Mud Lake which blocks Mishta-shipu and causes the water to rise in the area, including at Mud Lake. Such ice jamming normally occurs in the spring, so the blockage that occurred in the fall of 2006, as reported in television news reports, was considered to be quite unusual (P2.7.12.06).
	Labrador Innu Traditional Knowledge Committee Member, February 7, 2007 (p. 43)[(a)]	*Indirect* The ice is packed on the south side of the rapids at Muskrat Falls, and as a result, the current can be very strong in the cove near the portage. Innu avoided this area in the spring because one could easily be capsized by the current or crushed in the ice. The late Etuat Rich once saw some military men capsize in this area, with all hands lost except one. A short distance upstream, a sandy hill located by the mouth of Kamitinishkau-shipiss slipped into Mishta-shipu several decades ago, almost blocking the river. The parents of one of the ITKC members, while not being a direct witness to the event, had travelled through the area shortly after it had occurred (P3.7.2.07).
	Labrador Innu Traditional Knowledge Committee Member, November 19, 2006 (p. 44)[(a)]	*Indirect* Members of the ITKC noted that the mouths of rivers and brooks along the length of Mishta-shipu are, generally speaking, productive places for various animal and fish species, not just when ashkui form, but at other times of the year as well. Frequent mention was made of large numbers of ducks and geese at the mouths of brooks in the spring. Lots of utshashku (muskrat) were known to frequent marshes near the mouths of these brooks (P1.19.11.06).

(a) Source: *Innu Environmental Knowledge of the Mishta-shipu (Churchill River) Area of Labrador in Relation to the Proposed Lower Churchill Project* (Armitage 2007). Refer to Appendix 10-1.

10.4.4 Freshwater Quality

10.4.4.1 Information Sources and Data Collection

Freshwater quality is an important determinant of fish habitat quality. Water quality, including physical and chemical parameters, are important determinants of overall ecosystem health. Freshwater quality within and near the Study Area is discussed in this section. Freshwater quality information is contained within the

Freshwater Environment: Fish and Fish Habitat, Water Resources (AMEC 2010a) and supplementary reports (AMEC 2011a). Freshwater quality information for the Study Area was obtained from desktop reviews, literature reviews, and field sampling and analysis. Data collected are compared to the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (PAL) (CCME 2010, internet site) and the Guidelines for Canadian Drinking Water Quality (CDWQ) (Health Canada 2010).

During the 2008 field program, 44 water and 13 sediment samples were collected from the 53 watercourses surveyed within the Study Area (AMEC 2010a). A summary of the number of samples analyzed for each region is provided in Table 10.4.4-1.

Table 10.4.4-1 Water and Sediment Samples Collected During the 2008 Field Program and the Analysis Conducted

	Parameter	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Water Quality	General Chemistry	15	13	12	4
	Metals	15	13	12	4
	VOC	15	–	–	–
	BTEX	2	13	12	4
Sediment	General Chemistry	12	–	1	–
	Metals	–	–	1	–
	TOC	–	–	1	–

Source: AMEC (2010a).

Note: "-" = No sample collected.

The province collects and tests drinking water from various municipal water supplies which ensures that water supplies comply with CDWQ guidelines and addresses water quality issues that may arise. A total of 14 water supply monitoring locations are within the Study Area (Newfoundland and Labrador Water Resources Portal 2010, internet site).

Water quality data were collected from 53 watercourses during the watercourse survey (locations provided in AMEC 2010a). Each class of watercourse identified in Table 10.4.2-2 in each of the four regions was represented in the sampling effort. A Hydrolab™ water sensor recorded parameters such as water temperature, dissolved oxygen (mg/L and percent saturation (% sat)), turbidity, salinity, and pH. Water samples were collected and analyzed for standard water quality parameters such as general chemistry, metals, VOCs and, benzene, toluene, ethyl benzene, and xylenes (BTEX) (AMEC 2010a). Where a high proportion of fine sediment was present among the benthic substrate, sediment samples were collected and analyzed for metals and standard sediment quality.

All water and sediment samples were analyzed at the AMEC laboratory in Mississauga, a facility accredited by the Canadian Association for Laboratory Accreditation. Standard field duplicates of 10% of all samples were collected and sent to the laboratory for Quality Assurance / Quality Control. Water and sediment samples were analyzed in accordance with the CCME Canadian Water Quality Guidelines for PAL.

Water data were compared to specific parameters of the CCME Canadian Water Quality Guidelines for PAL (CCME 2010, internet site) and the Guidelines for CDWQs. General groupings of parameters were based on either aesthetics or contaminant guidelines for the CDWQ. Aesthetic parameters are characteristics or impurities such as smell or appearance that are usually not a threat to human health; however, can affect consumer's acceptance of the source. Contaminant parameters are those known or suspected of adversely affecting human health if present in concentrations equal to or greater than the guideline values. Although the guidelines for CDWQ apply to treated water (i.e., from consumers' taps) and not untreated water sources, the

CDWQ guidelines have been used by NLDEC to evaluate untreated water as well, therefore, these results are presented in this section.

10.4.4.2 Description of Freshwater Quality

In general, baseline studies indicate that the water quality of watercourses within undeveloped regions of the Study Area (e.g., Central and Southeastern Labrador) are typical for the province. Water resources located in the Avalon Peninsula region, comprised of more developed and densely populated areas, tend to show more elevated levels of BTEX, VOC and total petroleum hydrocarbons compared to other regions with less development (AMEC 2010a). Metals results showed exceedances of the CCME Canadian Water Quality Guidelines PAL (CCME 2010, internet site), at sample locations within Central and Southeastern Labrador and several sites within the Northern Peninsula (AMEC 2010a). Sites located in the southern end of the Northern Peninsula have less exceeded metal values than those of the northern portion of the Northern Peninsula region. Overall, the most commonly exceeded parameter was cadmium. A summary of *in situ* water quality exceedances from the 2008 sampling program (AMEC 2010a) is provided in Table 10.4.4-2.

Table 10.4.4-2 Summary of Sampled Water Quality Results Exceeding Canadian Council of Ministers of the Environment Protection of Aquatic Life Guidelines

Parameter	Central and Southeastern Labrador	Northern Peninsula	Central and Eastern Newfoundland	Avalon Peninsula
Metals				
Aluminum	5	7	8	1
Cadmium	6	12	11	1
Copper	–	1	–	–
Iron	6	5	11	–
Lead	1	–	–	–
Selenium	–	–	1	–
General Chemistry				
pH	5	5	5	1

Source: AMEC (2010a).

The province samples drinking water from numerous municipal water supplies to ensure compliance with the guidelines for CDWQ. Fourteen water supply monitoring locations were identified within watersheds that intersect with the Study Area. The results for these monitoring locations, as well as any exceedances of guideline parameters as outlined above, are provided in Table 10.4.4-3. No monitoring locations were present on watersheds intersecting with the Study Area in the Central and Southeastern Labrador region. A list of all sampled values and the ranges in the results for the various parameters are available in the baseline report (AMEC 2010a).

All three regions with monitoring stations had sites that exceeded colour parameter guidelines for CDWQ (aesthetic parameter). The Central and Eastern Newfoundland region also had a site that exceeded manganese CCME PAL guidelines and pH values that exceeded (below 6.5) both CDWQ and CCME PAL guidelines. Aluminum values in all three regions with monitoring stations exceeded CCME PAL guidelines, although aluminum values are typically elevated in NL waters (AMEC 2011a).

Table 10.4.4-3 Summary of Canadian Drinking Water Quality Guideline Exceedances at Provincial Monitoring Stations within Watersheds that Intersect with the Study Area

Location	Parameter	Aesthetic (A) or Contaminant (C)[(a)] Parameter
Northern Peninsula		
Flower's Cove	Colour	A
Hawke's Bay	Colour	A
Central and Eastern Newfoundland		
Gander Lake	Colour	A
	pH	A
Gander Lake Outflow	Colour	A
	pH	A
Noseworthy's Pond	Colour	A
	pH	A
Shoal Harbour Brook	Colour	A
	pH	A
Steve's Ponds	Colour	A
	Manganese	A
	pH	A
Brigades Pond	Colour	A
Norman's Cove – Long Cove	Colour	A
	pH	A
Avalon Peninsula		
Hodges River	Colour	A
Lee's Pond	Colour	A
Maloney's River	Colour	A

Source: AMEC (2011a; 2010a).
[(a)] There are no contaminant (C) exceedances for CDWQ.

Water samples analyzed for metals and hydrides demonstrated that all regions had at least one parameter that exceeded CCME PAL guidelines. In particular 32 of 34 samples collected had concentrations of various parameters in excess of CCME guidelines, whereas 24 sampled sites and 23 sampled sites were above CCME guidelines for iron and aluminum, respectively. In addition, there were CCME PAL guidelines exceedances for lead (2) and copper (1) (Table 10.4.4-2).

General chemistry analysis demonstrated an exceedance (below 6.5) in pH at 16 of the 53 sites sampled. Overall, pH values ranged from 5.49 to 8.04 for the sampled sites which mirrors the values obtained from the drinking water results (6.02-7.98). In addition, tests conducted on water samples for VOC and BTEX demonstrated no concentrations which exceeded CCME PAL guidelines (AMEC 2010a).

The results of *in situ* field measurements demonstrate an increasing trend in water temperature, as sampling locations moved towards the south and east (Table 10.4.4-4). Results for pH measurements mirror those found in the literature review and analytical sampling program noted above. The average percentage of dissolved oxygen was high, with values typically close to or over 90% of saturation, and turbidity values were generally low, with averages below 8 Nephelometric Turbidity Units (NTU).

Table 10.4.4-4 Summary of *In Situ* Water Quality Data from Watercourses within the Study Area

Region	Temperature (°C)	pH	Specific Conductance (m/sec)	Salinity (m/sec)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)
Central and Southeastern Labrador							
Average	13.99	6.3	16.0	0.00	1.80	86.08	8.73
Max	16.24	6.7	19.2	0.00	3.20	95.10	9.46
Min	10.75	6.1	13.9	0.00	0.00	75.50	7.75
Northern Peninsula							
Average	17.30	7.0	68.4	0.02	7.65	88.61	8.32
Max	21.37	8.3	182.2	0.08	104.30	102.90	9.28
Min	13.38	5.6	15.3	-0.01	0.00	2.70	0.23
Central and Eastern Newfoundland							
Average	18.82	6.5	25.1	0.00	0.16	93.52	8.59
Max	21.65	7.3	44.3	0.01	1.90	96.90	9.52
Min	13.77	4.8	12.8	-0.01	0.00	87.70	8.17
Avalon Peninsula							
Average	18.20	6.6	40.1	0.00	1.90	88.40	8.26
Max	19.41	7.4	64.4	0.02	1.90	96.30	8.44
Min	17.24	6.2	17.3	-0.01	1.90	86.60	8.05

Source: AMEC (2010a).

A total of five sediment samples were collected which showed no exceedances of CCME guidelines for any parameter (AMEC 2010a).

10.4.5 Freshwater Fish and Fish Habitat

Freshwater fish and fish habitat refers to the assemblage of fish species present in watercourses and waterbodies, based on water quality, physical and substrate characteristics, supporting these species. Fish species occurring in the Project regions are described in this section, along with their preferred aquatic habitat characteristics.

10.4.5.1 Information Sources and Data Collection

Fish and fish habitat information is provided in detail in the *Freshwater Environment: Fish and Fish Habitat, Water Resources* (AMEC 2010a) and supplementary reports (AMEC 2011a). Fish and fish habitat information for the Study Area was obtained from desktop reviews, literature reviews, and field work.

Literature reviews provided information on the fish species known to occur (i.e., using the habitat on a seasonal or year-round basis) within the various watersheds crossed by the Project. Baseline data collection that included determination of fish species presence was completed for 53 representative watercourses within the Study Area (AMEC 2010a).

Watercourses were sampled by trained crews using a back-pack electrofisher. Each watercourse was fished for 300 seconds and the species, length and weight of each fish was recorded. In addition, any deformities, erosions, lesions, or tumours on the fish were documented. The complete protocol for electrofishing is described in AMEC (2010a).

Benthic invertebrates were sampled during the field program. Two replicate samples were collected from each site using a standard Surber Sampler. Project interactions with benthic invertebrates are not likely due to construction methods and therefore, analysis of benthic invertebrates has not been completed.

AEK has been collected from consultation initiatives with Aboriginal groups in the Study Area (a summary of all Aboriginal consultation initiatives conducted for the Project can be found in Chapter 7 of the EIS). Sources of AEK include, but are not limited to, land use surveys and interviews, reviews of existing published and unpublished literature and through the provision of information to Nalcor by Aboriginal groups or organizations.

LEK was collected from consultation initiatives with various communities (a summary of all consultation with public stakeholders can be found in Chapter 8 of the EIS) including Open Houses and correspondence. A general literature review and media search was also conducted.

10.4.5.2 Description of Freshwater Fish and Fish Habitat

As discussed in previous sections, the watercourses identified within the Study Area offer a variety of habitats ranging from flat calm waters to riffles and rapids, and substrates ranging from fine to coarse material and in some cases bedrock. While certain substrates and habitats were more prevalent in different regions, no obvious trends existed that would suggest the exclusion of typical NL freshwater fish species from the watercourses within the Study Area.

The main limiting factor related to the presence of some species is their natural range. For many species (i.e., alewife (*Alosa pseudoharengus*), burbot (*Lota lota*)) Central and Southern Labrador represents the northern limits of their range and as such would be naturally less common than other species such as brook trout (*Salvelinus fontinalis*) whose range is typical throughout the province. In addition, the seasonality of the field program could have excluded some species (e.g., fall migrating species) from being captured during electrofishing. There is no clear link between watercourse type and regions and habitat present and fish species. The species noted, particularly on insular Newfoundland, are generalists and can use all but the fastest and steepest habitats.

The literature review identified a total of 20 fish species as occurring within watercourses in the four regions of the Project. A list of the fish species that were identified in the literature search as likely to occur within the regions, their preferred habitat and whether they were collected during the electrofishing program, is presented in Table 10.4.5-1. The failure to capture any particular species identified in the literature as being present within the regions does not preclude it from being in that or any nearby watershed. The exception to this would include many of the species endemic to the Labrador portion of the province such as suckers, burbot and dace (*Leuciscus leuciscus*), which are not resident species on the Island. AMEC (2010a) provides a brief life history of fish species found in NL.

Six of the species identified in the literature review as occurring in the watercourses of the region were caught during field sampling (Table 10.4.5-1): American eel; Atlantic salmon; brook trout; brown trout (*Salmo trutta*), threespine stickleback (*Gasterosteus aculeatus*); and white sucker (*Catostomus commersoni*).

The electrofishing program captured fish at all but three watercourses surveyed within the Study Area. The habitat and water quality parameters of those sites, P270 and P204 in the Northern Peninsula region and P369 in the Central and Eastern Newfoundland region, are similar to other fish bearing watercourses in their regions (AMEC 2010a). Watercourses in Labrador may have more species simply due to the isolation of insular Newfoundland, with no relation to water or habitat quality. A summary of all fish species captured during field sampling by region is provided in Table 10.4.5-2.

Electrofishing was also undertaken in areas that have since been removed from the scope of the Project, particularly in the Central and Southeastern Labrador region. Four fish species were captured in this region that were not found elsewhere within the Study Area. Those species are the burbot, longnose dace (*Rhinichthys cataractae*), pearl dace (*Semotilus margarita*), and mottled sculpin (*Cottus bairdi*). All four species are known to inhabit this region of Labrador. The two dace are likely limited to the Churchill River Watershed. Please refer to the AMEC (2010a) for more information on these species.

Table 10.4.5-1 Fish Species Identified in the Literature, Captured During the Electrofishing Program, and Their Preferred Habitats

Fish Species	Central and Southeastern Labrador		Northern Peninsula		Central and Eastern Newfoundland		Avalon Peninsula		Preferred Habitat
	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	
Alewife (*Alosa pseduoherengus*)	–	–	•[(a)]	–	•	–	–	–	Marine and estuarine waters, occasionally freshwater during spawning in December and January.
American eel (*Anguilla rostrata*)	•	–	•	♦[(b)]	•	–	–	–	Wide ranging habitats due to an ability to withstand poor water quality. Often found in muddy or silt-bottomed streams, rivers and lakes.
Arctic char (*Salvelinus alpines*)	–	–	•	–	•	–	–	–	Will use a wide range of substrates for spawning but prefer gravel / cobble. More commonly found in lakes rather than streams.
Atlantic salmon (*Salmo salar*)	•	–	•	♦	•	♦	•	♦	Spawning in gravel / cobble substrates. Parr prefer steam habitats with rapid water.
Atlantic sturgeon (*Acipenser oxyrinchus*)	•	–	–	–	–	–	–	–	Use freshwater for spawning in areas of fast moving water with high dissolved oxygen and hard bottom.
Brook trout (*Salvenlinus fontinalis*)	•	♦	•	♦	•	♦	•	♦	Clear, cold, spring-fed streams with a silt-free rocky substrate in riffle to run areas. Areas of well vegetated stream banks, abundant instream cover, and relatively stable water flow.
Brown trout (*Salmo trutta*)	–	–	–	–	–	–	•	♦	Clear, cool, well-oxygenated streams and lakes. Spawning substrate is generally shallow gravel sections of streams.

Table 10.4.5-1 Fish Species Identified in the Literature, Captured During the Electrofishing Program, and Their Preferred Habitats (continued)

Fish Species	Central and Southeastern Labrador		Northern Peninsula		Central and Eastern Newfoundland		Avalon Peninsula		Preferred Habitat
	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	
Burbot (*Lota lota*)	•	–	–	–	–	–	–	–	Frequent cool waters of large rivers, lower reaches of tributaries, and large lakes. Prefer substrates of gravel, rock, or cobble and often use undercut banks, roots of trees, and dense vegetation as cover.
Fourspine stickleback (*Apeltes quadracus*)	•	–	–	–	–	–	•	–	Brackish water and estuarine waters; sometimes use shorelines in freshwater for spawning.
Lake whitefish (*Coregorus clupeformis*)	•	–	–	–	–	–	–	–	Freshwater spawners in fall. Generally use shallow riffles or rapids with a gravel / cobble substrate (streams) or sandy substrates (lakes).
Longnose sucker (C*atostomus catostomus*)	•	–	–	–	–	–	–	–	Juveniles prefer sand / gravel substrate but can occur over silt, sand, gravel, cobble, and rubble. Adults prefer a gravel, cobble or boulder substrate.
Ninespine stickleback (*Pungitius pungitius*)	–	–	–	–	•	–	–	–	Move to streams to spawn in shallow areas of low water velocity, dense aquatic vegetation with substrates consisting of mud and silt; but can occur over sparsely vegetated areas with sand, gravel, or rocky substrates.
Northern redhorse (*Moxostoma aureouim*)	•	–	–	–	–	–	–	–	Inhabit both streams and lakes, preferring fast, clear to slightly turbid water and are generally found in the deeper portions of channels over sand or gravel substrates.

Table 10.4.5-1 Fish Species Identified in the Literature, Captured During the Electrofishing Program, and Their Preferred Habitats (continued)

Fish Species	Central and Southeastern Labrador		Northern Peninsula		Central and Eastern Newfoundland		Avalon Peninsula		Preferred Habitat
	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	
Ouananiche (Landlocked form of *Salmo salar*)	–	–	•	–	•	–	–	–	Spawning generally takes place within streams, with adults moving back to lakes for the remainder of the year.
Rainbow smelt (*Osmerus mordax*)	•	–	•	–	•	–	–	–	Spawns in lakes and rivers over a variety of substrates although gravel is preferred.
Rainbow trout (*Oncorhynchus mykiss*)	–	–	–	–	–	–	•	–	Spawn in clear, cold water with a silt free rocky substrate in riffle or run areas, well vegetated stream banks and abundant instream cover.
Round whitefish (*Prosopium cylindraceum*)	•	–	–	–	–	–	–	–	Spawn in cool ponds, streams, and rivers. Juveniles prefer slow steady water and backwater habitat while adults prefer faster flowing sections.
Threespine stickleback (*Gasterosteus aculeatus*)	•	–	•	♦	•	♦	•	♦	Generally inhabit vegetated areas, usually over mud and sand; can be found at a wide variety of depths.
Tomcod (*Microgadus tomcod*)	–	–	•	–	•	–	–	–	Sand, gravel, or boulder substrate is used when spawning in late fall and early winter.

Table 10.4.5-1 Fish Species Identified in the Literature, Captured During the Electrofishing Program, and Their Preferred Habitats (continued)

Fish Species	Central and Southeastern Labrador		Northern Peninsula		Central and Eastern Newfoundland		Avalon Peninsula		Preferred Habitat
	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	Identified in Literature	Captured during Electrofishing Program	
White sucker (*Catostomus commersonii*)	•	♦	–	–	–	–	–	–	Occur mainly over gravel, sand, silt, and rubble substrates and tend to be closely associated with riparian and instream cover such as submerged logs, roots, macrophytes, undercut banks, and large boulders.

Source: AMEC (2010a).
Note: "–" indicates no data available or not applicable.
(a) • The literature indicates the presence of this species.
(b) ♦ This species was collected during the sampling program (AMEC 2010a).

Table 10.4.5-2 Summary of Fish Species Captured During the 2008 Field Sampling Program

Species Captured		Region (number of Sampling Locations)			
		Central and Southeastern Labrador (6)	Northern Peninsula (16)	Central and Eastern Newfoundland (16)	Avalon Peninsula (6)
American eel	Number of watercourses where species was captured	0	2	0	0
	Total caught	0	9	0	0
Atlantic salmon	Number of locations species was captured	0	8	10	4
	Total caught	0	166	77	17
Brook trout	Number of locations species was captured	6	10	9	3
	Total caught	33	219	56	29
Brown trout	Number of locations species was captured	0	0	0	1
	Total caught	0	0	0	40
Threespine stickleback	Number of locations species was captured	0	3	5	3
	Total caught	0	9	12	6
White sucker	Number of locations species was captured	2	0	0	0
	Total caught	2	0	0	0

Source: AMEC (2010a).

Three fish species identified as being in the province have designations under the *SARA* (EC 2010k, internet site), COSEWIC and / or the *NLESA* (COSEWIC 2011, internet site). The American eel is listed as a Species of Special Concern by COSEWIC and Vulnerable under the *NLESA*. The South Newfoundland population of Atlantic salmon is listed as Threatened by COSEWIC. Neither the American eel nor Atlantic salmon currently have a listing or a status under the *SARA*.

The Newfoundland population of the banded killifish (*Fundulus diaphanous*) is listed as a Species of Special Concern under Schedule 1 of the *SARA* and Vulnerable under the *NLESA* (NLDEC 2010b, internet site; EC 2010k, internet site).

Aboriginal Ecological Knowledge

AEK regarding freshwater fish and fish habitat in parts of the Study Area was obtained through interviews completed with Labrador Innu, and members of the NunatuKavut Community Council and published literature. A summary is provided in Table 10.4.5-3, and includes information on lake trout (*Salvelinus namaycush*), whitefish, northern pike (*Esox lucius*), suckers, burbot, brook trout, Atlantic salmon, and the habitat, reproductive cycle, and diet of some of these fish. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.4.5.1).

Table 10.4.5-3 Aboriginal Ecological Knowledge of Freshwater Fish and Fish Habitat in the Study Area

Group	Source	Quote (Direct and / or Indirect)
Labrador Innu	Labrador Innu Traditional Knowledge Committee Members, Various Dates, 2006 and 2007 (p. 45)[(a)]	*Direct/Indirect* *Ushakamesh* – 'where there is always fish'. In general, these are located at the mouths of brooks and at points, but they also be found in deep water, just off-shore. ITKC members said that they used to fish *kukamess* (lake trout), *atikamek*^{u} (white fish), *tshinusheu* (pike), *makatsheu*/*mikuashai* (suckers), *minai* (burbot), and *matametk*^{u} (brook trout) at the mouths of the brooks along Mishta-shipu (ITKC, 22.11.06). Wherever there is lake trout, there is also burbot (P9, 22.11.06). They noted that there are hardly any ponds in the Mishta-shipu valley, and so they would travel up the brooks away from the river to ponds at higher elevations where fish were known to be plentiful (P2, 17.11.06). They would identify new *ushakamesh* through experimentation – "Sometimes when you don't find fish, you keep checking in different places, leaving the hooks out over night to see what you get" (P6.26.1.07).
	Labrador Innu Traditional Knowledge Committee Member, November 24, 2006 (p. 59)[(a)]	*Indirect* *Makatsheu*/*mikuashai* (suckers) may spawn just below the rapids up Etuat-shipiss, from its junction with Mishta-shipu. There is a small portage there along the side of the rapids. Just below the rapids, we saw a lot of suckers there (P3.24.11.06).
	Labrador Innu Traditional Knowledge Committee Member, November 28, 2006 (p. 62)[(a)]	*Indirect* *Makatsheu*/*mikuashai* (suckers) eat mud (P3.28.11.06).
	Labrador Innu Traditional Knowledge Committee Member, November 22, 2006 (p. 59)[(a)]	*Indirect* *Utshashumek*^{u} (Atlantic salmon) spawn (*amiu*) close to rapids. Their *uakuana* (eggs) stick. After they spawn, the eggs turn into esh (shellfish), and what's inside the shell emerges as a fish. As the fish grows, the shell opens, and *utshashumek*^{u} comes out (P9.22.11.06).
	Labrador Innu Traditional Knowledge Committee Member, November 22, 2006 (p. 52)[(a)]	*Direct* *Utshashumek*^{u} (Atlantic salmon) can go up any small brook as long as there are no major falls.
	Labrador Innu Traditional Knowledge Committee Members, February 6, 2007 and November 22, 2006 (p. 59)[(a)]	*Indirect* *Utshashumek*^{u} (Atlantic salmon) spawn in pools where they get stuck. I have seen a lot of *uakuana* (eggs) in pools. I don't know how salmon have their eggs, except whenever there are salmon, there's lots of *esh* (shellfish) around, so perhaps the salmon grows from the shell. Perhaps they grow their scales inside the shells. There's a lot of *esh* at the mouth of Kaneshekau-shipiss (Cape Caribou River). Salmon go up that river" (P4.6.2.07; P6.22.11.06).
	Labrador Innu Traditional Knowledge Committee Member, December 1, 2006 (p. 62)[(a)]	*Indirect* *Kukamess* (lake trout) eats *nipiu-apukushish* (possibly water shrew). I found one in the stomach of a lake trout at Penipuapishku-nipi (Hope Lake). Big lake trout eat *uatshishk*^{u} (muskrat) according to my grandfather who had found one in a stomach. It had been eaten head first (P6.1.12.06).

Table 10.4.5-3 Aboriginal Ecological Knowledge of Freshwater Fish and Fish Habitat in the Study Area (continued)

Group	Source	Quote (Direct and / or Indirect)
	Labrador Innu Traditional Knowledge Committee Members, November 28 and December 1, 2006 (p. 62)[(a)]	*Direct* "*Tshinusheu* (northern pike) eats mice and insects such as butterflies" (P1.28.11.06). "Pike also eats fish – any kind of fish it can find and it eats toads (*anik*^{u})" (P4.1.12.06).
	Labrador Innu Traditional Knowledge Committee Member, December 1, 2006 (p. 63)[(a)]	*Direct* "You cannot catch *atikamek*^{u} (whitefish) and *makatsheu*/*mikuashai* (suckers) on a big hook. You can only net these. I'm not sure if they take flies" (P4.1.12.06).
	An Innu Look at Hydro Developments in Nitassinan, Sheshatshiu, September, 2000	*Direct* "I heard there are a lot of whitefish and lake trout at Tshiashkueish (Gull Island). I know salmon can travel up the river as far as Manitutshu (Muskrat Falls). There is plenty of healthy fish like lake trout, whitefish there now. But if they build that dam, I have seen lake trout that are badly affected by the changes in the water from a reservoir. I have seen comparisons with fish from other areas where there is no reservoir. The lake trout has a lighter skin colour, but the lake trout living in the reservoir area have skin colouring very much on the dark side."
NunatuKavut Community Council	NunatuKavut Interview, May 2011	*Indirect* Trout migrate up the Traverspine River, and salmon, trout, suckers, night fish and feeder fish migrate up the Kenamu River. There is not much migration past the Kenamu River.
	NunatuKavut Interview, May 2011	*Indirect* It is good that the proposed transmission corridor only crosses one branch of the Pinware River; however, that branch is valuable for salmon and char.
	NunatuKavut Interview, May 2011	*Indirect* August would be a bad time for Project construction around the Kenamu and Traverspine Rivers because this is when fish are migrating up them.
	NunatuKavut Interview, May 2011	*Indirect* Trout are found in the Eagle River.
	NunatuKavut Interview, May 2011	*Indirect* Many pike are found in any inland waters.
	NunatuKavut Interview, May 2011	*Indirect* There are likely many freshwater mussels found in the proposed corridor.
	NunatuKavut Interview, May 2011	*Indirect* The transmission line may affect salmon and trout spawning in the Alexis, Pinware and Mary's Harbour Rivers, depending on their headlands.
	NunatuKavut Interview, May 2011	*Indirect* Freshwater pike, brown trout, and rainbow trout can be found along the transmission line.

Table 10.4.5-3 Aboriginal Ecological Knowledge of Freshwater Fish and Fish Habitat in the Study Area (continued)

Group	Source	Quote (Direct and / or Indirect)
	NunatuKavut Interview, 2011	*Indirect* I do not think the Project will hurt fish in the transmission link area at all. By the time they start construction in the spring or fall, by the time they cross the Kenamu or Traverspine Rivers, salmon will either be gone inland, or back out to sea, so it will make no difference to them.
	NunatuKavut Interview, May 3, 2011	*Indirect* There are freshwater mussels in the rivers. I've seen otters eating them. They taste different from the saltwater mussels, but they are still edible.
Ekuanitshit	Ekuanitshit Councillor and community member, Labrador-Island Transmission Link Band Council and Community Meetings, June 20, 2011	*Indirect* The salmon that is fished here in Ekuanitshit, and in many rivers along the Québec North Shore, migrates through the Strait of Belle Isle.

(a) Source: *Innu Environmental Knowledge of the Mishta-shipu (Churchill River) Area of Labrador in Relation to the Proposed Lower Churchill Project* (Armitage 2007). Refer to Appendix 10-1.

Local Ecological Knowledge

LEK regarding freshwater fish and fish habitat in parts of the Study Area was obtained through correspondence with a Forteau resident. This is listed below (Table 10.4.5-4), and includes information on salmon and their spawning grounds. The information provided is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.4.5.1).

Table 10.4.5-4 Local Ecological Knowledge of Freshwater Fish and Fish Habitat in the Study Area

Community	Source	Indirect Quote
Forteau, NL	Forteau Resident, Email Correspondence, January 30, 2011	In the valley runs Forteau River and the corridor crosses directly over the falls where salmon have to jump over the rock ledges to get to the spawning grounds further in the system to Northwest Brook.

10.4.6 Summary Overview - Species of Special Conservation Concern

The American eel was identified in the literature search as being present within three of the four regions (all but the Avalon Peninsula), and was captured in watercourses in the Northern Peninsula during the field program (AMEC 2010a). The Atlantic salmon (South Newfoundland population) and banded killifish were not identified in the literature as possibly occurring within the Study Area and were not captured during the electrofishing program.

10.5 Marine Environment

The Strait of Belle Isle is a marine (i.e., salt water) channel separating the south-east coast of Labrador from the north-west coast of the Northern Peninsula of Newfoundland. It is approximately 17 km wide at its narrowest point between Point Amour, Labrador, and Yankee Point, in Newfoundland, and extends approximately 118 km in a north-east by south-west direction. Conception Bay is a large bay on the north-east portion of the Avalon Peninsula that divides the northern Avalon Peninsula into two sub-peninsulas. The John's sub-peninsula borders the eastern shore of the bay, and the Carbonear sub-peninsula flanks the western shore.

The following sections provide a description of the Marine Environment within the Strait of Belle Isle and Conception Bay, including the physical (geology and bathymetry, currents and tides, winds and waves, sea ice and icebergs and marine water quality), and biological (marine fish and fish habitat, marine mammals and seabirds) environments, as appropriate.

10.5.1 Study Area

The Study Areas for the description of the Marine Environment encompasses those components of the Project that are to be constructed in the Marine Environment. This includes the Strait of Belle Isle as a whole, including the proposed submarine cable crossing corridor, and electrode site at L'Anse au Diable, and Dowden's Point in Conception Bay, the proposed electrode site. The Study Areas for the Marine Environment are shown in Figure 10.5.1-1 (Strait of Belle Isle) and Figure 10.5.1-2 (Conception Bay).

10.5.2 Geology, Bathymetry and Seabed Hazards

10.5.2.1 Information Sources and Data Collection

The primary information sources for the geology, bathymetry and seabed hazards in the Strait of Belle Isle were the 2007 and 2008 Project-specific surveys conducted by Fugro Jacques Geosurveys Inc. (2010) and AMEC (2010b). The following summarizes the various studies that were used to contribute to this description of existing conditions in the Strait of Belle Isle:

- *Marine Flora, Fauna and Habitat Survey – Strait of Belle Isle Submarine Cable Crossing Corridors, 2008 and 2009* (AMEC 2010b): A marine survey field program was conducted in 2008 and 2009 to gather detailed information on marine habitats, flora and fauna along the initially proposed submarine cable crossing corridors in the Strait of Belle Isle. A 2008 vessel-based survey was carried out using a drop-video camera system, and resulted in seafloor video coverage over approximately 52 km (85%) of the two initially identified corridors. A 2009 dive survey in the shallow inshore area on the Newfoundland side covered an additional 2.8 km. The video collected was subsequently reviewed and analyzed in detail to identify, classify and map the type, occurrence / abundance and distributions of marine habitat (substrate), macroflora and macrofauna within the initially identified submarine cable crossing corridors. A shoreline and intertidal survey was also conducted at four potential cable landing sites on the Labrador and Newfoundland sides of the Strait.
- *Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information for the Submarine Cable Crossing Corridors* (Fugro Jacques GeoSurveys Inc. 2010)**:** Nalcor has collected detailed information on bathymetry and substrate characteristics within the proposed submarine cable crossing corridors, including through side-scan sonar, multi-beam and sub-bottom profile surveys in 2007. This study presents a detailed analysis and interpretation of these geophysical survey data to identify and classify the seafloor marine habitats (substrate types and water depths) within the two initial corridors, also using the 2008 and 2009 marine video survey information (AMEC 2010b) to guide and inform the analysis. This study supplements the marine flora, fauna and habitat study (AMEC 2010b) by providing complete marine habitat analysis coverage for the two initial submarine cable corridors.

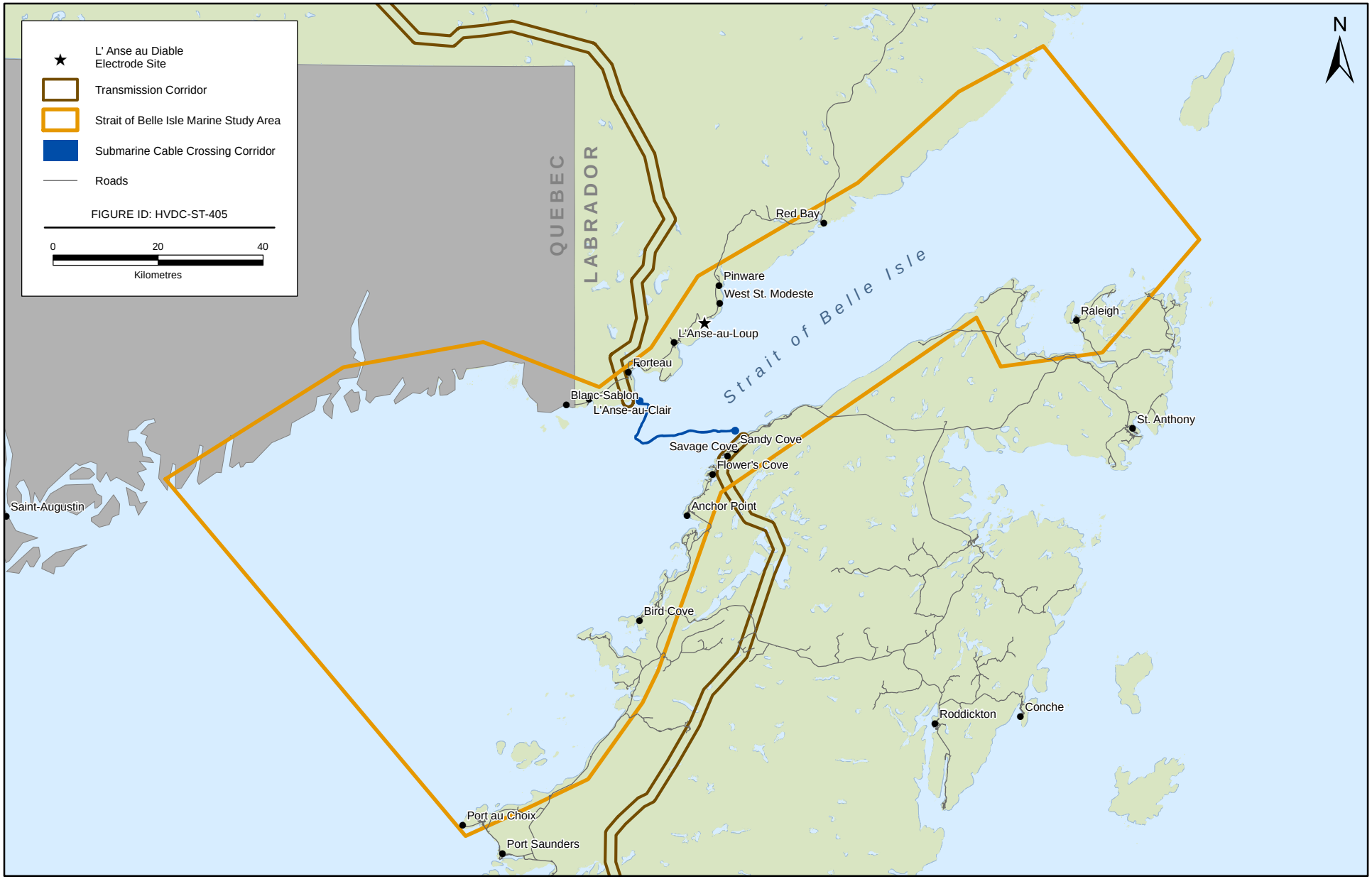


FIGURE 10.5.1-1

Strait of Belle Isle Marine Study Area

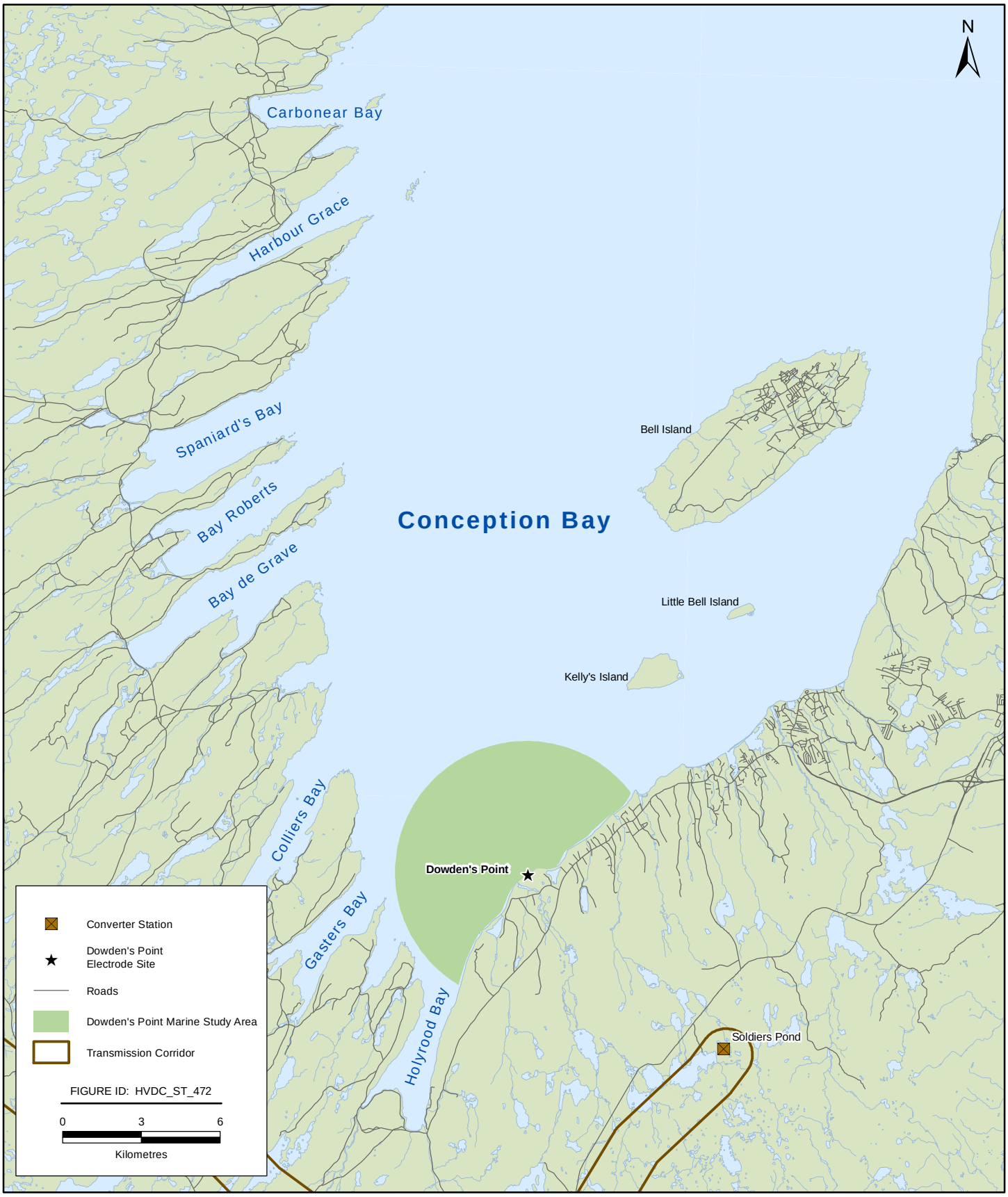


FIGURE 10.5.1-2

Dowden's Point, Conception Bay Marine Study Area

- *Marine Fish and Fish Habitat in the Strait of Belle Isle: Information Review and Compilation* (Sikumiut 2010a): This study involved the identification, compilation, review and presentation of existing and available information on marine fish and fish habitat in the Strait of Belle Isle. This includes information on the physical environment / marine habitats (climate, wind, bathymetry, water temperature and salinity, currents, tides, wave, icebergs and sea ice, and surficial geology) and the biological environment (plankton, benthic invertebrates, algae and fish species presence, abundance and distribution). The report supplements Nalcor's marine surveys in the Strait of Belle Isle.

- *Marine Water, Sediment, Benthos and Nearshore Habitat Surveys: Potential Electrode Sites* (Sikumiut 2011a): A 2010 marine sampling survey to collect information on water and sediment quality, and benthic invertebrates. It also included a bathymetric survey and video survey to identify substrate, macroflora and macrofauna distribution and backshore characteristics at two proposed shore electrode sites at L'Anse au Diable and Dowden's Point.

Following the change in the Project concept for the proposed Strait of Belle Isle marine cable crossing which identified Shoal Cove as a possible landing site, and the concept of one single corridor across the Strait of Belle Isle, additional supplementary studies were completed. As the single corridor is essentially an amalgamation of the two previously proposed and studied marine corridors, utilizing portions of each and a new short segment in to Shoal Cove, supplementary reports for AMEC (2010b) and Fugro-Jacques GeoSurveys (2010) were completed, in addition to studies of the new segment into Shoal Cove. The supplementary report includes a compilation of three reports: AMEC (2011a), Fugro-Jacques GeoSurveys (2011), and Sikumiut (2011b).

- AMEC (2011a), *Marine Flora, Fauna and Habitat Survey: Strait of Belle Isle Supplementary Report*, presents a discussion focused of the relevant data from the 2008-09 marine surveys that fall within proposed single corridor and provides a summary overview of the information.

- Fugro Jacques GeoSurveys Inc. (2011), *Marine Habitats in the Strait of Belle Isle: Interpretation of 2007 Geophysical (Sonar) Survey Information Supplementary Report*, also presents a discussion focused on the relevant data from the information from the 2007 marine geophysical surveys and associated interpretation and analyses that fall within the proposed single corridor and provides a summary overview of the information.

- Sikumiut (2011b), *Strait of Belle Isle Corridor Segment: Marine Water, Sediment, Benthos and Habitat Survey Supplementary Report*, presents the results of a marine habitat survey for the corridor segment to Shoal Cove. Marine water, sediment and benthic samples were also collected from within this same corridor segment and the results of these surveys are provided.

In addition, information, including bathymetric and geological data, was obtained from a review of work completed in support of provincial government initiatives within the Strait of Belle Isle (Hatch Mott MacDonald 2005, internet site; Woodworth-Lynas et al. 1992).

Information was also obtained from the review of academic research papers and work completed for and by provincial and federal government departments and agencies that pertain to the Marine Environment in Conception Bay.

LEK was collected from consultation initiatives with various communities (a summary of all consultation with public stakeholders can be found in Chapter 8 of the EIS) including open houses and correspondence. A general literature review and media search was also conducted.

10.5.2.2 Description of Geology and Bathymetry

Strait of Belle Isle

The Strait of Belle Isle is the northern point of the St. Lawrence Lowland and is in the Canadian Appalachian region. At its narrowest point, between Point Amour, Labrador, and Yankee Point, Newfoundland, the Strait of Belle Isle is underlain by a vertical succession of sedimentary rock layers (i.e., limestone, shale and sandstone)

of Cambrian age overlaying Precambrian basement rock (Figure 10.5.2-1) (Hatch Mott MacDonald 2005, internet site). The coast on the Labrador side is steep granite, which rises to flat-topped ridges and summits from 300 m to 900 m above sea level. The Newfoundland coast is much lower, with shorelines rising to approximately 30 m. Water depths in the Strait of Belle Isle vary greatly, reaching over 125 m in places. Across most of the Strait of Belle Isle the seabed comprises a coarse-grained armour of pebbles, cobbles and boulders overlying glacial till and localized glaciomarine deposits. Marine sands form a discontinuous surficial veneer in shallow water areas and thicken locally in some coastal embayments. Bedrock is exposed on the seabed in places and consists of sandstone, dolomite and limestone with some interbedded shale (Nalcor 2009).

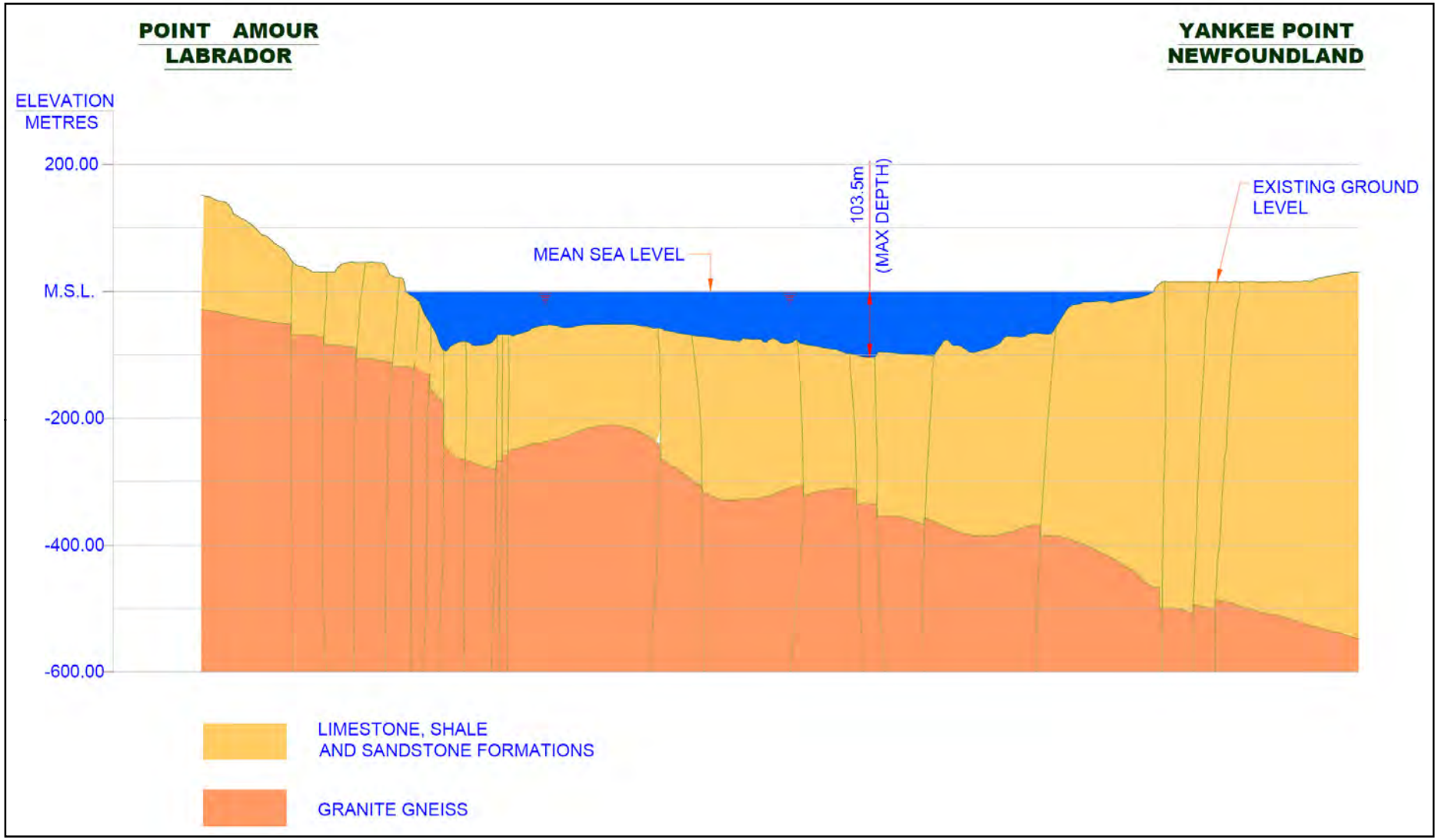
There has been considerable research (Hatch Mott MacDonald 2005, internet site; Jacques Whitford 2000b; Woodworth-Lynas et al. 1992; Toulany et al. 1987) conducted on the surficial geology in the Strait of Belle Isle since the late 1970s for potential fixed link and submarine cable crossing projects. The most recent survey, commissioned by Nalcor, identified five substrate classes, dominated by the gravel and cobble class, which occupied more than 60% of the seabed within the marine cable corridor (Table 10.5.2-1) (Fugro Jacques Geosurveys Inc. 2011). Note that as described above, at the time of the 2007 survey, two proposed cable corridors were being considered and the focus now has been on for the sections that fall within the single proposed corridor.

Table 10.5.2-1 Substrate Class Description and Percent Coverage of the Proposed Marine Cable Corridor

Substrate Class	Percent Coverage of the Seabed within the Marine Cable Corridor (%)	Description of Substrate	Location of Substrate
Exposed Bedrock	8.3	Continuous rock	Majority of Exposed Bedrock occurs on the steep western margin of a deep, bedrock-controlled valley located 8 to 13 km from the Labrador coast.
Coarse – Large	15.6	Rubble and boulder (140 to >1,000 mm diameter substrate)	Occurs in berms or side-mounds of relic iceberg scours mainly located at depths between 97 and 110 m at the centre of the Strait.
Coarse – Small	60.5	Gravel and cobble (2 to 140 mm diameter substrate)	Dominant substrate type, found throughout the marine cable corridor.
Shells	8.5	Calcareous remains of shellfish	Shell deposits occur as thin, narrow stringers, usually overlying areas of Coarse-Small substrate. The only exception is a Shell deposit covering the floor of the bedrock-controlled valley, located 8 to 13 km from the Labrador coast.
Coarse – Small / Shells	7.1	Equal portions Coarse-Small and Shells	Near Forteau Point. Deposits occur as regional units, not stringers as with the Shell deposits.
Fine	0	Detritus, silt, and / or sand (>0.06 to 2 mm diameter substrate)	

Source: Fugro Jacques Geosurveys Inc. 2011.

Note: The substrate Class Fine was identified with the previously proposed two corridors near L'Anse Amour, however this class was no longer represented in the proposed single cable corridor.



Source: Hatch Mott MacDonald (2005, internet site)

FIGURE ID: HVDC_ST_232

FIGURE 10.5.2-1

Inferred Geological Section of the Strait of Belle Isle Between Point Amour, Labrador and Yankee Point, Newfoundland

Water depths vary greatly across the Strait of Belle Isle, reaching depths >125 m. Woodworth-Lynas et al. (1992) identified five physiographic zones defined by their bathymetry. From west to east, these zones are:

- Labrador Coastal Zone: consisting of the north-western slope of the Labrador Trough, which has depths up to 115 m and a width of 1 to 2 km, with uniform slopes of 6% to 12%;
- Centre Bank South and Centre Bank North: depths ranging from 15 to 85 m, separated by a narrow 85 m deep trough;
- Newfoundland Trough: 5 to 12 km wide with depths ranging from 70 to 125 m; and
- Newfoundland Coastal Zone: bounded by the Newfoundland coastline and a linear escarpment that separates this zone from the Newfoundland Trough.

Detailed bathymetry near the proposed submarine cable crossing corridor, including the physiographic zones, is shown in Figure 10.5.2-2.

Conception Bay

The seabed of Conception Bay is composed of mainly gravel, very fine sand, and mud (Slatt 1974). Substrates in Conception Bay consist of large stable boulders intermixed with smaller boulders, cobbles, and sand patches (LGL 1993; Whittick and Hooper 1977). In shallow water, substrates are variable, ranging from bedrock to unstable boulders to sand. The amount of sand cover increases with depth. At its deepest points, the substrate in Conception Bay is entirely sand with occasional boulders (Whittick and Hooper 1977).

Video collected in 2010 demonstrated that generally, the substrate in the Study Area of the Dowden's Point shoreline electrode site is relatively uniform comprising various mixes of boulder, cobble and sand with boulder / cobble being the dominant substrate type (Sikumiut 2011a). A breakdown of substrate classes as determined from underwater video collected in October 2010 is provided in Table 10.5.2-2.

Table 10.5.2-2 Substrate Classes Identified from Underwater Video at Dowden's Point, October 2010

Substrate Class	Area (hectare (ha))	Percent (%)
Boulder / Cobble	2.63	84.9
Boulder	0.24	7.9
Boulder / Cobble / Sand	0.21	6.9
Sand with Boulder / Cobble	0.01	0.2
Total Area	**3.10**	**100.0**

Source: Sikumiut (2011a).

Detailed bathymetric data were collected at the Dowden's Point shoreline electrode site in October 2010. The maximum recorded depth in the Study Area was 5.5 m. The bathymetry demonstrates that the seabed is uniform with depth increasing with distance from the shoreline. No large depressions or hummocks on the seabed were detected (Sikumiut 2011a).

Local Ecological Knowledge

LEK regarding the geology and bathymetry aspects of the Marine Environment in parts of the Study Area was obtained through conversation with participants of the Labrador-Island Transmission Link Strait of Belle Isle Field Programs Meetings in L'Anse au Loup and West St. Modeste. The information provided on water depth in the straits is listed in Table 10.5.2-3, and is generally in keeping with the scientific data obtained through the field studies and literature review conducted for the EA (as reported in Section 10.5.2.1).