the 2007 breeding bird surveys and as such, this species is listed as a confirmed breeder in the Study Corridor (Table C3 in Appendix C).

Ruby-crowned Kinglet

Ruby-crowned Kinglets have also been recently ranked as Sensitive by NSDNR (2010) and are given a rank of "S4B" by the ACCDC indicating that they are fairly common throughout their range in the province, but are of long-term concern. For reasons unknown, the population of this species has shown a steady decline in Nova Scotia during the last several decades (CWS 2010). The population for Canada as a whole has remained relatively stable.

Ruby-crowned Kinglets were relatively abundant in the Study Corridor, comprising 2.6% of all of the birds recorded during the field surveys. This species was found in a variety of forested habitat types in the Study Corridor including mature and immature softwood forest, mature and immature mixedwood forest, and mixedwood treed swamp (Table C2 in Appendix C). Mature mixedwood forest was the habitat type used most frequently by this species with 65% of all Ruby-crowned Kinglets recorded in this habitat type. This species was recorded throughout the study corridor but was most frequently encountered in the area between the cavern site and the Stewiacke River. Ruby-crowned Kinglets singing in suitable breeding habitat were recorded during the field surveys and as such, this species is listed as a possible breeder in the Study Corridor (Table C3 in Appendix C).

Boreal Chickadee

Boreal Chickadees are associated mainly with mature coniferous forest habitats. Both mature and immature conifer stands are used; however, older stands typically provide more nesting and winter shelter opportunities in the form of tree cavities as well as better feeding opportunities. BBS data (CWS 2010) indicates that Boreal Chickadee abundance in Nova Scotia has declined since the late 1960s. Loss of mature coniferous forest habitat as a result of timber harvesting is probably an important factor in the decline of Boreal Chickadee populations in Nova Scotia. NSDNR has listed this species as a Sensitive species and it is ranked as "S3" by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern.

Five Boreal Chickadees were recorded in the Study Corridor during the 2007 field survey. Two birds were recorded in mature mixedwood forest while three were recorded in coniferous treed swamp (Table C2 in Appendix C). The three birds found in coniferous treed swamp were all recorded in Wetland 8. The two birds recorded in mature mixedwood forest near Wetland 16 were part of a family group. Boreal Chickadee is listed as a confirmed breeder in the Study Corridor (Table C3 in Appendix C).

Gray Jay

Gray Jays are typically associated with coniferous forest habitats and seldom venture from this habitat type. BBS data (CWS 2010) indicate that this species has undergone a gradual

decrease in abundance since 1970. This species is listed as a Sensitive species by NSDNR and is listed as “S3S4” by the ACCDC indicating that breeding populations are uncommon to fairly common throughout their range in the province and are of long-term concern.

During the field surveys Gray Jays were encountered at three locations. Two records were from the vicinity of the Cloverdale Road and one record was from the area adjacent to Wetland 17. Gray Jays were found in immature mixedwood and immature softwood habitat (Table C2 in Appendix C). This species is listed as a possible breeder in the Study Corridor (Table C3 in Appendix C).

Black-backed Woodpecker

Black-backed Woodpeckers are typically found in mature softwood stands and in burned areas where dead trees are plentiful. This species was ranked as Sensitive by NSDNR in 2010 and was given a rank of “S34” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province, and are of long-term concern. No BBS data for Black-backed Woodpecker are available for Nova Scotia but are available for New Brunswick (CWS 2010). In New Brunswick, Black-backed Woodpecker abundance has decreased from the mid-1980s to the mid-1990s then stabilized at a low level over the past 15 years. Current abundance levels are similar to those encountered in the 1960s and 1970s. Reductions in Black-backed Woodpecker abundance may be attributable to increased harvesting of mature coniferous forests, shorter rotation timber harvesting, and fire suppression.

Black-backed Woodpeckers were recorded at five locations during the field surveys. All of the records were from mature mixedwood forest habitat (Table C2 in Appendix C). At four of the five locations, this species was identified based on the distinctive sign that this species leaves when foraging. At the fifth location an occupied Black-backed Woodpecker nest was found in a dead spruce tree located in a small patch of mature forest in a clear-cut adjacent to Wetland 17. Two adults were observed and begging calls of the nestlings were heard. This species is therefore listed as a confirmed breeder in the Study Corridor (Table C3 in Appendix C).

Killdeer

Killdeer typically nest in open disturbed areas such as gravel pits or agricultural land. Although this species has generally benefitted from human activities, its Nova Scotia population has been in decline since the early-1990s. It was listed as a Sensitive species in Nova Scotia by NSDNR in 2010 and is currently listed as “S3S4B” by ACCDC. It is believed that intensive farming practices may reduce the suitability of nest sites in various ways including accidental tillage of nests, exposure to pesticides, and reductions in the availability of food items such as invertebrates.

A total of nine Killdeer were observed during the field surveys. Six were observed in clear-cuts while the remaining three were observed flying over the Study Corridor (Table C2 in Appendix C). Only the two Killdeer observed during the 2008 surveys are accurately georeferenced. These birds were observed in one year old clear-cuts near the Cloverdale Road. Three of the

Killdeer observed in 2007 were also found in recent clear-cuts in this area. A pair of these Killdeer exhibited agitated behavior suggesting that a nest was nearby. The nest was not discovered so the pair of Killdeer were listed as probable breeders (Table C3 in Appendix C). Another Killdeer was found in a young clear-cut near the cavern site. The locations of the other three Killdeer observed flying over the Study Corridor is not known.

Spotted Sandpiper

The Spotted Sandpiper was listed as a Sensitive species in Nova Scotia by NSDNR in 2010. ACCDC ranks this species as “S3S4B”.Spotted Sandpipers typically nest in herbaceous plant communities in riparian habitats. They forage along the shores of lakes and rivers. The Nova Scotia Spotted Sandpiper population has declined since the late 1970’s (CWS 2010). The trend for the Nova Scotia population reflects the trend for this species in Canada as a whole. Several factors are believed to be responsible for the decline of this species including habitat loss, pesticide use, channelization of rivers and displacement of Spotted Sandpipers from suitable nesting habitat through human use of freshwater beaches and shores. One Spotted Sandpiper was observed near the Stewiacke River on August 14, 2007. The riparian habitat along the Stewiacke River provides suitable breeding habitat for this species; however, given the timing of the observation and the fact that no Spotted Sandpipers were observed along the banks of the Stewiacke River during either the 2007 or 2008 breeding bird surveys, it is likely that this bird was a migrant.

Wilson’s Snipe

Wilson’s Snipe nest in marshes, bogs and fens where grasses and sedges provide sufficient cover for nesting and foraging. This species is very cryptic and it is typically detected during the breeding season mostly when the males conduct their song flights. These song flights can occur well away from the nesting sites and can be detected from long distances making it difficult to locate nesting habitat. Wilson’s Snipe abundance in Canada has generally increased since 1970; however, in Nova Scotia Wilson’s Snipe numbers decreased from the early 1970’s to the early 1990’s and have remained relatively stable since then (CWS 2010). In 2010, NSDNR listed Wilson’s Snipe as a Sensitive species. It is listed as “S3S4B” by ACCDC.

There were four observations of Wilson’s Snipe during the 2008 breeding bird survey. All of the snipe were recorded in either clear-cut or mature mixedwood habitat (Table C2 in Appendix C). All of the observations were clustered around the Coverdale Road crossing point and there is a high likelihood that the data represent one or two male Wilson’s Snipe rather than four. All of the snipe were heard making flight songs so this species was listed as a Possible breeder in the Study Corridor (Table C3 in Appendix C).

Bay-breasted Warbler

Bay-breasted Warblers nest in mature conifer stands and population trends for this species are often correlated with spruce budworm abundance. In Nova Scotia, BBS data (CWS 2010) indicates that the abundance of Bay-breasted Warbler has steadily decreased since the mid-

1970s. In 2010 it was listed as a Sensitive Species by NSDNR. It is ranked “S3S4B” by ACCDC. There are a number of factors that are believed to have contributed to the decline of this species including suppression of spruce budworm outbreaks, habitat fragmentation, large-scale harvesting of mature conifer stands, deforestation in the wintering grounds, as well as the potential for reductions in the abundance of coniferous forest in the future as a result of climate change.

Bay-breasted Warblers were observed at two locations during the 2007 field surveys. One bird was observed in mixedwood treed swamp habitat at Wetland 15. The second bird was recorded in mature mixedwood forest at an unknown location along the 2008 alternate corridor route. This species is listed as a possible breeder in the Study Corridor (Table C3 in Appendix C).

Raptors

Five raptor species were encountered in the study corridor during the field surveys including Bald Eagle, Red-tailed Hawk, Sharp-shinned Hawk, American Kestrel, and Barred Owl. None of these species is listed as Sensitive in Nova Scotia by NSDNR; however, they typically occur in low numbers and are often sensitive to anthropogenic disturbance, particularly around their nest sites. Figures 5.4A and 5.4B show the locations where these species were encountered. One of the raptor species, Red-tailed Hawk was confirmed as nesting in or near the study corridor. The only evidence of breeding activity for the other four species was territorial behavior. Barred Owls were heard calling during the 2008 breeding bird survey; however, the calling owl was approximately 1 km outside of the Study Corridor. At one location near Wetland 1, a Sharp-shinned Hawk was observed chasing a Red-tailed Hawk which was in turn was chased by an American Kestrel. This would suggest that Sharp-shinned Hawks and American Kestrels were nesting nearby. The Red-tailed Hawk was probably associated with a nest located near the cavern site. No evidence of breeding activity was observed for the Bald Eagle which was observed flying over the Study Corridor

A single occupied Red-tailed Hawk nest was found approximately 300 m southeast of the cavern site. A second probable nest site was found near Wetland 18. Agitated Red-tailed Hawks were observed at this location on three occasions suggesting that a nest was nearby.

Maritime Breeding Bird Atlas

Additional information regarding use of the area by bird species of concern was derived from a review of the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992), online data derived from the current BBA program. A total of 93 bird species have been recorded within the two, 10 km X 10 km breeding bird atlas squares within which the Study Corridor is situated. These species along with their breeding status in the square and their provincial population status are listed in (Table C3 in Appendix C). Twenty-three of these species are listed as Species of Conservation Concern in Nova Scotia by ACCDC, NSDNR or *SARA.* No suitable breeding habitat is present in the study corridor for six of these species including Barn Swallow, Bobolink, Cliff Swallow, Common Loon, Peregrine Falcon, and Rose-breasted Grosbeak.

Suitable breeding habitat is present for 17 of the species of which 14 were recorded during the field surveys and have been discussed earlier in the text. The remaining three species could potentially nest in the study corridor but were not detected during the various field surveys. These species included Pine Siskin, Tree Swallow and Wilson's Warbler.

Pine Siskins typically nest in mature conifer stands or in ornamental conifer plantings. Stands of mature coniferous forest are scattered throughout the Study Corridor. Areas most likely to provide nesting habitat for this species include the riparian forest along the Stewiacke River, areas of mature coniferous dominated forest near the Cloverdale Road, between Wetlands 17 and 18 and between Wetlands 21 and Wetland 23.

Tree Swallows nest in unoccupied woodpecker holes and will also use nest boxes. They feed largely over lakes, rivers and wetlands containing open water. Their nests are often situated near these foraging sites. The riparian forest along the Stewiacke River is the portion of the Study Corridor most likely to provide nesting habitat for this species.

Wilson's Warblers generally nest in shrub thickets. This habitat type is present in the Study Corridor but is not abundant. This habitat type occurs most abundantly along the Cloverdale Road which runs parallel to a wetland composed largely of tall shrub swamp.

Tree Swallows and Pine Siskins are easily detected so it is unlikely that they were missed during the field surveys. The Wilson's Warbler has a non-descript song and closely resembles the Yellow Warbler in appearance so there is some potential for this species to be overlooked. However, given the small amount of suitable habitat present in the Study Corridor it is unlikely that many Wilson's Warblers are present there.

5.5.2 Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the Study Corridor was derived from field surveys and a review of the Nova Scotia significant habitat mapping data base (NSDNR 2007). Field surveys were conducted concurrently with vegetation, wetland and breeding bird surveys in June and August of 2007 and 2008. The field surveys provide a good indication of the presence of large mammal species in the Study Corridor. Knowledge of the distribution of small mammals in the Study Corridor is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements, which can be used to predict areas where they are likely to be found.

The mammal species recorded in the Study Corridor are a mixture of species characteristic of forest and wetland habitats. Species recorded during the field surveys included American Red Squirrel (*Tamiasciurus hudsonicus*), Eastern Chipmunk (*Tamias striatus*), Snowshoe Hare (*Lepus americanus*), American Beaver (*Castor canadensis*), North American Porcupine (*Erethizon dorsatum*), Eastern Coyote (*Canis latrans*), American Black Bear (*Ursus americanus*), Northern Raccoon (*Procyon lotor),* Northern River Otter (*Lutra canadensis*), and White-tailed Deer (*Odocoileus virginianus*).

A review of the NSDNR significant habitat mapping database (NSDNR 2007) did not reveal the presence of any known rare or sensitive mammal species in the vicinity of the Study Corridor or critical habitat such as deer wintering areas. All of the habitats present in the Study Corridor are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species. There is no karst topography in the area so it is unlikely that any caves are present in the area that would provide hibenaculum sites for hibernating bats such as Little Brown Bats (*Myotis lucifugus*) and Eastern Pipistrelles (*Pipistrellus subflavus*). A review of the abandoned mine opening data base (NSDNR 2008) revealed the presence of three known abandoned mine shafts within a five kilometer radius of the Study Corridor including two coal mines and a gold mine. The gold mine is a surface trench which would not provide suitable bat hibernaculum sites. The two abandoned coal mines have shafts which may provide suitable hibernaculum sites. These are located in Cloverdale and Forest Glen. The Cloverdale mine site is located approximately 3.1 km from the Study Corridor while the Forest Glen mine site is located 1.9 km from the Study Corridor.

5.5.3 Amphibians and Reptiles

Information regarding amphibians and reptiles and their habitat within the Study Corridor was also derived during the field surveys. Field surveys were conducted concurrently with wetland, vegetation and bird surveys conducted between June 2007 and August 2008.

Ten herpetile species were encountered during the surveys including Pickerel Frog (*Rana palustris*), Green Frog (*Rana clamitans*), Wood Frog (*Rana sylvatica*), Northern Spring Peeper (*Pseudacris crucifer*), American Toad (*Bufo americanus*), Common Garter Snake (*Thamnophis sirtalis*), Redbelly Snake (*Storeria occipitomaculata*), Ringneck Snake (*Diadophis punctatus*), Smooth Green Snake (*Liochlorophis vernalis*), and Wood Turtle (*Glyptemys insculpta*). None of these species with the exception of Wood Turtle is considered to be uncommon, rare or sensitive in Nova Scotia by ACCDC (2010 or NSDNR 2010).

Wood turtles are a species of concern. They are ranked as S3 by ACCDC (2010). Provincially, they are currently listed as a Sensitive species, as well as being listed as Vulnerable under the Nova Scotia *Endangered Species Act* (NSDNR 2009). The Wood Turtle is also listed as Threatened under Schedule 1 of *SARA*. Wood Turtles are slow to mature, have high rates of egg and nestling mortality, are long lived, and in pristine habitats have low adult mortality rates. Populations are maintained as a result of the longevity of this species which allows adults to reproduce many times during their life to compensate for low levels of recruitment. Any factor which increases the mortality rate of adults in a given population even to a small degree can have an adverse effect on the ability of the population to persist. Anthropogenic factors that affect Wood Turtle populations include collection of Wood Turtles as pets, roadkill and loss of foraging and nesting habitat to development.

Wood turtles are almost invariably associated with streams, creeks, and rivers and the associated rich intervale forest, shrub communities, as well as with the meadows and farmland terrestrial habitat associated with these watercourses. Streams with sand and/or gravel bottoms

are preferred, but rocky streams are used occasionally. Wood turtles may wander some distance from watercourses during summer foraging but characteristically remain within linear home ranges. These home ranges are 1 to 6 ha in size and are centred on a suitable river or stream where non-vegetated or sparsely vegetated sandy beaches and banks are present that serve as nesting sites. Natural nesting sites consist of sandy river beaches but may also include select disturbed sites such as railway grades and roadsides. Some turtles may travel considerable distances up small tributaries that lack suitable nesting sites and hibernacula during the summer months but offer good foraging opportunities. These smaller streams may serve as dispersal corridors between populations on different river systems.

During the field surveys an adult Wood Turtle was observed in June 2008, in a hay field near the banks of the Little River, a tributary of the Stewiacke River (Figures 5.4A and 5.4B). This location is situated outside of the Study Corridor. Both the Little River and the Stewiacke River are known to provide habitat for Wood Turtles. The Little River site provides both good foraging habitat and good nesting habitat. The portion of the Stewiacke River located within the Study Corridor provides good water depth and structural elements such as submerged logs that provide good winter hibernation sites. However, the steep mud banks along this section of the river do not provide suitable nesting sites and hinder access to the adjacent riparian forest which could provide foraging habitat. As such, this portion of the Stewiacke River does not provide high quality Wood Turtle habitat.

5.6 WETLANDS

Field surveys were conducted in the Study Corridor, including alternate routes. Delineations and related surveys typically extended to the boundaries of the Study Corridor (see Figures 5.3A and 5.3B). Field delineation of Wetlands 9 and 21 extended to approximately 200 m from the Proposed RoW with the remainder of their boundaries being extrapolated using information provided by provincial wetland mapping. Further information regarding the distribution of known and potential wetlands within the Study Corridor was obtained from the Nova Scotia Wetland Inventory Database (NSDNR 2007), provincial Wet Areas Mapping (NSDNR 2010), and wetlands identified by the Nova Scotia Geomatics Centre (NSGC 1997).

Prior to field surveys, the distribution of known and prospective wetlands within the Study Corridor were identified using information provided by the Nova Scotia Wetland Inventory Database (NSDNR 2007), Nova Scotia Geomatics Centre (NSGC) topographic mapping, and provincial Wet Areas Mapping (WAM). The WAM data base was used to identify portions of the proposed centerline routes that had high potential to be occupied by wetland habitat. Using this data base, all areas having an estimated depth to groundwater of 50 cm or less were considered to have a high potential for the presence of wetland habitat. Using this information as a guide, field surveys were conducted in the summer of 2007 and 2008, as well as in October 2011, to delineate wetlands present along the proposed RoW. The technical approach used for wetland identification and delineation during the surveys was based on principles prescribed in the US Army Corps of Engineers Wetlands Delineation Manual (Environmental Technical Services Co. 1995) using vegetation, soil, and hydrology as wetland indicators. Field

delineations were restricted to those wetland portions within the boundaries of the proposed and alternate corridors.

Data collected during field surveys and through a desktop analysis were used to evaluate the importance of wetlands for providing a suite of key hydrogeomorphological and wildlife-related functions. Habitat descriptions and inventories of plants and wildlife (including birds, mammals, reptiles and amphibians) were performed for delineated wetland portions. Designations for landscape position, landform, and water flow path were assigned to each of the wetlands following guidelines outlined by Tiner (2003) and used to infer potential key functions. Although wetlands were typically assigned their dominant condition, multiple designations were maintained for those comprised of more than one major landscape position, landform, and / or water flow path.

The NSDNR and NSGC mapping identified nine wetlands that fall entirely or partially within the Study Corridor (see Figures 5.3A and 5.3B). These wetlands were generally found in areas identified as having high water tables by the WAM data. A total of 21 wetlands were encountered within the Study Corridor during 2007-2011 field surveys (Table 5.8 and Figures 5.3A and 5.3B). Most of these wetlands were also located within areas identified as having high potential for the presence of wetland habitat by the WAM data. However, several wetlands including Wetlands 2, 3, 13, and 17 were not identified as potential wetland sites by the WAM data. Most of the field delineated wetlands are small, with area values being less than 2 ha (overall average is < 1 ha); but Wetland 9 is estimated to be over 6 ha in size. Several of the wetlands extend outside of the Study Corridor (*e.g.*, Wetland 6) and would therefore have greater total areas than presented in Table 5.8. In addition to those wetlands identified during field surveys, the Nova Scotia Wetland Inventory Database and NSDNRs Wet Areas Mapping (2010) identify a number of other locations that have potential for supporting wetland habitat within the Study Corridor (see Figures 5.3A and 5.3B).

TABLE 5.8 Wetlands Identified Within Study Corridor

Wetland ID	Area[1] within corridor (ha)	Vegetation communities	Landscape position	Landform	Surface water flow path[2]
1	0.87	Deciduous Treed Swamp	Lotic Stream	Basin	Throughflow
2	0.16	Tall Shrub Swamp	Lotic River	Fringe	Bidirectional-Nontidal
3	1.45	Coniferous Treed Swamp, Tall Shrub Swamp	Terrene	Basin	Outflow
4	0.38	Mixedwood Treed Swamp, Coniferous Treed Swamp	Terrene	Slope	Outflow
5	0.75	Low Shrub Swamp, Tall Shrub Swamp	Lotic Stream	Basin	Throughflow
6	0.65	Mixedwood Treed Swamp, Cut-over Treed Swamp	Terrene	Basin	Outflow
7	0.02	Coniferous Treed Swamp	Lotic Stream	Basin	Throughflow
8	1.75	Coniferous Treed Swamp	Lotic Stream	Basin	Throughflow

TABLE 5.8 Wetlands Identified Within Study Corridor

Wetland ID	Area[1] within corridor (ha)	Vegetation communities	Landscape position	Landform	Surface water flow path[2]
9	6.02	Coniferous Treed Swamp, Mixedwood Treed Swamp, Cut-over Treed Swamp	Terrene	Basin	Outflow
10	0.41	Tall Shrub Swamp	Terrene	Basin	Outflow
11	0.41	Tall Shrub Swamp	Terrene	Basin	Outflow
12	0.24	Fresh Marsh (old beaver flood)	Lotic Stream	Fringe	Throughflow
13	0.18	Mixedwood Treed Swamp	Terrene	Basin	Outflow
14	0.32	Mixedwood Treed Swamp	Lotic Stream	Basin	Throughflow
15	0.25	Mixedwood Treed Swamp	Terrene	Basin	Throughflow
16	1.64	Coniferous Treed Swamp, Mixedwood Treed Swamp, Cut-over Treed Swamp, Wet meadow	Terrene and Lotic Stream	Basin	Outflow and Througthflow
17	0.29	Mixedwood Treed Swamp (Immature)	Terrene	Basin	Outflow
18	1.42	Mixedwood Treed Swamp, Deciduous Treed Swamp, Cut-over Treed Swamp, Cut-over Treed Swamp (Herbicided)	Terrene	Basin	Outflow
19	0.46	Mixedwood Treed Swamp	Terrene	Basin	Outflow
20	0.18	Tall Shrub Swamp	Terrene	Basin	Isolated
21	1.61	Mixedwood Treed Swamp	Terrene	Basin	Outflow

[1]Area values only include those wetland portions within the Study Corridor and therefore do not convey total areas for wetlands extending beyond the corridor (*i.e.*, Wetland 6 and 9)

[2] Designations for landscape position, landform, and water flow path follows Tiner (2010)

5.6.1 Vegetation Communities

The majority of the wetlands encountered during field surveys are swamps, but a freshwater marsh and elements of wet meadow are also represented.

All wetlands encountered during field surveys, except one (Wetland 12), are primarily comprised of swamp. Swamps are mineral wetlands or peat lands and characteristically have tall woody vegetation (Warner and Rubec, 1997). Their water table is generally at or near the surface and is commonly present in the form of either stagnant or flowing pools or channels. Swamps generally have some internal water movement originating from their margins or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat. Specific swamp habitat types encountered during field

surveys include treed (including coniferous, mixedwood, and deciduous treed types as well as their cut-over counterparts), tall shrub, and low shrub vegetation communities.

Treed swamp comprises the large majority of wetland habitat within the Study Corridor. The mixedwood treed swamp habitat is particularly prominent, being identified within 13 of the surveyed wetlands, compared to five occurrences of coniferous treed swamp and two of deciduous treed swamp. Although the composition of the prominent vegetation varies amongst these specific habitat types (as well as among specific wetlands), red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and black spruce (*Picea mariana*) are typically the most dominant species, with lesser amounts of American larch (*Larix laricina*), paper birch (*Betula papyrifera*), eastern white pine (*Pinus strobus*), gray birch (*Betula populifolia*), and white spruce (*Picea glauca*) also being present. Speckled alder (*Alnus incana*) is generally the most abundant shrub within the swamps where it often formed a prominent understory canopy; but balsam fir and black spruce are also important components of this strata, along with lesser amounts of northern wild raisin (*Viburnum nudum*), common Labrador tea (*Ledum groenlandicum*), sheep laurel (*Kalmia angustifolia*), and black huckleberry (*Gaylussacia baccata*). The ground vegetation is comprised of an extensive cover of peatmoss (*Sphagnum spp*.) and a variety of graminoids and forbs, particularly three-seeded sedge (*Carex trisperma*), cinnamon fern (*Osmunda cinnamomea*), dwarf red raspberry (*Rubus pubescens*), Canada manna grass (*Glyceria canadensis*), sensitive fern (*Onoclea sensibilis*), and tussock sedge (*Carex stricta*).

Several of the treed swamps have been recently subject to tree harvesting activities and therefore have communities that are at an early stage of successional development. Although these areas sometimes have a few remnant or regenerating trees, particularly red maple, they are characteristically dominated by herbaceous vegetation. Prominent species include fowl manna grass (*Glyceria striata*) and common woolly bulrush (*Scirpus cyperinus*). One of the swamps which had been cut-over was also evidently subject to herbicide treatment (Wetland 18). In addition to peatmoss, the vegetation within this habitat was dominated by tussock sedge, bunchberry (*Cornus canadensis*), and small cranberry (*Vaccinium oxycoccos*).

Tall shrub habitats were encountered within six of the surveyed wetlands and were typically dominated by speckled alder. Common winterberry (*Ilex verticillata*), bristly dewberry (*Rubus hispidus*), and white meadowsweet (*Spiraea alba*) were also important components of the shrub strata within particular wetlands. Additionally, a diffuse tree cover provided by balsam fir, black spruce, and / or red maple was sometimes present. Peatmoss formed a prominent cover on the floor of these habitats and a variety of herbaceous taxa were present, most notably tussock sedge, common tall manna grass, bluejoint reed grass (*Calamagrostis canadensis*), sensitive fern, northern water horehound (*Lycopus uniflorus*), Schweinitz's groundsel (*Packera schweinitziana*), spotted jewelweed (*Impatiens capensis*), and cinnamon fern (*Osmunda cinnamomea*).

The single low shrub swamp habitat identified within Wetland 5 was dominated by a mixture of shrubs and herbaceous plants. White meadowsweet was the most prominent species within the shrub layer, but balsam willow (*Salix pyrifolia*) was also prominent and a number of other taxa

were present, including Virginia rose (*Rosa virginiana*) and shining rose (*Rosa nitida*). Herbaceous cover was primarily provided by bluejoint reed grass, tussock sedge, and Schweinitz's groundsel.

Wetland 16 was recognized as having a minor component of wet meadow habitat. Wet meadows are typically dominated by graminoids such as grasses, sedges and bulrushes, with up to 15 cm of surface water during the late fall, winter, and early spring (NSDNR 1999). During the growing season surface water is restricted to shallow depressions and drainage ditches. Wet meadows are a common occurrence on agricultural systems where periodic grazing or mowing keeps shrubs from establishing, but are also present in natural systems. The wet meadow habitat within the Study Corridor had a prominent ground cover provided by peatmoss and a variety of herbaceous plants, including common tall manna grass (*Glyceria grandis*), bluejoint reed grass, and cinnamon fern.

A single freshwater marsh was encountered in the Project Corridor (Wetland 12). Marshes are typically mineral wetlands and are periodically inundated by standing or slow flowing water whose levels generally fluctuate seasonally. During drier periods declining water levels may expose areas of matted vegetation or mud flats and their surface waters are typically rich in nutrients. Although their substrate is usually mineral material, well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees (Warner and Rubec, 1997). The marsh encountered during field surveys was present as a result of past beaver activity and was dominated by spotted jewelweed (*Impatiens capensis*), shallow sedge (*Carex lurida*), bindweed (*Polygonum sp.*), and nodding sedge (*Carex gynandra*).

5.6.2 Landscape Position, Landform, and Water Flow Path

Landscape position represents the relationship between wetlands and waterbodies / watercourses. Two wetland landscape positions were identified in the Project area: terrene and lotic (Table 5.10). Wetlands 1, 2, 5, 7, 8, 12, 14, and 16 are considered to have a lotic landscape position because they are found along watercourses and are periodically flooded at least during high discharge periods. All of these wetlands are located along streams with the exception of Wetland 2 which is found on the banks of the Stewiacke River. The remaining wetlands have been designated a terrene landscape position indicating that they are either isolated or headwater wetlands, fragments of former isolated or headwater wetlands that are now connected to downslope wetlands via drainage ditches, and wetlands that are on broad, flat terrain cut through by stream but where overbank flooding does not occur (*i.e.*, hydrologically decoupled from streams) (Tiner, 2008). Due to variation in the hydrological character of Wetland 16 throughout its extent, it has been designated both terrene and lotic landscape positions.

Landform is the physical form of a wetland or the predominant land mass upon which it occurs. Three wetland landforms were recognized within the Project area: basin, fringe, and slope (Table 5.10). The majority of wetlands are classified as having a basin landform, indicating that

they occur in distinct depressions that are primarily formed by the surrounding upland habitat. Two wetlands (Wetlands 2 and 12) are classified as having a fringe landform because they occur within the banks of streams or rivers whereas Wetland 4 was considered to have a “slope” landform because it Is found on a slope of >2%.

Water flow paths reflect hydrological relationships among wetlands as well as watercourses and/or waterbodies and are typically based on surface water connections because these are more readily identified than groundwater linkages. Four types of water flow paths were identified for wetlands within the Project area: outflow, throughflow, isolated, and bidirectional-nontidal (Table 5.8). Many of the wetlands within the Study Corridor are considered to have an “outflow” surface water flow path but lack any channelized water inflow. In contrast, those with a “throughflow” system have surface water that flows through them, as may be promoted by the presence of a watercourse or another type of wetland above and below them. Wetland 16 was considered to have both outflow and throughflow portions. Wetland 20 is considered to be “isolated” from a surface water perspective indicating that it is essentially a closed (“geographically isolated”) depression where water comes from direct precipitation, localized surface water runoff, and/or ground water discharge. The surface water flow path of Wetland 2 is categorized as bidirectional-nontidal as a result of being maintained via periodic overbank flooding from the Stewiacke River.

5.6.3 Wetland Functions

The identification and evaluation of key functions follows guidelines outlined by NovaWET (Tiner 2010) but is supplemented with additional information obtained from field surveys. Functions which are considered by the evaluation included surface water detention, coastal storm surge detention, streamflow maintenance, nutrient transformation, carbon sequestration, sediment and other particulate retention, shoreline stabilization, socioeconomic value, fish habitat ,waterfowl and waterbird habitat, habitat for Species at Risk and / or Species of Conservation Concern. Designations of “high”, “moderate”, “low”, or “negligible” were assigned to each wetland to represent their expected relative potential for providing the given functions (Table 5.9). These rankings were assigned using predicted relationships among their landscape position, landform, water flow pathways, and other structural attributes, as outlined by Tiner (2010), but have been modified based on additional data collected during field surveys and desktop analyses of the Project area. Although wetland size is an important feature that would affect their capacity to provide the aforementioned functions, area has not been directly factored into the interpretations provided here.

TABLE 5.9 Wetland Functions

Wetland ID	Surface Water Detention	Coastal Storm Surge Detention	Streamflow Maintenance	Nutrient Transformation	Carbon Sequestration	Sediment and Other Particulate Retention	Shoreline Stabilization	Socioeconomic Value	Fish Habitat	Waterfowl and Waterbird Habitat	Plant Species of Conservation Concern	Bird Species At Risk / of Conservation Concern
1	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Gmelin's water buttercup	Olive-sided Flycatcher
2	Moderate-High	Negligible	Moderate	Moderate	Moderate	Moderate - High	High	Low	Moderate	Low	-	-
3	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	alder-leaved buckthorn	Canada Warbler, Yellow-bellied Flycatcher
4	Low	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	-	Canada Warbler, Yellow-bellied Flycatcher
5	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	-	Wilson's Snipe
6	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	-	Canada Warbler, Ruby-crowned Kinglet, Wilson's Snipe
7	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	-	-
8	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	-	Canada Warbler, Boreal Chickadee
9	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	-	Yellow-bellied Flycatcher
10	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	large purple fringed orchid	-
11	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	Nova Scotia agalinis	Canada Warbler
12	Moderate-High	Negligible	Moderate	High	Low	Moderate - High	High	Low	High	Moderate	Bicknell's crane's-bill, woods-rush, Gmelin's water buttercup	-

TABLE 5.9 Wetland Functions

Wetland ID	Surface Water Detention	Coastal Storm Surge Detention	Streamflow Maintenance	Nutrient Transformation	Carbon Sequestration	Sediment and Other Particulate Retention	Shoreline Stabilization	Socioeconomic Value	Fish Habitat	Waterfowl and Waterbird Habitat	Plant Species of Conservation Concern	Bird Species At Risk / of Conservation Concern
13	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	large purple fringed orchid	-
14	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	large purple fringed orchid	Ruby-crowned Kinglet
15	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Low - Moderate	Moderate	Low	Moderate	Low	triangle moonwort	Canada Warbler, Bay-brested Warbler, Yellow-bellied Flycatcher
16	Moderate-High	Negligible	Moderate - High	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	large purple fringed orchid	Canada Warbler, Black-backed Woodpecker
17	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	-	Gray Jay, Black-backed Woodpecker
18	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	large purple fringed orchid	Canada Warbler, Olive-sided Flycatcher, Common Nighthawk, Black-backed Woodpecker
19	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	-	-
20	Low	Negligible	Low	Moderate	Moderate	Low	Low	Low	Negligible	Low	-	-
21	Moderate	Negligible	Moderate - High	Moderate	Moderate	Low	Moderate	Low	Low	Low	-	-

Surface Water Detention

The majority of the wetlands within the Study Corridor are considered to have moderate to high potential for detaining surface water. The relative value of wetlands for performing this function is determined by their landform (basins provide confines in which surface water may be detained) and the amount of surface water inflow which they are likely to receive (wetlands with channelized inflow have greater potential to receive high amounts of surface water inputs). Although most of the wetlands are flat basins and many would receive some hydrological inputs from channelized inflows, most are unlikely to have much standing water in them throughout much of the year. Wetland 4 is considered to have low potential for providing this because its sloped nature would prevent it from retaining surface water to any significant degree (Tiner 2010).

Coastal Storm Surge Detention

None of the wetlands are located along the coast. As a result, they do not contribute to the function of coastal storm surge detention.

Streamflow Maintenance

Wetlands have potential to moderate stream flow by slowing the flow of water and by temporarily storing surface water. Headwater wetlands (those along first and second order streams) that are not ditched are generally considered to have high potential for providing streamflow maintenance whereas those located along higher order watercourses are considered to have lesser potential (Tiner 2010). Because most of the wetlands are located along headwater streams or are otherwise located along larger watercourses, they are considered to have moderate to high potential to contribute to this function.

Nutrient Transformation

Many wetlands have high potential to provide important biogeochemical processes by way of nutrient transformation. For example, under low-oxygen (*i.e.*, anaerobic) conditions they convert certain elements (*e.g.*, nitrogen, iron, manganese, sulfur, and carbon) from their oxidized to reduced forms, and in doing so contribute to important nutrient transformation functions, such as denitrification (Tiner 2005). With the exception of Wetland 12 (a beaver-flooded marsh), wetlands found within the Study Corridor are likely to be only seasonally saturated (*i.e.*, high water tables for extended periods during the year, usually from late fall into spring, opposed to permanently saturated) and / or temporarily flooded (*i.e.*, inundated for brief periods usually at the beginning of the growing season as opposed to seasonally or semipermanently flooded), their potential to perform important nutrient transformation functions are likely to be lessened (Tiner 2010). Conversely, many of the wetlands have moderate to high amounts of alders and the nitrogen –fixation capabilities of these plants convert nitrogen gas to a form that may be taken up by plants or transported by water. Based on these considerations, all wetlands within the Study Corridor have been assigned a moderate designation for this function, with the

exception of Wetland 12 which is considered to have relatively high value for nutrient transformation.

Carbon Sequestration

Wetlands can act as both sinks and sources for greenhouse gases. Peatlands such as bogs and fens can be important carbon sinks by storing large volumes of organic matter in the form of peat. Marshes and swamps that remain saturated throughout the year also tend to accumulate peat and act as carbon sinks. Wetlands with large seasonal water level fluctuations are typically poor at sequestering carbon since exposure of the substrate to air during draw down periods promotes rapid decomposition of organic matter deposited in the sediment. Observations made during site visits indicate that because most of the swamps have considerably large seasonal water fluctuations and minimal peat development, they do not have high value in terms of carbon sequestration. However, with the exception of Wetland 12 (a riparian marsh), all wetlands within the Study Corridor are either dominated by woody plants or are regenerating with such (following tree harvesting activities) and this characteristic would contribute to their potential to sequester carbon. As such, most of the wetlands are considered to have “moderate” potential to provide this function.

Sediment and Other Particulate Retention

Some wetlands are quite effective at removing sediments and other particulate matter from surface water. The ability of a wetland to perform this function is dependent on various factors, including the degree of flow channelization through the wetland. In general, seasonally flooded wetlands that are located on the banks of waterbodies or watercourses are considered to have high value for the retention of sediments and other particulate matter whereas those that are only temporarily flooded are regarded as having moderate value for performing this function (Tiner 2010). Wetlands 2 and 12 are considered to have moderate – high potential for this function because they are expected to be seasonally inundated by adjacent watercourses. Swamps which are located along the banks of watercourses but which are suspected of being temporarily flooded are considered to have moderate value for retention of sediments and other particulate matter whereas those that do not have channelized inflows are regarded as having low potential.

Shoreline Stabilization

Wetlands may provide effective protection from shoreline erosion by absorbing energy from waves, tides and flowing water without experiencing extensive damage to vegetation or wetland substrates. Wetlands that are located on the shores of waterbodies or watercourses are generally considered to have high value in this regard whereas headwater wetlands are regarded as having moderate value (Tiner 2010). Following this rationale, Wetlands 2 and 12 are considered to have relatively “high” potential to contribute to shoreline stabilization, Wetland 20 is considered to have ‘low’ potential” and the remaining are considered to have “moderate” potential.

Socioeconomic Value

The wetlands in the Study Corridor have little socio-economic value. Apart from several of the wetlands having been recently subject to forest management activities there is no evidence to indicate that they are currently being used for recreational, agricultural, cultural, or business purposes. None of the wetlands are part of any protected area such as a national or provincial park, national wildlife area, federal migratory bird sanctuary, ecological reserve, provincial wildlife management area, wildlife refuge, or game sanctuary.

Fish Habitat

The value of wetlands for providing fish habitat is generally related to their connectivity with deepwater habitats. As such, wetlands are generally considered to have high value for fish if they provide spawning/nursery habitat or refuge for native fish species in adjacent estuaries, lakes, rivers or streams (Tiner 2010). Additionally, wetlands may intermittently support populations of certain fish species as a result of colonization during flood events and some isolated, but permanently flooded, wetlands can support native populations of species such as minnows. Additionally, those that do not directly support fish may still be important for maintaining their habitat by improving the quality of downstream water; for example, by providing shade to maintain water temperature in adjacent water bodies or watercourses. Wetlands that are isolated and are not permanently flooded do not generally support fish populations.

The value of wetlands for providing fish habitat was evaluated by assessing the degree to which they were contiguous with a permanent waterbody or watercourse which was either known or expected to be capable of supporting native fish species. Wetland 12, a beaver-flooded marsh, is considered to have relatively “high” value for fish habitat as a result of being contiguous with Watering Brook. Many of the swamps within the Study Corridor are located along watercourses that are capable of supporting fish but are not regularly inundated outside of the confines of the channelized flow. However, because they are important for maintaining water quality within the watercourses, they are therefore considered here to have “moderate” value for fish habitat. Those that do not have channelized flow throughout their extent but which are sources for watercourses (*i.e.*, wetlands with a “outflow” surface water flow path) were considered to have relatively “low” value. Wetland 20 is isolated from watercourses and is considered to have negligible value for fish habitat.

Waterfowl and Waterbird Habitat

The ability of wetlands to provide habitat for waterfowl and other waterbirds varies according to their position relative to waterbodies and watercourses, the presence and character of open water, and the availability of appropriate vegetation for foraging and nesting opportunities. Because of relationships to certain habitat features, certain wetland types (*e.g.*, salt marshes, lentic marshes, lotic river marshes) are generally considered important for waterfowl and other waterbird habitat whereas others have little or no capacity to provide this function (Tiner 2010).

With the exception of Wetland 12, wetlands within the Study Corridor have minimal potential to provide habitat for waterfowl and other waterbirds. Although many of the wetlands were located adjacent to watercourses, these features did not contain sufficient amounts of open water to support waterfowl and / or other waterbirds. No waterfowl or waterbirds were encountered within or in association with wetlands of the Study Corridor during field surveys with the exception of Solitary Sandpiper which was observed within Wetland 12.

Species of Conservation Concern

Plants

A total of 249 plant species were encountered within wetlands during 2007-2008 field surveys, including seven Species of Conservation Concern: Nova Scotia agalinis, triangle moonwort, Bicknell's crane's-bill, woods-rush, large purple fringed orchid, Gmelin's water buttercup, and alder-leaved buckthorn (Table C1 in Appendix C). These species were distributed amongst ten of the surveyed wetlands (Wetlands 1, 3, 10, 11, 12, 13, 14, 15, 16, and 18), with each being found to contain one species of conservation concern, except for Wetland 12 which had three. Complete lists of vascular plants associated with field-surveyed wetland portions are provided in Table C4 of Appendix C.

Nova Scotia agalinis is a small herb that is endemic to Nova Scotia, considered “Secure” by NSDNR, and assigned a ranking of “S3” by the ACCDC. Typically associated with moist, especially sandy soil (Gleason and Cronquist 1991), it was found within Wetland 11.

Triangle moonwort is a small fern which is known from rich, wooded hillsides of the province (Zinck 1998). Its population is considered “Sensitive” by NSDNR and is ranked as “S2S3” by the ACCDC. This species was found at the edge of Wetland 15 and the adjacent mature mixedwood forest.

The provincial population of Bicknell's crane's-bill is ranked as “Secure” by the ACCDC and as “S3” by the ACCDC. This species is scattered throughout central and southern parts of Nova Scotia and is usually associated with recently burned or cleared areas (Zinck 1998). This species was more typically encountered within clear cuts during field surveys, but was recorded within a relatively dry draw-down area of an abandoned beaver pond at Wetland 12.

The population of woods-rush is considered “Sensitive” by NSDNR and is ranked as “S3” by the ACCDC. Woods-rush is typically associated with wet woods and swamps within the province (Zinck 1998) and was encountered within Wetland 12.

Large purple fringed orchid is a relatively large orchid found in wet meadows and along streams. It is considered “Secure” by NSDNR and ranked “S3” by the ACCDC. This species was encountered within wetlands in the southern half of the Study Corridor, including Wetlands 10, 13, 14, 16, and 18.

The provincial population of Gmelin's water buttercup (*Ranunculus gmelinii*) is considered "Secure" by NSDNR but is given a ranking of "S3" by the ACCDC indicating that it is uncommon. This species is scattered throughout much of Nova Scotia where it may be found in a variety of aquatic habitats, including marshes, slow-moving streams, ditches, shallow pools, and ponds in relatively alkaline areas (Zinck 1998). Gmelin's water buttercup was encountered in Wetlands 1 and 12, and was particularly associated with the watercourse flowing through the former.

The shrub alder-leaved buckthorn is scatted throughout central Nova Scotia where it may be found in swampy woods and boggy meadows, particularly in alkaline areas (Zinck 1998). This species is considered "Sensitive" by NSDNR and is ranked as "S3" by the ACCDC. One clump of alder-leaved buckthorn was encountered during field surveys and was located within Wetland 3.

Wildlife

A total of 36 bird, six mammal and five herpetile species were encountered within wetlands in the Study Corridor during the 2007-2008 field surveys. These included ten species that are considered At Risk or of Conservation Concern including Common Nighthawk, Olive-sided Flycatcher, Canada Warbler, Yellow-bellied Flycatcher, Ruby-crowned Kinglet, Wilson's Snipe, Black-backed Woodpecker, Boreal Chickadee, Gray Jay, and Bay-breasted Warbler. These species were found in or near 13 of the 21 wetlands sampled in the Study Corridor (Wetlands 1, 3, 4, 5, 6, 8, 9, 11, 14, 15, 16, 17, and 18). Complete lists of wildlife species associated with field-surveyed wetland portions are provided in Table C5 of Appendix C.

Common Nighthawk is listed as Threatened under Schedule 1 of the federal *Species at Risk Act* (*SARA*). It is also listed as Threatened under the Nova Scotia *Endangered Species Act* (*NSESA*) and is ranked "S3B" by ACCDC. This species typically nests in open upland habitats such as burns and clear-cuts and is normally not associated with wetland habitat except when foraging. This species was recorded around Wetland 18. It is possible that Common Nighthawks may nest in a portion of this wetland that has been clear-cut and herbicided.

Olive-sided Flycatchers are listed as Threatened under *SARA* and are listed as At Risk by the Nova Scotia Department of Natural Resources (NSDNR). ACCDC ranks this species as "S3B". Olive-sided Flycatchers often nest in wetlands that have a combination of open spaces with large scattered trees or snags for foraging and areas of mature conifers for nesting. This species was recorded in or near Wetland 1 and Wetland 2. All records of this species in the Study Corridor were associated with wetland habitat.

Canada Warbler is also listed as Threatened under *SARA* and is listed as At Risk by NSDNR. ACCDC ranks this species as "S3B". Canada Warbler can be found in both upland and wetland habitat types. Its nesting habitat is characterized by an open deciduous or mixedwood canopy with a dense understory of either shrubs or advanced regeneration of tree species such as balsam fir and spruce. Canada Warblers were widely distributed in swamps in the Study

Corridor and were present in or near eight of the 22 wetlands sampled. These included Wetlands 3, 4, 6, 8, 11, 15, 16, and 18. Only one Canada Warbler recorded in the Study Corridor was not associated with wetland habitat.

Yellow-bellied Flycatchers are listed as a Sensitive species by NSDNR and are ranked “S3S4B” by ACCDC. This species is typically associated with damp coniferous forest including treed swamps. Yellow-bellied Flycatchers were relatively abundant in the Study Corridor, accounting for 2.6 % of all birds recorded during the breeding bird surveys. This species was encountered in or near four of the wetlands sampled in the Study Corridor including Wetlands 3, 4, 9, and 15.

Ruby-crowned Kinglets are listed as a Sensitive species by NSDNR and are ranked “S3S4B” by ACCDC. This species is typically associated with coniferous or mixedwood forest habitat including both mature and immature stands. Ruby-crowned Kinglets were also relatively abundant in the Study Corridor, accounting for 2.6 % of all birds recorded during the breeding bird surveys. This species was encountered in or near Wetlands 6 and 14.

Wilson’s Snipe nest in marshes, bogs and fens where grasses and sedges provide sufficient cover for nesting and foraging. This species is listed as a Sensitive species by NSDNR and is ranked “S3S4B” by ACCDC. Wilson’s Snipe were recorded in Wetlands 5 and 6 near the Cloverdale Road. This was one of only a few locations in the Study Corridor where wetlands with dense sedge and grass cover were present.

Black-backed Woodpeckers are typically found in mature coniferous forest habitat. Although mature living or dead conifers are required as nest sites, Black-backed Woodpeckers often situate their nests in small islands of mature forest in clear-cuts. Black-backed Woodpeckers typically forage on dead or dying conifers. Wetlands such as softwood or mixedwood treed swamps are often used by this species as foraging areas. Black-backed Woodpeckers are listed as a Sensitive species by NSDNR and are ranked “S3S4” by ACCDC. This species was recorded in Wetlands 17, and 18. An active Black-backed Woodpecker nest was found at the edge of Wetland 17.

Boreal Chickadees are associated with coniferous forest habitat. They inhabit both mature and immature conifer stands but breed and survive more successfully in mature stands than immature stands due to the greater availability of tree cavities in older stands. These tree cavities are used as nesting sites in the spring and summer and for thermal cover during the winter. The Boreal Chickadee is listed as a Sensitive species by NSDNR and is ranked “S3” by ACCDC. Boreal Chickadees were encountered in or near Wetland 8.

Gray Jays are typically associated with coniferous forest habitat. This species is listed as a Sensitive species by NSDNR and is ranked “S3S4” by ACCDC. Wetland 17 was the only wetland in which Gray Jays were noted.

Bay-breasted Warblers are generally found in open conifer stands. This species is listed as a Sensitive species by NSDNR and is ranked “S3S4B” by ACCDC. Bay-breasted Warblers were noted in only one wetland (Wetland 15).

5.7 LAND AND RESOURCE USE

5.7.1 Residential, Institutional, Industrial, and Commercial Land Use

The Project is located entirely within the Municipality of the County of Colchester. There are two incorporated towns located in the County: Truro (population 11,765) and Stewiacke (population 1,421) (Statistics Canada 2011). The proposed underground storage location is near the community of Alton. Nearby communities include Stewiacke, Riverside, Cloverdale, Stewiacke Valley, Brookfield and Stewiacke East (Figure 5.5).

The majority of land use in the Study Corridor is residential, agricultural and forestry-related (Figure 5.5). The Proposed RoW intersects 16 properties with 10 of the parcels owned by the provincial Crown. There are no residences located within 100 m of the Proposed RoW and four residences within 500 m of the RoW. The distance to the closest residence is approximately 320 m.

There is currently no land use zoning or development plan in place that applies to the Project site or adjacent lands. The Project site is a rural part of Colchester County, comprised of traditional rural activity (*i.e.*, forestry, farming and hunting) with no anticipation of any change to land use in the area. There are no plans, to create land use controls in this area in the foreseeable future (Colchester Director of Community Development pers. comm.).

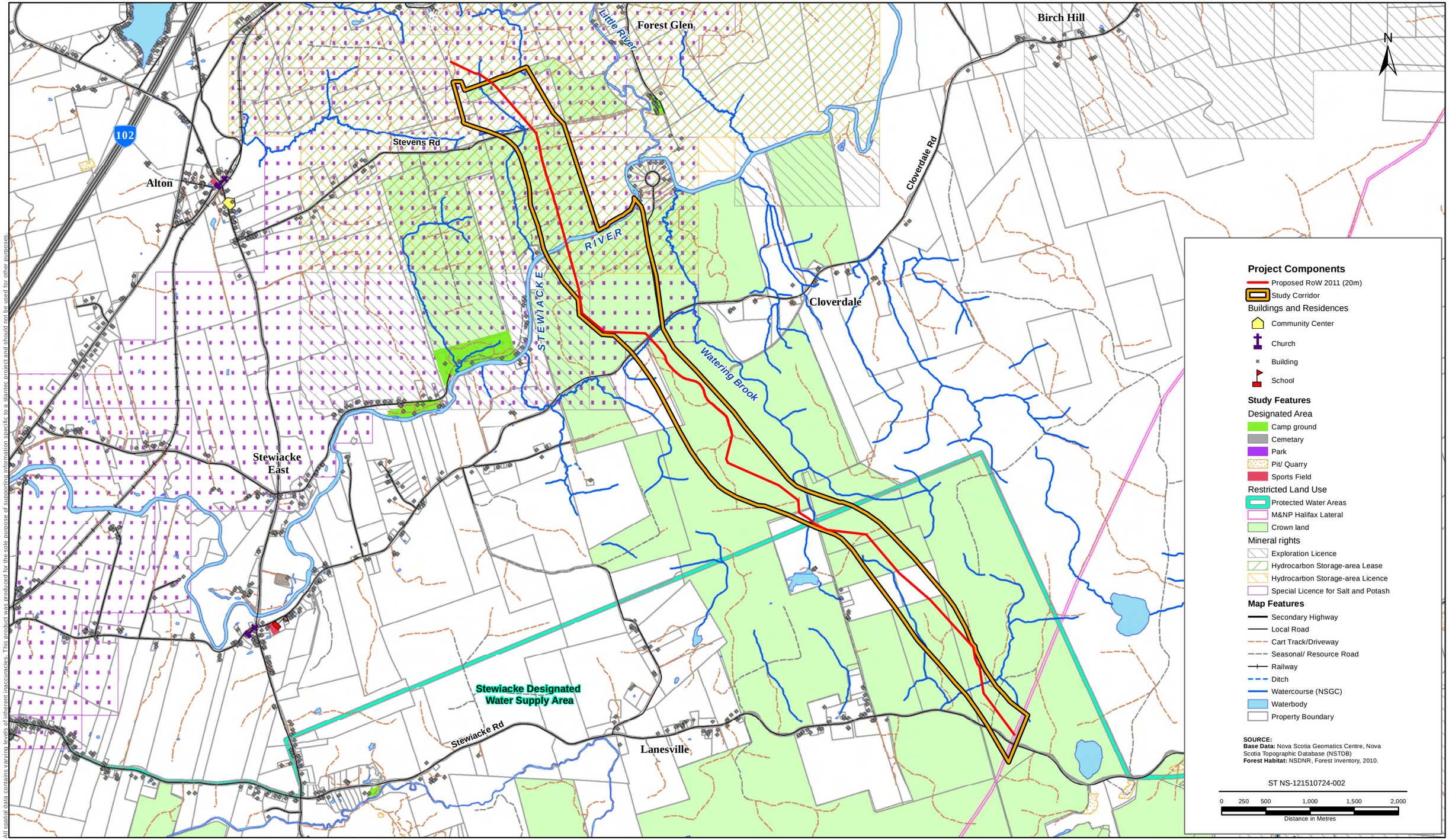
The largest residential population centres near the proposed Project are the Town of Stewiacke located less than 1 km from the RoW and the Town of Truro located 20 km from the Project.

Table 5.10 provides statistics on the population and dwelling counts of the Study Corridor (Colchester Subdivision C) compared to the nearest town (Stewiacke), the overall county and the province. These statistics help to demonstrate the rural nature of the Study Corridor, given the low population density relative to Stewiacke, Colchester County and the province. Statistical updates are expected in 2012.

TABLE 5.10 Population and Dwelling Counts

	Colchester Subdivision C	Stewiacke	Colchester County	Nova Scotia
Population in 2006	13,312	1,421	50,023	913,462
Total Private Dwellings	5,639	618	22,951	425,681
Population Density (individuals per sq km)	9.2	80.4	13.8	17.3
Land Area (sq km)	1,443	17.67	3,627	52,917

Source: Statistics Canada 2011



PREPARED BY: M. Huskins-Shupe	ALTON NATURAL GAS PIPELINE PROJECT	FIGURE NO.: 5.5
REVIEWED BY: K. Fraser	**Socio-Economic Features**	DATE: Dec 13, 2011
CLIENT: alton NATURAL GAS STORAGE LP		Stantec

File Path: V:\1215\active\121510xxx\121510724_Alton\geomatics\mapping\mxd\ReportFigures\ST_NS_121510724-002_Socio_Economic.mxd

Institutional land uses near the proposed RoW include the East Stewiacke Elementary School located 4.9 km from the Project Study Corridor and two churches 2.8 km and 5.3 km from Study Corridor.

Commercial land uses in the immediate Study Corridor are predominantly home-based service industries (*e.g.,* construction contracting, auto repair, electronic and motor repairs, *etc*.). The Town of Stewiacke is the closest commercial centre with various food and retail outlets, financial institutions and business services.

Industries operating in the immediate Project area include Logan Drilling Limited and National Truss Span, both located on Commo Road in Stewiacke. Other industries located within the core of the Town of Stewiacke include a pallet manufacturer and a window manufacturer.

5.7.2 Agriculture and Natural Resource Use

As shown on Figure 5.5, there are mineral exploration licenses (salt and potash) issued in the Study Corridor. Forent Energy has 514,000 acres of land in the area known has the Alton Block (Forent Energy 2011a). Forent has a three-year exploration license from 2011 to 2014 and tenure to April 8, 2020 (Forent Energy 2011a). There are numerous oil and gas shows have been detected throughout the block. In 2010 Forent completed a gravity gradiometry survey of the Atlon Block and completed a 2D seismic program in July 2011 (Forent Energy 2011a). Forent announced in November 2011 that the company has received approval from both the Nova Scotia Department of Energy and NSE to drill three wells on the Alton Block (Forent Energy 2011b). Forent intends to complete the three well program by the end of March 2012, with beginning the drilling in February 2012 (Forent Energy 2011b).

As shown in Figure 5.5, it is estimated that the proposed Study Corridor crosses 10 parcels of land owned by the crown. In March 2010, the province loaned $75 million to help Northern Pulp purchased 475,000 acres of land to ensure a wood supply to the Abercrombie, Pictou Co., pulp mill and to protect the land as a forestry asset (NS Government 2010).

In 2010, Colchester County produced a total of 435,153 m^3 of wood products. Of this, 85% were softwood products and 15% were hardwood products (Table 5.12).

TABLE 5.11 Volume of Colchester County Wood Products by Owner Class, 2010

	Softwood (m^3 solid)	Hardwood (m^3 solid)	Total (m^3 solid)
Crown Land	68,326	14,793	83,119
Industrial	4,679	668	5,347
Private	297,477	49,210	346,687
Federal	0	0	0
All Owners	370,482	64,671	435,153

Source: NSDNR 2011

As shown in Table 5.12, there are approximately 442 farms in Colchester County, representing about 11.6% of the provincial total (Statistics Canada 2011). A wide variety of crops are grown but the major proportion of cropland is devoted to forage crops, dairy cattle and beef production. Agricultural practices in Colchester are cultivated to forage crops or pasture land. Forage crops may include alfalfa, grass alfalfa, clover, forage corn, and occasional small grains (wheat, oats, and barley). Agriculture is not currently practiced within the Study Corridor.

TABLE 5.12 Colchester Farm and Farm Operators Statistics

	Colchester Subdivision C	Colchester	Nova Scotia
Total Population in 2006	27,201	50,023	913,462
Total Number of Operators	235	600	5,100
Total Number of Farms	171	442	3,795
Land Area (km^2)	1,502	3,628	52,917
Total Area of Farms (hectares)	23,191	50,600	403,044
Total Gross Farm Receipts (excluding forest products sold) ($)	28,701,555	52,943,558	509,520,691
Total Farm Capital (market value in dollars)	111,997,891	231,931,642	1,980,984,174

Source: Stats Canada 2011

5.7.3 Tourism and Recreation

Recreational land use in the Study Corridor includes the Stewiacke River Park, a small picnic park on the Stewiacke River, off the Stewiacke River Park Road approximately 1.8 km from the Study Corridor. The park offers covered picnic tables, cook shelters, a playground and river access. The park is a popular spot for launching canoes or kayaks and also contains a 1 km walking trail. In close proximity to the Stewiacke River Park, there is a private property which hosts an annual country/bluegrass music festival, usually in the month of June.

Additional recreational facilities include softball fields in Stewiacke and local community centres in Stewiacke and Alton. There are a couple campgrounds near the Study Corridor including two off Stewiacke River Park and one off Forest Glen Road.

Informal recreational land use in the Study Corridor includes hunting, ATV use and snowmobile use. Hunting is licensed through the provincial government and seasons generally run through the fall months.

Further removed from the Study Corridor (approximately 15.1 km from the Study Corridor), but relevant to tourism associated with the Stewiacke area, is the Shubenacadie Provincial Wildlife Park located between Shubenacadie and Stewiacke on Highway No. 2. This 40 ha park is owned and operated by NSDNR and contains wildlife exhibits of native and exotic species of mammals and birds. Adjacent to the wildlife park is a large picnic and playground area.

5.7.4 Labour and Economy

In 2005, Nova Scotians recorded a median household income of $46,605, the 2006 Census data identified a labour force participation rate (*i.e.,* the percentage of eligible population who are active in the labour market) of 62.9% and an unemployment rate of 9.1% (Table 5.13). The median age of the population in 2006 was 41.8 years.

Colchester County has a population of 50,023 and covers a land area of 3,628 km^2, with a population density of 13.8 per square kilometre. This is less than the provincial density average of 17.3 for Nova Scotia. A large number of the county's population lives in rural areas with only 26% of the population living in the two towns in the county (Truro, population 11,765 and Stewiacke, population 1,421) (Statistics Canada 2011).

Table 5.13 provides a summary of select labour force characteristics based on census data from 2006. The Project area (*e.g.,* Alton) falls under the federal census classification of Colchester Subdivision C, which is a rural area that covers a land area of 1,443.05 km^2. However, due to its proximity, statistics for the Town of Stewiacke are also provided for reference to help characterize the overall Study Corridor (Table 5.13). Statistics for Colchester County are inclusive of the Subdivision C and Stewiacke statistics.

TABLE 5.13 Summary of Selected Demographic, Income and Labour Characteristics, 2006

	Colchester Subdivision C	Stewiacke	Colchester County	Nova Scotia
Population in 2006	13,312	1,421	50,023	913,462
Population Change (% change 2001 to 2006)	-0.6	2.4	1.5	0.6
Median age of the population (years)	41.7	42.9	42.5	41.8
Median household income in 2005	$47,618	$41,787	$42,782	$46,605
Labour force participation rate	65.1	55.6	62.1	62.9
Unemployment rate	6.9	5.2	7.9	9.1
Employment rate	60.6	52.7	57.2	57.2

Source: Statistics Canada 2011

Of particular note is the 0.6% population decrease in Colchester Subdivision C and 2.4% population increase in the Town of Stewiacke, relative to the 0.6% population increase for Nova Scotia. The Project area also has a slightly higher median income and higher employment rate compared to the Province as a whole.

Table 5.14 summarizes labour force by industry, showing a clear distinction between the rural division of Colchester County versus the Town of Stewiacke. Manufacturing and construction industry makes up 23.1% of the labour force for Colchester Subdivision C but only 12.8% of the labour force in Stewiacke. The leading industry for the Town of Stewiacke in terms of total labour force is other services (36.1% versus 21.2% for Colchester Subdivision C).

TABLE 5.14 Summary of Labour Force by Industry, 2006

	Colchester Subdivision C	Stewiacke	Colchester County	Nova Scotia
Total Experienced Labour Force	7,005	665	25,160	468,590
Agriculture and other resource-based industry (% of total labour force)	455 (6.5%)	40 (6.0%)	1,460 (5.8%)	27,400 (5.9%)
Manufacturing and construction industries (% of total labour force)	1,615 (23.1%)	85 (12.8%)	5,260 (20.9%)	71,675 (15.3%)
Wholesale and retail trade (% of total labour force)	1,270 (18.1%)	100 (15.0%)	4,755 (18.9%)	75,005 (16.0%)
Finance and Real Estate (% of total labour force)	180 (2.6%)	25 (3.8%)	740 (2.9%)	21,355 (4.6%)
Health and Education (% of total labour force)	940 (13.4%)	90 (13.5%)	4,240 (16.9%)	89,385 (19.1%)
Business Services (% of total labour force)	1,060 (15.1%)	85 (12.8%)	3,905 (15.5%)	80,930 (17.3%)
Other Services (% of total labour force)	1,485 (21.2%)	240 (36.1%)	4,790 (19.0%)	102,840 (21.9%)

Source: Statistics Canada 2011

In line with their mandate to drive sustainable economic growth, the Colchester Regional Development Agency (CoRDA) has prepared a Regional Economic Plan for Colchester (Growing Colchester 2005-2010). Their economic model focuses on the following objectives: supporting existing businesses to survive and grow; attracting new enterprise to Colchester; creating new enterprise through innovation and entrepreneurial activity; and creating a vibrant and welcoming community in which to live and work (CoRDA n.d.).

In an unrelated, but compatible initiative, CoRDA and the Town of Stewiacke have proceeded with the development for the Stewiacke Business Park. In 2005, they commissioned a study to facilitate the marketing of Town-owned lands near Exit 11 on Highway 102. With land recently transferred from Municipal ownership, the 80 acres of prime highway frontage is located at the Stewiacke exit of Highway 102 (CoRDA, n.d.). With its location on the Halifax-Moncton Growth Corridor, proximity to Truro, proximity to the rapidly developing Municipality of East Hants, and exposure on a heavily travelled route through central Nova Scotia, Exit 11 could be an advantageous location to justify building new business infrastructure in the area (EDM 2005).

5.7.5 Protected Areas

Nova Scotia has set a goal to protect 12% of the land in Nova Scotia by 2015 and selected the candidate lands, mainly Crown lands, for consideration under the program (NSE 2011). As shown on Figure 2.2 in Section 2.0, the majority of Crown land within the Study Corridor (labeled on the figure as Southern Corridor (Preferred)) falls under the 12% candidate lands; however these candidate lands were identified in 2011 after the Study Corridor was identified. It is also noted that the existing M&NE Halifax Lateral natural gas transmission line runs through a portion of these candidate lands.

The Study Corridor is mostly comprised of provincial Crown lands. The majority of the Crown land within the Study Corridor was land purchased in March 2010 when the province loaned $75 million to help Northern Pulp purchased 475,000 acres of land to ensure a wood supply to the Abercrombie, Pictou Co., pulp mill and to protect the land as a forestry asset (NS Government 2010). As a part of the Province's *Environmental Goals and Sustainable Prosperity Act* developed in 2007, Nova Scotia set a goal to protect 12% of the land in Nova Scotia by 2015 (NSE 2011). To reach this goal the province plans to protect Crown land, buy and protect land, and help land trusts and land owners protect private land.

As of January 1, 2011, 474,399 ha (8.6%) of the Province was legally protected, including wilderness areas, nature reserves, larger provincial parks, national parks, national wildlife areas and land trust areas (NSE 2011). An additional 188,961 ha (3.4%) is required to meet the target by 2015 (NSE 2011). As a mechanism to selecting areas to be protected, the Province applied the "4-Rs" approach to all provincial Crown land and lands owned by the participating forestry companies. This included:

- Remote areas in the mostly natural state with few human impacts;
- Representative examples of the full variety of lands in Nova Scotia;
- Rich places where plant and animal life flourish; and
- Rare places with unique or rare landscapes, plants or animals (NSE 2011).

The process of protecting 12% of the province's land by 2015 was divided into four steps (NSE 2011). The first step, completed in 2011, was the 12% land identification; where the government has identified the potential 12% lands. To provide some flexibility in decision making, more than 200,000 ha of land is included in the potential 12% land protection area. The second step, also completed in 2011, was to review the 12% lands selected in the first step to create a draft protected areas plan. The third step, planned for 2012, is to conduct public consultation to provide the public with an opportunity to ask questions and voice their opinions. The final step, planned for 2013-2015 is to complete the final protected areas plan and the required steps needed to legally protect each area.

Following the first and second steps of the process, approximately 220,000 ha have been selected as candidate lands to meet the 12% conservation goal. Of these lands, there are approximately 188,000 ha that will be selected and formally designated as Protected Lands. The majority of Crown land within the Study Corridor falls under the 12% candidate lands; however, these candidate lands were identified in 2011 after the Study Corridor was identified. The Proposed RoW traverses the candidate lands in recently deforested regions and along existing roads/trails wherever possible to reduce disturbance. It is also noted that the existing M&NE Halifax Lateral natural gas transmission line runs through a portion of these candidate lands.

Refer to Section 5.7.7 (Water Supplies) for information regarding a Protected Water Area that is intersected by the Proposed RoW.

5.7.6 Mi'kmaq Traditional Land and Resource Use

Overview

The Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO or Mi'kmaq Rights Initiative) represents the negotiations between the Mi'kmaq of Nova Scotia, the Province of Nova Scotia and the Government of Canada. Proponents are encouraged to contact the KMKNO to discuss whether a MEKS is required for their projects. There are 13 First Nation communities with Chiefs in Council in Nova Scotia. Mi'kmaq people living off-reserve are represented by the Native Council of Nova Scotia (NCNS).

There are two established Mi'kmaq reserves located within 15 km of the Study Corridor. The first community is the Indian Brook First Nation (also referred to as the Shubenacadie First Nation), located approximately 15 km southwest of the Study Corridor. It is located west of the town of Shubenacadie and the Shubenacadie River. The other community is the Millbrook First Nation, and it is located approximately 14 km from the Study Corridor. It is northeast of the Project, near the town of Truro. The Mi'kmaq people of both these communities have a history of continuous occupation in this area that spans centuries and begins hundreds of years before European contact.

Mi'kmaq Ecological Knowledge Study (MEKS)

The Proponent commissioned Membertou Geomatics Solutions (MGS) to conduct a MEKS to assess the potential impacts of the proposed Project on current uses of the area for traditional purposes by members of the Mi'kmaq community (Appendix D). This MEKS is also an update to the MEKS prepared for the 2007 Alton Gas EA. The purpose of the MEKS was to:

- determine historic and current Mi'kmaq land and resource use in the Project area;
- provide an inventory of plants of significance to the Mi'kmaq in the Project area;
- provide an analysis of potential impacts of the Project on Mi'kmaq land and resource use; and
- provide recommendations for further action or mitigation.

This information is used to assess any interactions that may occur between Project activities and Mi'kmaq traditional resource use. For the purpose of the MEKS, the "Project Site" is the proposed pipeline RoW that will run approximately 10.8 km southeast from the storage caverns. The "Study Area", as defined in the MEKS, is the area with a 5 km radius of the Project Site that includes the areas and communities of Alton, Brentwood, Forest Glen, Wittenburg, and Stewiacke East.

MEKS information was gathered by three means:

- literature and archival research;
- interviews; and

- field sampling.

For the literature and archival research, various archival documents and published works were reviewed for information regarding the past or present Mi'kmaq occupation of the study area. Reviewed documents included census records, colonial government records, and published books.

The MEKS interviews were the key source of information regarding Mi'kmaq use in the Project Site and Study Area. For the interviews, an initial list of potential Mi'kmaq interviewees was developed and those were targeted for interviews. Fifteen interviews were undertaken with individuals from the Mi'kmaq communities of Millbrook and Indian Brook in November and December 2011. All of the interviews that were completed following the procedures identified within the Mi'kmaq Ecological Knowledge Protocol (MEKP). This protocol is a document that has been established by the Assembly of Nova Scotia Mi'kmaq Chiefs, which speaks to the process, procedures and results that are expected of a MEKS. Interviewees were shown maps of the Study Area and asked various questions regarding their Mi'kmaq traditional use activities, including where they undertook those activities, when they undertook them, and what type of resource they used.

In October 2011, site visits were undertaken over three days along the Proposed RoW by MGS staff members, guided by a Mi'kmaq Ecological Knowledge holder from the Waycobah First Nation community. This provided the opportunity for further identification of traditional use activities occurring near the Project Site and Study Area.

Based on the data documentation and analysis, it was found that the Mi'kmaq have historically undertaken some traditional use activities, primarily fishing, in the Project Site (or adjacent to), and that this practice continues to occur today. It appears the majority of activity that occurs in the area is trout fishing (MGS 2012, Appendix D). These activities also involve the harvesting of plants and animals, and activities occur in varying locations throughout the Study Area and at varying times of the year. Trout was found to be the most fished species in the Study Area and other species of fish noted were bass and salmon. Deer, rabbit, partridge, porcupine, and pheasants were recorded as being hunting in multiple areas. Blueberries were the most gathered species within the Study Area (MGS 2012, Appendix D). Further details describing historic and current use of the area are outlined in the Mi'kmaq Ecological Knowledge Study (MEKS) (**Appendix D**).

5.7.7 Water Supplies

Section 106 of the Environment Act allows the Minister of Environment to designate an area surrounding a drinking water source as a Protected Water Area (PWA), provided certain requirements are met. PWAs are created at the request of a water works operator (Province of Nova Scotia 2009).

The Stewiacke Watershed was designated as a Protected Water Area (PWA) in 1973 because the St. Andrews River is the source of drinking water supplies for the Town of Stewiacke. As shown on Figure 5.5, a portion of this PWA is crossed by the Proposed RoW.

Certain activities are regulated or prohibited in PWAs in accordance with their respective PWA Regulations; however, no construction/development activities are prohibited or regulated within the Stewiacke Watershed PWA (NSE 2010).

5.8 ARCHAEOLOGICAL AND HERITAGE RESOURCES

The Study Corridor traverses a range of environments and landforms. Distinct ecological zones have different heritage site types and densities, depending on their ability to contribute to or support human land use.

In order to assess existing conditions of the Study Corridor, a Phase 1 Archaeological Impact Assessment was conducted. The assessment included historical background research to identify areas with high potential for containing archaeological resources and a pedestrian survey to examine those areas. Details are included in the Archaeological Impact Assessment report (Appendix E).

5.8.1 Background Research

Recorded Archaeological Sites

While there are no recorded archaeological sites within the Study Corridor, background research indicates the presence of five recorded pre-Contact archaeological sites within 6 km of the Study Corridor: BgCt-01, 03, 04, 05, and BhCt-01. The proximity of these sites and the location of the Study Corridor suggest that there is a high potential for Study Corridor containing intact archaeological resources.

Archaeological Potential - Historic

The background research found no archaeological concerns (historic) within the Proposed RoW and, therefore, the historic archaeological potential is considered to be low.

Archaeological Potential - First Nations

While there are a number of minor watercourses running through the Proposed RoW all are considered as having low archaeological potential, mainly based on the fact that they are too narrow and shallow to have been navigable. The one major watercourse running through the RoW is the Stewiacke River, which contains a number of recorded archaeological sites, and both banks of this river are considered as having high archaeological potential.

5.8.2 Archaeological Fieldwork

Pedestrian Survey

A pedestrian survey was conducted in July 2008 and May 2011**.** Details of the survey are provided in Appendix E.

The survey included the south bank of the Stewiacke, which was a very steep grade down to the river, over undulating, moss-covered ground. It does level off to a certain degree about 30 to 40 m from the river, but would not seem to be desirable for habitat given its low nature.

The north bank of the Stewiacke River, which, at the centerline of the Proposed RoW was approximately 25 to 30 m wide with a steady flow from east to west, was evaluated. The bank on this side was level and flat, although it is a 10 m-wide strip with a wet area to the north. Approximately 10 m north of the wet area, the land rises sharply up to a large hill. The riverbank had been eroded by the spring high water and the banks were examined to see if there were artifacts present. Nothing was found. The strip of ground immediately adjacent to the river was considered to have moderate to high potential and it was determined that is should be shovel tested.

Shovel Testing

The testing area (Proposed RoW) was on the north bank of the Stewiacke River, an area that had been flagged as having archaeological potential during the pedestrian survey. During that same survey the south bank was determined to have low potential for containing archaeological resources because it had a slope that exceeded 30°.

The testing area consisted of an 8 m wide, flat, strip of river bank that was actively eroding, a strip of relatively high ground north of the river bank, a 20 m wide wet area, and a long upslope to the top of a large hill. It was determined that the narrow strip of dry ground north of the river was of low to moderate potential and would warrant some limited shovel testing, which could help to clarify its potential.

A total of seven tests were excavated along the test line. All tests were dug by hand and the soils were screened through a 6 mm mesh. No cultural material was recovered from any of the tests. The results of the shovel testing at the proposed RoW suggests that this area would have a low potential for containing archaeological resources. There seem to be much better places for the Mi’kmaq to have settled, particularly the flatter area downstream and the confluence of the Stewiacke and Shubenacadie Rivers, which has the highest archaeological potential in the area. The Project also proposes to HDD under the Stewiacke River, which would reduce any negative impacts along the river banks.