6.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

6.1 GROUNDWATER RESOURCES

6.1.1 VEC Identification

Groundwater is an integral component of the hydrologic cycle that originates from the infiltration of precipitation or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures and other void spaces which have developed in consolidated materials. Within the sub-surface, the upper surface of the saturated zone is called the water table. Where the water table intersects the ground surface, interaction between groundwater and surface water can occur. In general, groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where it discharges from the sub-surface to springs, streams, and lakes.

An aquifer is a geological formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. The yield of dug or drilled water wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers into which the wells are constructed. Within an aquifer, the natural groundwater quality is directly influenced by the geochemical composition of the sub-surface materials through which the water passes, and the time the water resides within those materials. Aquifers may vary in capacity from only a few litres per minute (Lpm), suitable for individual family use, to many thousands of Lpm, suitable for municipal or major industrial uses. In many areas of rural Nova Scotia, even the poorly permeable rocks and soils are the only water supply.

Groundwater resources are a VEC since these resources provide potable water supply to approximately half of the total population of Nova Scotia, and almost all the population in rural areas. The key environmental issues with respect to groundwater resources include:

- loss of yield to aquifers, wells, springs, or surface water resources; and
- adverse changes in water quality in aquifers, wells, and interrelated surface water resources (see Section 6.2, Fish and Fish Habitat).

6.1.2 Boundaries

Assessment boundaries for protection of groundwater resources are based on a combination of aquifer hydraulic properties and distance to groundwater wells that may be affected by Project activities.

Spatial boundaries for the assessment of groundwater resources are based on a combination of the locations of the known aquifers relative to the Project, aquifer hydraulic properties, expected

groundwater flow directions, and the distance between the Project and wells that may be affected by Project activities. For example, the area of influence or capture area of a typical low yield domestic water well is generally less than about 100 m, and rarely exceeds a few hundred meters, occurring generally in a direction hydraulically up-gradient of the well. For high-capacity industrial or municipal wells, the capture area could extend several kilometres depending on extraction rates. Since no major municipal or industrial supply wells are known to be present within 5 km down-gradient of the Study Corridor and/or Proposed RoW, boundaries for this assessment are limited to protection of domestic water wells only.

Project boundaries with regard to potential groundwater interactions depend on the type of work being done. Most construction effects, such as dewatering and vibration, would be of temporary concern to domestic wells located within about 50 m of the pipeline.

Although blasting is not anticipated, the effect of blasting is considered for wells within 500 m on both sides of the Proposed RoW. This zone is based on previous investigations of well blast damage claims in hard rock terrain in Nova Scotia; to our knowledge, no specific blast damage research has been done to date on bedrock similar to the Halifax or Goldenville Formations. Studies of blasting effects on wells in softer sandstone and shale bedrock (Berger, 1980, 1983; Vogwill, 1979) suggest no measurable effects beyond 200 m.

Potential effects of accidental spills and acidic drainage (although unlikely) should be considered for wells which are identified to be within 500 m of the Proposed RoW, and hydraulically down-gradient of the Proposed RoW in areas of highly permeable media (such as sand and gravel aquifers) or mineralized bedrock.

Most physical or chemical effects on groundwater resources are likely to be temporary, and to occur during the 1-2 month construction phase, and a few days to a week in the vicinity of an individual well. Effects from accidental releases of hazardous materials or acidic drainage (although unlikely) could occur throughout the lifetime of the Project, anticipated to be a minimum of 25 years.

The following discussion of the local groundwater resources and hydrogeology in the vicinity of the Project is based on a desktop study using available mapping and databases, and does not include any water well inspection, groundwater sampling and analysis, or groundwater depth measurements. Specific well types and locations were not confirmed in the field.

6.1.3 Residual Environmental Effects Evaluation Criteria

The residual environmental effect on groundwater resources from Project interactions is considered to be **significant** if one or more of the following occurs:

- yield from an otherwise adequate well or spring water supply decreases to the point where it is inadequate for intended use;
- the quality of groundwater from an otherwise adequate well or spring water supply

deteriorates to the point where it becomes non-potable or cannot meet the *Guidelines for Canadian Drinking Water Quality* (Health Canada, 1996); and/or

- the aquifer is physically or chemically altered to the extent that interaction with local surface water results in stream flow or chemistry changes that adversely affect aquatic life or surface water supply.

The residual environmental effect on groundwater resources is considered to be **positive** if the quantity or quality of well or spring water supply is improved as a result of Project activities.

6.1.4 Potential Interactions, Issues and Concerns

Uncontrolled groundwater flow along a pipeline could interact with stream water at points where the pipeline intersects streams. Groundwater intercepted by the pipeline trench could flow along the pipe in areas where the fill/aggregate permeability is greater than the surrounding aquifer materials. In many cases, this groundwater will be cooler, likely more alkaline, and of higher pH than surface water, and could therefore be a benefit to the ecosystem. Similarly, a pipeline that transects wetlands may discharge groundwater with elevated organic acids, with resultant deposition of iron and manganese flocs in the surface water (Section 6.2).

With respect to groundwater quantity, the main concerns related to pipeline development are:

- loss of well yield or lowered water level during excavation, *e.g.*, interruption of groundwater flow, interruption of recharge to well, and dewatering drawdown of water table (construction); and

- possible damage to or loss of wells during blasting operations (construction).

With respect to groundwater quality, the main issues related to pipeline development are:

- chemistry changes in down-gradient aquifers or wells due to uncontrolled acidic drainage (all phases); and

- accidental releases of hazardous materials (all phases).

Water quantity concerns are mainly related to construction, and are expected to be temporary and mitigable to an acceptable level.

6.1.5 Analysis, Mitigation and Residual Environmental Effects Prediction

6.1.5.1 Construction

The main potential adverse effects on groundwater resources during the construction phase include changes in groundwater quantity or quality in nearby or down-gradient water wells. Physical changes in groundwater flow may be caused by trench excavation, dewatering, or

blasting operations. Changes in aquifer or well water quality may be caused by blasting, acidic drainage, or accidental release of hazardous substances.

Trench Excavation and Dewatering

During construction, the pipeline trench will typically be excavated to average depths ranging from 1.5 to 2 m. While much of the excavation will occur in unconsolidated overburden deposits, some areas of thin overburden or exposed bedrock may require ripping or blasting of bedrock (although not anticipated).

Depth to water table in Nova Scotia averages 3 m; it is deeper in upland areas and closer to the surface in lowland areas and near stream crossings. Where the water table is encountered above the trench bottom and in significant cuts required to maintain pipeline gradient, it may be necessary to dewater the trench, which may have a temporary effect on groundwater level.

Excavation is more likely to affect the shallow (<10 m depth) groundwater flow regime in overburden and shallow bedrock, with minimal effect on deeper flow systems. Interception or diversion of horizontal groundwater flow could temporarily or permanently affect down-gradient dug or shallow drilled wells, springs, and wetlands. Excavation dewatering may possibly result in loss of yield for dug wells in the immediate vicinity of the excavation, typically 4 to 5 m deep, especially during dry periods when water levels are naturally low. This is not expected to be a problem for this Project due to lengthy distance to the closed residence.

Desktop research shows that the distance to the closest residence is approximately 320 m. The magnitude of the effect on water supply will depend on distance, location (up-gradient or down-gradient) of the excavation, hydraulic properties of the overburden deposits, depth of the excavation, and duration of excavation dewatering operations. For example, effects are unlikely to be significant at distances over 50 m from the excavation, and would be of more concern in highly permeable sand and gravel areas than in the glacial till terrain intersected by most of the route (overburden hydrogeology has not been assessed on a site-specific basis). The magnitude of water level decline in a dug well is likely to be greater up-gradient of an excavation.

Effects, if any, should be temporary, since most excavations will be shallow (1.5 m), and will be open for a few days to weeks at most, and pumping durations would be measured in hours to days on a site-specific basis during construction. No aquifer dewatering should occur during operation; however, long-term diversion of groundwater along the pipeline could occur unless the mitigative measures (*i.e.*, trench plugs) discussed below are implemented.

Shallow spring water supplies located close to and hydraulically down-gradient of the pipeline may be temporarily or permanently affected by the presence of a pipeline. (Note: this is not true if the water table is lower than the depth of the pipeline, 1.5 m in this case, and if the pipeline installation does not interfere with surface re-charge of the aquifer, which is likely to be the case particularly after a year or two of settlement) Changes in the local aquifer permeability caused by equipment compaction or use of fill materials of lower permeability than the natural

surrounding aquifer could reduce or intercept flow to some springs. The excavated material is the only expected fill material, so the permeability should not be significantly different.

Groundwater contributions to local stream waters may be affected if considerable flow interception occurs. Baseflow quantity effects are expected to be minimal. Since pipeline trenches are shallow and oriented perpendicular to most streams, deeper unaffected groundwater will still contribute to stream flow, and typical streams are supplied over a much larger area than that affected by a typical pipeline. Water quantity changes to stream waters due to trench excavation are therefore not considered to be significant.

Disposal of groundwater pumped from trenches will be controlled through standard erosion and sedimentation control practices to prevent siltation of nearby streams or overland flow towards wells. Mitigation measures will be implemented for areas within 200 m of residential water wells and near stream crossings. Procedures for disposal of pumped water and erosion control measures will be presented in the EMP that will be prepared prior to construction (see outline in Section 2.8.5).

Most effects on groundwater resources due to pipeline construction can be mitigated during planning and construction by using proven mitigation methods for control of runoff, excavation dewatering, and blasting. Most wells have been avoided due to the avoidance of residential areas during the route selection process. Mitigation should include, as required, measures to:

- identify and monitor water quantity and quality in all wells within 200 m of an excavation;
- avoid interruption of major springs used as water supplies;
- dewater excavations only where necessary;
- adjust scheduling to reduce the duration of excavation dewatering;
- use materials in trench backfill that closely approximate natural aquifer hydraulic properties;
- provide temporary potable water to affected users as required; and
- replace seriously affected wells with deeper dug wells or drilled wells.

Desktop research shows that the distance to the closest residence is approximately 320 m. After ground-truthing, any wells within 200 m of the pipeline will be located, inspected, and inventoried for type, depth, water level, and probable yield. Baseline water quality samples should be collected for these wells, and analysis performed for total coliform bacteria, pH, and selected indicator parameters, depending on site-specific concerns (*e.g.*, acidity, turbidity). A water sample should be collected, labelled, and archived for later analysis in the event of a damage claim.

Careful scheduling can reduce the probability of well yield losses in areas prone to aquifer dewatering. Dewatering of excavations should be done only when necessary for safe installation of pipe and the duration of dewatering operations reduced. Depending on safety concerns for humans and biota, one method is to allow aquifer water to stand in excavations until

immediately before pipeline installation and backfill. Appropriate safety precautions should be maintained around any open or flooded excavations. A better way is to reduce the length of time the excavation is open, by having the pipe ready and installing it as soon as possible after the trench is dug. This is how we plan to construct.

Depending on the nature of the potential groundwater disruption, composition of pipeline backfill materials should be considered. For example, it may be desirable to use permeable materials as backfill for pipeline segments completed in permeable media up-gradient of a spring, to maintain natural flow patterns towards a spring. In poorly permeable terrain, such as glacial till or bedrock, trench plugs consisting of impermeable materials may be necessary to prevent the trench from acting as an interceptor drain. The excavated material will normally be used as backfill, which will satisfy this requirement, except possibly at bedrock excavations.

In the unlikely event that interruption of residential wells or springs affects water supply, it may be necessary to provide a temporary water supply to affected users for a few days to weeks, depending on the construction schedule in each residential area. This is usually done using a portable storage tank and pumping system for the entire water supply, or a filter system or bottled supply for potable uses only.

In the unlikely event that a water supply well or spring is permanently impaired by pipeline construction, the well will be replaced as soon as practical with a drilled well of equivalent capacity and water quality. Drilled wells are preferred to replace dug wells or springs. Where drilled wells are not practical (*e.g.*, in gypsum terrain), a deeper dug well or cistern system may be appropriate.

Residual environmental effects of excavation and dewatering on groundwater resources should be temporary and of limited extent, provided that the above mitigative measures are implemented.

Blasting

Non-rippable bedrock within the typical excavation zone of about 1.5 to 2 m depth may require blasting. Deeper excavations may be required, depending on the gradient requirements of the pipeline. Alton is not anticipating any requirement for blasting.

Damage to water wells from blasting of the scale that would be carried out for the proposed pipeline is extremely unlikely. Studies have shown that relatively high levels of ground vibration have no significant or lasting effect on drilled or dug wells. The most likely noticeable effect would be a temporary increase in turbidity due to ground vibration. Well known relationships exist between blast charge weight, distance, and ground vibration. These relationships can be applied to design blasts to protect adjacent wells from damage.

All blasting areas will be identified on appropriate mapping; this may be refined through geotechnical drilling or geophysical surveys in critical areas. The fact is that most areas requiring blasting will be identified when the trenching machine hits the rock. This can only be

identified on mapping after the fact, and will not be identified on maps until after construction is complete. All wells within 500 m of any blasting zone should be ground truthed. Ground truthing involves field identification of groundwater users, information collection (*e.g.*, construction details, historical problems, use of treatment systems) from the owner, general site assessment of well/spring condition, and identification of any water supply problems. Associated work typically includes plotting of well location, water sample collection for subsequent analysis, and water level measurement (if readily accessible). In 6.1.2 above it was stated that blasting has no measurable effect over 200 m.

A concise blasting and blast monitoring protocol should be established and enforced in residential areas for all contractors. The route does not go through any residential areas. All blasting activities must be carried out in compliance with appropriate regulations and guidelines to reduce damage to both structures and water wells.

The energy imparted by blasting will be reduced by using proven design techniques. Explosive charges should be as small as necessary to break the rock for excavation and to maintain acceptable ground vibration levels at the nearest structures and wells. Monitoring of water wells should be incorporated into blast monitoring programs.

In the event of a damage claim, an inspection of the affected well will be conducted, including a short pumping test to determine effective well yield. A water sample should be analyzed and compared with the archived sample to identify water quality changes. If damage is proven, remediation may range from provision of suitable water storage tankage to deepening the well or replacing a severely damaged well.

Provided that the mitigation procedures are followed, significant adverse environmental effects on groundwater resources from blasting are unlikely to occur.

In summary, adverse residual environmental effects on groundwater resources during Project construction are predicted to be not significant.

6.1.5.2 Operation and Maintenance

Project interactions with groundwater resources during pipeline operation are anticipated to be minimal. Possible long-term effects, including interception of recharge to water wells, will be effectively controlled with the mitigative measures described above for the construction phase, and as described in the following discussion.

The Stewiacke-St. Andrews River watershed designation (see Figure 5.5) restricts the use of any herbicides within the catchment; thus herbicides will not be used to control vegetation along RoW portion within the watershed, nor will herbicides be used along the rest of the RoW. Mechanical means using bush-cutters will primarily be used to control vegetation growth on the RoW.

Depending on the local hydrogeology, the pipeline trench could cause permanent diversion of groundwater flow to shallow springs or dug wells. However, the shallow trench depth is unlikely to affect deep regional flow systems or most shallow flow systems. In addition to the mitigative measures discussed in Section 6.1.5.1, any springs or wells adversely affected by the pipeline development will be remediated by deepening or replacement with an appropriate drilled well.

Residual environmental effects on groundwater resources during Project operation are predicted to be not significant.

6.1.6 Follow-up and Monitoring

Pre-construction monitoring will be conducted to collect baseline groundwater data for wells potentially affected by trench excavation and dewatering, and blasting.

- All wells within 200 m of RoW where trench excavation and dewatering will occur will be located, inspected and inventoried for depth, water level and probable yield. Baseline water quality samples will be collected (*e.g.* RCAP-MS+bacteria) as appropriate.

- All wells within 500 m of blasting areas will be ground truthed. Low yield wells within 500 m of blasting zone will be identified.

6.1.7 Summary of Residual Environmental Effects Assessment

The proposed Project is expected to create few residual environmental effects on groundwater resources. Most of the Proposed RoW traverses largely unpopulated terrain, and areas where groundwater resources may be potentially affected by construction and operation are typically semi-rural to rural areas where there are few nearby residential wells. Vegetation management along the RoW will be by mechanical means and unlikely to affect groundwater resources during Project operation.

In summary, residual environmental effects of the Project on groundwater resources are predicted to be not significant.

6.2 FISH AND FISH HABITAT

6.2.1 VEC Identification

The Aquatic Environment was selected as a VEC because of the potential for Project activities to interact with the freshwater environment. The Aquatic Environment VEC will address surface water quality and fish and fish habitat as indicators of the overall VEC.

In the context of the Aquatic Environment VEC, the following definitions apply:

Fish is defined in Section 2 of the *Fisheries Act* and includes: (a) parts of fish, (b) shellfish, crustaceans, and any parts of shellfish, or crustaceans, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, and crustaceans.

Fish habitat as defined in Section 34(1) of the *Fisheries Act* includes spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes. Fish habitat will be assumed to include the physical (*e.g.*, substrate/sediment, temperature, flow velocity and volumes, riparian vegetation), chemical (*e.g.*, water quality), and biological (*e.g.*, fish, benthic macroinvertebrates, aquatic macrophytes) attributes of the aquatic environment that are required by fish to carry out life cycle processes.

Surface water quality is described as the chemical, physical (*e.g.*, temperature, clarity), and biological (*e.g.*, bacteria, algae) attributes of surface water.

Aquatic organisms and habitat are valued in Nova Scotia for their intrinsic contribution to local, regional and international biodiversity. Species-at-risk (those species that are low in abundance and threatened with extirpation and/or extinction) require special attention during the assessment process as, by their very definition, populations and their habitat are more sensitive to anthropogenic stressors. In addition, specific legislation has been developed to protect aquatic species-at-risk (*e.g., SARA*), some of which are present in the assessment area. Therefore, species-at-risk and their habitat are the focus of this assessment. A precautionary approach to assessment aimed at the protection of species-at-risk also serves to protect lesser known aquatic organisms as well as those with larger populations. Fish in the Stewiacke River watershed are also valued for economic and cultural reasons; fish populations in the Stewiacke River and watershed have long been a source of subsistence for First Nations and continue to have a high cultural and economic significance to the Mi'kmaq people of the area.

It is proposed that pipeline crossings will utilize dam and pump techniques to place the pipe under watercourses and HDD cross under the Stewiacke River, thereby reducing the interaction between Project construction and operation and freshwater resources along the pipeline route.

6.2.2 Boundaries

Interaction between fish and fish habitat and the proposed Project in terms of potential physical degradation of fish habitat is generally limited to the Study Corridor. Consideration of alteration of water chemistry extends to the watershed downstream of the Study Corridor. The ecosystem along the Study Corridor was described in Section 5.3 using field surveys, existing published literature, technical reports, consultation with scientific experts and knowledge of the Study Team. Water quality parameters were described using field data collected specifically in support of the Project.

The main effects from the Project on surface water resources involve changes in water quality, mainly from suspended solids caused by erosion and sediment transport from all areas or acidic drainage from acid risk areas. Erosion, sediment transport, and acidic drainage have the greatest potential to affect surface water resources in the immediate vicinity of stream

crossings. In these areas, effects may be felt both locally and up to several kilometres downstream; however, most effects are expected to dissipate within 1 km due to natural stream flow dispersion and proposed mitigation measures.

The spatial boundaries for assessment of potential Project interactions with surface water resources include runoff from the 20 m wide RoW along its entire length, the RoW approach slopes on either side of any stream crossing up to 60 m from the watercourse, and up to 1 km downstream of any stream crossing.

Most physical or chemical effects on surface water resources are likely to be temporary due to infrequency of accidental events and short duration of construction. The duration of surface water effects will generally be limited to the time necessary for areas disturbed during the construction phase to be stabilized by erosion control measures and re-vegetation. Effects caused by accidental release of hazardous materials, acidic drainage, or uncontrolled erosion and sedimentation could occur throughout the life of the Project.

The majority of fish species anticipated to occur within the fish bearing watercourses crossed by the Project are resident populations and therefore present year round. Migratory species may be found within the Stewiacke River and tributaries (GL-16 and GL-1) and are present at particular times of the year. For example, Atlantic Salmon and Striped Bass are anadromous, meaning these species spawn and juveniles are reared within the freshwater systems; as adults, these species migrate to the Bay of Fundy and subsequently the Atlantic Ocean. Other anadromous species known to pass through the Stewiacke River include sea lamprey, Atlantic sturgeon, striped bass, gaspereau, blueback herring, American shad and rainbow smelt. These species would be present in the Stewiacke seasonally, while migrating between spawning grounds farther upstream and marine foraging habitats. The catadromous American eel is also present in the Stewiacke and associated tributaries as juvenilles and adults.

Fish and fish habitat are protected under the federal *Fisheries Act* and the Nova Scotia *Environment Act*. Species-at-risk are protected under the federal *SARA* and the Nova Scotia *Endangered Species Act*.

Fish habitat is protected under the *Fisheries Act* and by DFO's *Policy for the Management of Fish Habitat* (DFO 1986). The *Policy for the Management of Fish Habitat* is regulated by Sections 20, 21, 22, 30, 32, 35, 36, 37, 40 and 43 of the *Fisheries Act*. The *Fisheries Act* is administered by DFO, except Section 36 (which deals with the control of deleterious substances in fish habitat) which is administered by Environment Canada in close cooperation with DFO. This policy applies to all projects and activities in or near water which could result in the Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. DFO also works in collaboration with NSE to protect fish and fish habitat. Provincial regulations applicable to fish habitat protection include the Nova Scotia *Environment Act* and the Activities Designation Regulations which require completion of an application for a Division I Water Approval for Watercourse Alterations. The approval is issued by NSE.

6.2.3 Residual Environmental Effects Evaluation Criteria

Potential significant residual adverse environmental effects on the aquatic environment may affect multiple aspects of the VEC, including fish and fish habitat, and surface water quality. The significant effects criteria for each of these are defined below.

A **significant residual adverse environmental effect** on fish and fish habitat is one that alters fish habitat physically, chemically, or biologically, in quality or extent, in such a way as to cause an adverse change in the ecological function of that habitat, such that natural recruitment would not re-establish the community to its original composition, density and extent in one generation. It is also considered a significant effect if the alteration of the habitat results in an unmitigated or non-compensated net loss of fish habitat as defined in the *Fisheries Act*. Additionally, if fish habitat is altered in such a way as to affect an adverse change (caused by avoidance and/or mortality) in the distribution or abundance of a fish species or community that is dependent upon that habitat, it is considered a significant adverse environmental effect on fish and fish habitat.

Species at Risk

A **significant residual adverse environmental effect** on all wildlife species listed in Schedule 1 of *SARA* as “Extirpated”, “Endangered” or “Threatened” or listed by NSDNR as “At Risk” is:

- One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of *SARA*, or in contravention of any of the prohibitions stated in Section 3 of the Nova Scotia *Endangered Species Act*.

Species of Conservation Concern

A **significant residual adverse environmental effect** on listed wildlife species not under the protection of *SARA* or the Nova Scotia *Endangered Species Act* (*i.e.,* listed as “Special Concern” in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*; or ranked as S1, S2, or S3 by ACCDC; and/or ranked “May Be At Risk” or “Sensitive” by NSDNR (2007c)) is:

- One that alters the aquatic habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Stewiacke/Shubenacadie watershed is substantially reduced as a result; or

- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure fish population(s) within the Stewiacke/Shubenacadie watershed is substantially reduced as a result; or

- In the case of fish species of “Special Concern” listed in Schedule 1 of *SARA*, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of *SARA*) that are in place at the time of relevant Project activities.

Secure Species

A **significant residual adverse environmental effect** on all secure fish species (including those ranked S4 or S5 by ACCDC, and/or designated as “Secure” by NSDNR) is one that alters fish habitat physically, chemically, or biologically, in quality or extent, in such a way as to cause an adverse change in the ecological function of that habitat, such that natural recruitment would not re-establish the community to its original composition, density within the assessment boundaries, defined as the Stewiacke/Shubenacadie watershed. It is also considered a significant effect if the alteration of the habitat results in an unmitigated or non-compensated net loss of fish habitat as defined in the *Fisheries Act*. Additionally, if fish habitat is altered in such a way as to affect an adverse change (caused by avoidance and/or mortality) in the distribution or abundance of a fish species or community that is dependent upon that habitat, it is considered a significant adverse environmental effect on fish and fish habitat.

A **significant residual adverse environmental effect** on surface water quality is one that causes a long-term Project-related exceedance of the CCME guidelines for the protection of aquatic life or recreation (CCME 2007).

6.2.4 Potential Interactions, Issues and Concerns

Potential interactions between the Project and fish and fish habitat relate primarily to:

- Direct mortality from sedimentation or in-stream work;
- Loss of habitat due to sedimentation or the return of drilling fluids within fish bearing watercourses;
- Effects on water quality from hydrocarbon or chemical spills; and
- Effects on water quality from acidic drainage.

Since surface water supplies are sensitive to environmental effects resulting from development activities, any major development in a watershed can pose a potential water quality hazard. Pipeline installation across watercourses will be achieved via a dry crossing or trenchless crossing. Dry watercourse crossings, specifically dam and pump crossings, are achieved by removing any fish populations from the section of watercourse where the in-stream work is to occur. Once fish populations are removed the flow of water within the watercourse is isolated from the pipeline trench by damming the flow upstream of the crossing and diverting the water around the construction area using water pumps. A number of techniques are available to isolate the water flow (*e.g.*, cofferdams, AquaDams®). Water flow downstream is maintained using appropriately sized pumps and hoses to accommodate the anticipated flow over the

duration of the crossing. Once the watercourse flow is successfully diverted, construction of the crossing can be conducted in a dry watercourse bed. It should be noted that if a stream channel is dry at the time of the crossing, the crossing will be conducted as an open trench crossing (*i.e.*, no dam and pump set up). The materials to conduct a dam and pump crossing will be on site or readily available as a contingency.

The proposed dry crossing method reduces the potential for environmental effects on fish and fish habitat downstream of the crossing. Given the limited footprint of a dry crossing, there is minimal disturbance to the watercourse channel and to fish and fish habitat. With implementation of appropriate mitigation, including construction sequencing and fish salvage, dry crossings generally do not constitute harmful alteration, disruption or destruction (HADD) of fish habitat under the *Fisheries Act*. The appropriate mitigation measures associated with dry crossing methods of watercourses are described within Section 6.2.5.

It is proposed that trenchless crossings will be completed using HDD, which is a method that is generally considered applicable where large watercourses must be crossed and/or in-stream activity is not preferred for reasons such as the complex nature of the channel or presence of sensitive habitat features, such as observed within the Stewiacke River. HDD involves drilling a hole underneath a watercourse of sufficient size for the pipe, through the use of a drill that can be steered as it progresses. The drill rig is set up above the approach slope on one side of the watercourse and a small diameter pilot hole is drilled under the watercourse and out at the target point on the other side of the watercourse, above the approach slope. Consecutively larger reams are then used to enlarge the hole until the pipe can be pulled through. HDDs generally originate and terminate more than 10 m from the edges of the watercourse due to the approach angles needed to attain the required depth of cover over the pipe beneath the streambed. Set-up of the HDD rig and support structures will occur outside the riparian buffer zone with vegetation maintained.

With the HDD method of pipeline installation there is little or no direct disturbance to the watercourse channel. Environmental issues associated with potential leaking of drilling fluids are considered in Section 7.2 (Assessment of Malfunctions and Accidental Events). Given the typical quick completion of a dam and pump crossing versus an HDD crossing (*i.e.*, one to two days for dam and pump versus several days or weeks for an HDD), it is proposed and anticipated that Alton and its Contractor will use the dam and pump crossing method for all of the crossings except the Stewiacke River.

Potential adverse effects on surface water resources during construction may include downstream sedimentation due to soil erosion from the RoW during clearing, grubbing, trenching, stream and wetland crossings or dewatering of the trench. Alternatively water quality may be diminished from the release of drill fluids from the drill rig, release of drill mud from fractures in the earth’s surface or collapse of the borehole all in association with stream crossings, and downstream changes in water quality due to acidic drainage or accidental releases.

6.2.5 Analysis, Mitigation and Residual Environmental Effects Prediction

6.2.5.1 Construction

During construction, the RoW will be cleared and grubbed, followed by stripping and stockpiling of useable topsoil and subsoil, RoW grading, trench excavation, pipeline installation and backfill, and final cleanup and reclamation, including revegetation. During these construction activities, there will be potential for erosion and transportation of sediment into nearby watercourses. The severity of erosion and sediment transport depends on several factors, including precipitation, soil type, slope, vegetation cover, distance to a watercourse, and season. In general, fine-grained clay-silt materials situated on steep slopes are of greatest concern.

To reduce the potential for erosion, vegetation will remain within the 30 m buffer alongside fish-bearing stream crossings during clearing and grubbing and will be removed by hand just prior to the watercourse crossing to eliminate the potential for sedimentation from erosion. Due to the decreased activities required with the riparian zone during HDD operations, riparian vegetation adjacent to stream crossings will be maintained. All stockpiled material (topsoil and grade spoil (subsoil)) will be stored at least 30 m from watercourses and protected from erosion in all cases.

After clearing and grubbing has been completed, runoff and erosion may increase along the pipeline RoW slopes unless careful erosion control measures are applied. Erosion controls will be developed, once engineering has been finalized, and prescribed within the EMP for each watercourse crossing. In general, Alton will use the methods described within Sections 5.2 of the 3rd Edition of the *Pipeline Associated Watercourse Crossings* (CAPP 2005) guidance document endorsed by DFO.

These methods to reduce erosion and sediment transport during pipeline construction will include:

- the control of surface runoff;
- specific procedures for storage and handling of excavated materials;
- provision of temporary erosion control measures after initial clearing is completed;
- avoidance of introduction of deleterious materials (mineral and organic) into streams or wetlands;
- isolation and stabilization of topsoil/subsoil storage piles from watercourses with drainage barriers, plastic sheeting, seeding, or other measures; and
- timely revegetation/stabilization of area after construction.

Application of water quality protection measures during watercourse crossings (discussed below) will be enforced within the Stewiacke River proposed HDD crossing (GL-16) to protect

the *SARA* listed species and the headwaters of the St. Andrew's River (GL-14, GL-15) to protect the Town of Stewiacke's water supply.

The potential effects of erosion and sedimentation are considered to be temporary, since all areas disturbed by pipeline construction will be stabilized with appropriate erosion and sedimentation control and reclamation measures both during and after construction.

Dewatering will occasionally be necessary for flooded trenches or trenches with considerable groundwater inflow. Uncontrolled discharge to watercourses from dewatering operations may degrade water quality by sedimentation, in a manner similar to sedimentation of soils eroded from the RoW and deposited into watercourses.

The following mitigative measures should be implemented as appropriate for control of excavation dewatering discharges:

- reduce dewatering volumes by diverting surface runoff away from excavations;
- dewater excavations only as necessary for pipeline installation; and
- discharge all pumped water a minimum of 30 m from stream and ensure sufficient filtration prior to re-entry to a watercourse.

Stream Crossings

The greatest potential for adverse effects on watercourses or wetlands is associated with the construction at stream crossings. Approximately eight stream crossings are planned along the approximately 10.8 km Proposed RoW. Seven of eight are anticipated to be dry crossings (dam and pump technique with pipeline construction undertaken in an area isolated from stream flow), which will reduce the potential effects. The remaining crossing (Stewiacke River Crossing GL-16) is anticipated to be a trenchless crossing (*i.e.*, HDD) which will greatly reduce potential effects at that large watercourse. Careful attention to sediment and erosion control, hazardous materials handling and working in the dry by all personnel will mitigate the effects of these crossings.

Approximately half of the fish species anticipated within the Project Area are anadromous or sea-run, adults of these species reside in saltwater and migrate to freshwater to spawn. These anadromous species constitute the majority of the sportfish in the assessment area. There are two general spawning periods of these species, fall and spring. Salmonids - Atlantic salmon and brook trout - spawn in the fall with the eggs incubating in the gravel substrate throughout winter and emerging in April to June the following year. Other anadromous species such as alewife and American shad spawn in the spring. The incubation period for these spring spawners is considerably shorter based on the warmer water temperatures in early spring as compared to winter. By July of a typical year the majority of the anadromous species have completed spawning, the adults have returned to saltwater and the juvenile fish are mobile and able of escaping threats. Of the remaining 11 species of freshwater or diadromous fish, six species

would be spawning between in the months of July and August when Project activities are expected to occur. These summer spawners present in the Study Corridor are associated with brackish waters, slow moving currents and/or lake environments and there for not anticipated to be significantly affected by the majority of smaller watercourse crossings, one exception may occur in the Stewiacke River where spawning activity and egg incubation of brown bullhead, cyprinids, stickleback, smallmouth bass and mummichog may be affected by Project activities. The proposed HDD technique of crossing the Stewiacke and BMPs including sediment control measures will greatly reduce the potential of Project interactions with the fish community.

The Stewiacke River proposed HDD crossing will be further described within the Project-specific EMP. For the EA, a generic diagram of the HDD crossing technique is provided for reference (Figure 2.3 in Section 2.0). Environmental issues associated with potential leaking of drilling fluids are considered in Section 7.2 (Assessment of Malfunctions and Accidental Events). The remaining watercourses are proposed to be crossed utilizing a dry crossing technique as illustrated in Figure 2.4 in Section 2.0.

While most excavations required for stream crossings will be temporary and localized, some potential exists for adverse effects on surface water resources downstream of the activity. The corridor crosses only one known watershed that is protected under provincial legislation as a designated water supply watershed: the headwaters of the St. Andrews River supplying the Town of Stewiacke. The water supply intake is located 1.5 km south of Stewiacke and 7 km downstream of the two stream crossings in this watershed (GL-14 and GL-15). Adherence to water quality impact abatement measures should be followed here, as in all sections of the RoW. Potential effects on surface water intakes along the Stewiacke River are expected to be minimal due to limited work within the riparian zone and the distance between construction activities and the intakes, which promotes attenuation by dilution and dispersion.

Additional mitigative strategies will be provided in the EMP. Based on BMPs and regulatory requirements, the following mitigation measures will be used to control possible surface water effects during stream crossings. Alton will:

- use isolated stream crossing techniques (dry crossing) where watercourse crossings are not proposed to be HDD;
- maintain levels of clean flow around water crossing during installation at dry crossings;
- employ erosion/sedimentation abatement measures as described in the EMP;
- provide contingency plans for mitigation of potential erosion and stream sedimentation;
- leave a 30 m wide undisturbed (vegetated buffer) zone on either side of fish-bearing streams until specific water crossing activities commence;
- prepare equipment and piping ahead of time to reduce duration of stream crossing work;

- avoid unnecessary disturbance to a stream bed or wetland;
- construct temporary bridges or use alternate pathways (logging roads, bridges) where applicable;
- erect sediment control structures along all stream banks prior to crossing work;
- maintain sediment control structures (by inspecting and repairing structural problems during and after storm events, removing accumulated sediment at regular intervals or at designated capacities, and by disposing of it at an approved site, given its unsuitability as structural fill material).
- stabilize exposed soil as soon as possible (*e.g.*, stabilize interim exposed soil with mulch, erosion control blankets or final exposed soil with fast-growing, non-invasive, native vegetation); and
- discharge all pumped water a minimum of 30 m from watercourses and ensure sufficient filtration prior to re-entry to a watercourse; and
- restore watercourse channels and banks to their original state following pipeline installation.

Due to trenchless pipe installation within the Stewiacke and in combination of the mitigative measures outlined including erosion and sedimentation control procedures, residual environmental effects on fish and fish habitat and surface waters are predicted to be low.

Acidic Drainage

As the pipeline route does not cross any areas underlain by Halifax Formation slates, acid drainage is not considered to be a risk for this pipeline route.

Summary

No significant adverse effects residual environmental effects are expected on fish or fish habitat due to construction of the Project. Due to the use of well understood water crossing and mitigation methods (*e.g.*, CAPP standards) and brief duration of crossings along the RoW, no harmful alteration, destruction, or disruption of fish habitat is predicted. A follow up monitoring program (see Section 6.2.6) will be designed and implemented.

6.2.5.2 Operation and Maintenance

During the operational phase of the Project, there will be little effect on surface water resources. Erosion is likely to be minimal after final clean-up and reclamation is completed and the RoW is stabilized. Possible long-term effects due to changes to down-gradient water quality caused by uncontrolled acidic drainage or sedimentation are expected to be minimal given implementation of the mitigation measures discussed for the construction phase.

The Stewiacke-St. Andrews River watershed designation (see Figure 5.5) restricts the use of any herbicides within the catchment; thus herbicides will not be used to control vegetation along RoW portion within the watershed, nor will herbicides be used along the rest of the RoW. Mechanical means using bush-cutters will primarily be used, especially on slopes in the vicinity of streams, wetlands, and upstream of water supply catchments. Streams and wetlands will be avoided during vegetation maintenance and pipeline inspection.

Based on the limited interaction of the pipeline with environmental components during the operational phase, the materials used during operation and mitigation, adverse residual environmental effects on surface water resources during Project operation are predicted to be not significant.

6.2.6 Follow-Up and Monitoring

All stream crossings will undergo follow-up monitoring to ensure that the aquatic habitat within the dry crossings, where initially present, has regenerated. Particular attention will be given to stream that were determined to be fish habitat to establish that no HADD has taken place, consistent with predictions. The timing, duration and level of effort for the follow-up monitoring program will be determined with consultation between Alton, DFO and NSE.

All stream crossings upstream of water supply systems (*e.g.*, St. Andrews River, two crossings) should be monitored for suspended solids, pH, and hydrocarbons during construction and clean-up of crossing site. The potential adverse effect of acidic drainage on surface waters as habitat for fish is addressed in Section 1.1.5.2. Inspection of erosion control devices should be conducted periodically after major storm events during construction until vegetation is re-established, and periodically thereafter.

6.2.7 Summary of Residual Environmental Effects Assessment

Project construction has the greatest potential for adverse residual effects on fish habitat and surface water resources due to erosion from unstable surfaces and sedimentation in watercourses. However, the proposed mitigative procedures, including standard water crossing methods, will reduce or eliminate the potential for long-term residual effects both during and after construction. No harmful alteration, destruction or disruption of fish habitat is predicted. Residual effects are therefore expected to be not significant.

During pipeline operation, residual environmental effects are predicted to be not significant, provided recommended mitigative measures are applied during construction and maintenance. Avoidance of herbicide application will be required in the St. Andrews Watershed.

6.3 RARE VASCULAR PLANTS

6.3.1 VEC Identification

Rare vascular plants and their habitats was selected as a VEC because uncommon and sensitive plant species are elements of indigenous biodiversity and are often indicative of rare habitats that harbour unique assemblages of plants and animals. Preservation of rare plant species often ensures that rare habitats and their unique assemblages of species are preserved.

6.3.2 Boundaries

The spatial boundary for the Project includes the Study Corridor, where Project activities can most directly interact with rare plants and their habitats (see Figures 5.3A and 5.3B). The environmental effects of the loss of habitat and biodiversity are assessed within the context of the regional biogeoclimatic zone (Central Lowlands Ecodistrict) within which the Study Corridor is found. With respect to Species at Risk and Species of Conservation Concern (defined in Section 4.3), population effects are considered on a larger scale outside the Study Corridor and regional biogeoclimatic zone, depending on the particular species.

The temporal boundaries for the assessment of the potential environmental effects of the Project on Rare Vascular Plants include the duration of Project construction, operation and decommissioning of the Project which is expected to last for a minimum of 25 years.

Information used in support of the assessment of Rare Vascular Plants, was obtained from aerial photography, ACCDC, NSDNR, COSEWIC, and other information from stakeholders and government departments with applicable expertise. Field data was gathered in spring and summer of 2007 and 2008. Supplementary data was collected during the fall of 2011.

6.3.3 Residual Environmental Effects Evaluation Criteria

There are both federal (*SARA*) and provincial (Nova Scotia *Endangered Species Act*) legislation for the protection of Species at Risk and Species of Conservation Concern, and there are different levels of protection afforded a species within these acts pending the species rarity ranking. As a result, multiple significance criteria are required to accommodate the different levels of protection afforded by these various acts, agencies and listings. Definitions of rarity ranks referred to in the significance criteria are summarized in Appendix B.

Species at Risk

A **significant residual adverse environmental effect** on all vascular plant species listed in Schedule 1 of *SARA* as “Extirpated”, “Endangered” or “Threatened” or listed by NSDNR as “At Risk” is:

- One that results in a non-permitted contravention of any of the prohibitions stated in

Sections 32-36 of SARA, or in contravention of any of the prohibitions stated in Section 3 of the Nova Scotia *Endangered Species Act*.

Species of Conservation Concern

A **significant residual adverse environmental effect** on listed vascular plant species not under the protection of *SARA* or the Nova Scotia *Endangered Species Act* (*i.e.,* listed as "Special Concern" in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*; or ranked as S1, S2, or S3 by ACCDC; and/or ranked "May Be At Risk" or "Sensitive" by NSDNR (2007c)) is:

- One that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Central Lowlands Ecodistrict is substantially reduced as a result; or

- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure wildlife population(s) within the Central Lowlands Ecodistrict is substantially reduced as a result; or

- In the case of vascular plant species of "Special Concern" listed in Schedule 1 of SARA, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of SARA) that are in place at the time of relevant Project activities.

Secure Species

A **significant residual adverse environmental effect** on all secure vascular plant species (including those ranked S4 or S5 by ACCDC, and/or designated as "Secure" by NSDNR) is:

- One that affects vascular plants (*e.g.,* direct mortality, change in migratory patterns, habitat avoidance) or vascular plant habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Central Lowlands Ecodistrict, and natural recruitment may not re-establish the population(s) to its original level.

6.3.4 Potential Interactions, Issues and Concerns

Clearing and grubbing would be the activities most likely to adversely affect plant species of conservation interest during the construction phase of the Project. Sedimentation of wetlands or rivers could alter soil conditions or smother, wetland or aquatic habitats that support plant species of conservation interest.

During the operational phase of the Project, the maintenance of the RoW throughout the life of the Project will inhibit the natural succession of plant communities on the RoW. Woody vegetation will be permitted to grow on the RoW but will not be allowed to become more than a few meters tall. This may impede the re-establishment of plant species of conservation interest characteristic of mature forest but may be beneficial to species that live in disturbed habitats. Plant species of conservation interest present on the RoW during the operational phase may be exposed to light physical disturbance during mechanical vegetation management. Herbicides will not be used on the RoW for vegetation management.

6.3.5 Analysis, Mitigation and Residual Environmental Effects Prediction

6.3.5.1 Construction

Clearing and grubbing for site preparation will remove vegetation and can change the quality of the habitat along the edge of the proposed pipeline RoW and other Project facilities. Vegetation and habitat within the Project footprint will be altered over the life of the Project, though regrowth of low growing species will be allowed within the Proposed RoW. Forest clearing will alter the habitat along the edge of the Project footprint, allowing shade intolerant species to colonize areas that were previously shaded understory, potentially reducing the suitability of the habitat for slow growing shade tolerant species.

The most important mitigation for effects on Rare Vascular Plants is avoidance. For the proposed Project, avoidance was exercised during the routing of the preferred pipeline RoW; in particular through modifications from the original 2008 RoW alignment to the current Proposed RoW (see Figure 5.4).

Eleven of the eighteen plant species of conservation interest identified during the field surveys could be expected to be directly affected by site preparation activities along the 2008 RoW alignment. These include Nova Scotia agalinis (*Agalinis neoscotica*), lesser brown sedge (*Carex adusta*), Houghton's sedge (*Carex houghtoniana*), Bicknell's Crane's-bill (*Geranium bicknellii*), Clammy hedge-hyssop (*Gratiola neglecta*), Yellow-seeded false pimpernel (*Lindernia dubia*), northern clubmoss (*Lycopodium complanatum*), Canada rice grass (*Piptatherum canadense*), large purple-fringed orchid (*Platanthera grandiflora*), Hooker's orchid (*Platanthera hookeri*), and yellow nodding ladies'-tresses (*Spiranthes ochroleuca*). The other seven plant species of conservation interest were not encountered in or in close proximity to the Study Corridor.

Nova Scotia agalinis is a small herb that is endemic to Nova Scotia. Although not found elsewhere, it is fairly common within the province where its population is considered "Secure" by NSDNR and is assigned a ranking of "S3" by the ACCDC. Typically associated with moist, especially sandy soil (Gleason and Cronquist 1991), it was found at one location within the Study Corridor and was associated with Wetland 11. The 2008 RoW passed through this wetland potentially adversely affecting this species either through direct physical disturbance or indirectly through alteration of wetland hydrology. The original pipeline route (2008 RoW

alignment) was shifted approximately 70 m to the northeast of this wetland; thereby, avoiding this species and its habitat.

Lesser brown sedge is a tall graminoid associated with acidic soils of dry open woods, clearings and rocky areas (Zinck 1998). Its population is considered “Sensitive” by NSDNR and is ranked as “S2S3” by the ACCDC. This species was encountered at two locations during field surveys and was growing in recent clear cuts. It was observed to be particularly abundant in a section of clear cut immediately west of Wetland 6 and was also encountered approximately 200 m north of the Stewiacke River. Lesser brown sedge is likely to be found in other clear cuts within the Study Corridor. The 2008 RoW alignment would have passed through the clear-cut near Wetland 6 that contains the larger of the two known population of this species in the Study Corridor. Clearing and grubbing will adversely affect this species although following construction, the RoW would provide suitable habitat for this species. Any adverse effects on lesser brown sedge will be eliminated by shifting the RoW to the west so that it runs along an existing woods road as currently proposed *(i.e.,* 2011 alignment).

Houghton's sedge is considered “Sensitive” by NSDNR and is ranked as “S2?” by the ACCDC, indicating that although it is considered rare within the province, there is uncertainty regarding is distribution and/or abundance. This species is associated with sandy soils and roadside banks and is known to be scattered throughout the province from Queens to Colchester counties (Zinck 1998). Houghton's sedge was found to be particularly abundant within clear cuts in the north-central portion of the Study Corridor (with some records indicating patches of up to 200 plants) but was also recorded in similar habitat elsewhere. The 2008 proposed pipeline RoW would have ran through or ran close to 18 out of 43 patches of Houghton’s sedge known to be present in the Study Corridor. This species appears to be widespread and abundant in clear-cuts in the Study Corridor. It was also found along a woods road near Wetland 6 suggesting that it would probably readily colonize the pipeline RoW following construction. The pipeline route for the 2008 RoW was shifted to the west to avoid Wetlands 4, 6 and 19 (Figure 5.3). This will have the added benefit of reducing the number of known Houghton’s sedge sites potentially affected by pipeline construction from 18 to 11. Given, the wide distribution and relatively high abundance of this species in the Study Corridor wetland as well as its preference for disturbed habitats, the loss of 11 patches of Houghton’s sedge is not expected to have any substantial effect on the local or regional population of this species.

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). It was encountered within clear cuts during field surveys, and was found to be particularly abundant towards the center of the Study Corridor. This species was also recorded within the relatively dry draw-down of a beaver flood at Wetland 12. The original 2008 RoW passes through or very near to 11 out of 14 known Bicknell's crane's-bill patches present in the Study Corridor. The pipeline route for the 2008 RoW was shifted at several locations to avoid Wetlands 6 and 11 (Figure 5.3). This will have the added benefit of reducing the number of known Bicknell's crane's-bill sites potentially affected by pipeline construction from 11 to 1. This species is widely

distributed and fairly abundant in the Study Corridor and also prefers early successional habitats such as would be found on the RoW following construction. The loss of one patch is not expected to have any substantial effect on local or regional populations of this species.

Clammy hedge-hyssop is considered “Sensitive” by NSDNR and is ranked as “S1S2” by the ACCDC. Within Nova Scotia, this species is associated with wet or muddy habitats and has been previously recorded in the vicinity of the Project (Zinck 1998). Clammy hedge-hyssop was observed to be abundant in and around puddles of a woods road located towards the northern end of the Study Corridor (Figure 5.4). In this area, approximately 300 plants were found to be distributed throughout a section of the woods road that was less than 100 m in length. This population is located within the original 2008 proposed pipeline RoW. Although this species prefers growing on disturbed habitats, intense disturbance such as grubbing of the pipeline RoW could potentially eliminate this population. To avoid this possibility, the 2008 RoW was shifted approximately 150 m west of this population. Additional mitigation will include the flagging of areas around the population and signage to prevent construction vehicles from driving up the road that the population is situated on, thereby, reducing the potential for accidental disturbance of the population. These mitigative measures should eliminate any adverse interaction between clammy hedge-hyssop and Project activities.

Yellow nodding ladies'-tresses is considered sensitive by NSDNR and is assigned a ranking of “S2S3” by the ACCDC indicating that it is rare to uncommon throughout its range in the province. Within Nova Scotia, yellow nodding ladies'-tresses are typically associated with the dry sand barrens in southwestern counties but are also found in other habitats such as roadsides and fields, as well as along rivers (Zinck 1998). Yellow nodding ladies'-tresses was identified to be rather common along a woods road at the northern end of the Study Corridor (the majority of which were in close proximity to the population of clammy hedge-hyssop noted previously). A single plant was found along the edge of a woods road approximately 650 m south of this population. A third population was found outside of the Study Corridor near the southern end of the corridor (Figure 5.3). This population was also found on a woods road. The original 2008 proposed RoW would have passed through both populations at the northern end of the Study Corridor. Shifting of the RoW to the west (as currently proposed) to protect the clammy hedge-hyssop population will also protect the yellow nodding ladies'-tresses population found at this location as will the other proposed mitigation measures including signage and flagging of areas around the population. The loss of one yellow nodding ladies'-tresses plant to pipeline construction is not expected to have a substantial effect on local or regional populations of this species. Yellow nodding ladies'-tresses show a preference for highly disturbed woods roads so it is likely that this species will establish on the Proposed RoW.

Yellow-seeded false pimpernel is an annual herb associated with wet areas such as the muddy edges of streams, drained millponds and gravel pits (Zinck 1998). The population of this species is considered “Secure” by NSDNR and has been assigned a ranking of “S3S4” by the ACCDC indicating that its population is considered uncommon to fairly common within Nova Scotia. Yellow-seeded false pimpernel was encountered along a woods road at the northern end of the Study Corridor (in close proximity to the population of clammy hedge-hyssop previously noted).

The original 2008 proposed RoW would have passed through this population probably resulting in its loss. The mitigation measures developed to protect the clammy hedge-hyssop population at this location (shifting of the RoW, symbolic fencing and signage) will also protect this species.

Shifting of the northern end of the original 2008 pipeline RoW to the west (Figure 5.3) will benefit clammy hedge-hyssop, yellow nodding ladies'-tresses and yellow-seeded false pimpernel. However, the current Proposed RoW will have an adverse effect on a population of blue vervain (*Verbena hastata*) found along the edge of the Stevens Road. Blue vervain is a tall herbaceous plant found on river terraces and in rich, mucky soils of the province. This species is considered “Sensitive” by NSDNR and is ranked as “S3” by the ACCDC. A patch of approximately 20 plants was observed in close proximity to the stream draining Wetland 1 along the edge of the Stevens Road (Figure 5.3). Another three plants were found close by off the northern side of a road junction. This second population can be expected to be affected by clearing and grubbing of the current Proposed RoW. There is a high likelihood that the larger population would also be affected by pipeline construction activities. The Stevens Road will be used as an access route to bring supplies and personnel to the pipeline RoW and the proposed HDD work site. The heavy vehicle traffic and required road improvements would likely result in the loss of most if not all of these plants. In order maintain this population, the existing population will be removed from the edge of the woods road and replaced once construction activities have ceased in that area. Techniques for culturing blue vervain are well developed so the probability of successful removal, storage and re-introduction of this species is expected to be high.

Canada rice grass is considered “Sensitive” by NSDNR and is ranked “S2” by the ACCDC indicating that it is rare throughout its range in the province. This species is known to be scattered throughout several parts of the province where it is associated with dry, sandy soils (Zinck 1998). During field surveys, Canada rice grass was encountered towards the center of the Study Corridor where it was found within a regenerating clear cut and in low open coniferous forest. The population situated in the clear-cut near the Cloverdale Road is located outside of the original 2008 RoW but in close proximity to it. To reduce any adverse effects of construction on this species, the 2008 RoW was shifted an additional 20 m to the south.

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 2008 proposed RoW passed through Wetlands 13, 16 and 18 and there is potential for large purple fringed orchids present in these wetlands to be adversely affected by either direct physical disturbance or indirectly through alteration of wetland hydrology. The 2008 pipeline route was shifted to avoid Wetlands 13 and 18 thereby avoiding adverse effects on large purple fringed orchids at these locations. At Wetland 16, large purple orchid was found approximately 30 m east of the point where the RoW crosses the wetland. As such, no physical disturbance of this population is anticipated; however, there is potential for adverse effects associated with possible alteration of wetland hydrology. Care will be taken to ensure that

trenching and burying of the pipeline do not alter the hydrology or trophic status of the wetland. Mitigation measures that will be used include:

- use of geotextile cloth or corduroy road to reduce disturbance to wetland substrates;
- retention of existing local drainage patterns;
- stabilization and/or revegetation of disturbed areas immediately following construction;
- isolation of stockpiled soil from adjacent water bodies; and
- direction of surface runoff as overland flow through shallow vegetated channels or into detention/sedimentation basins equipped with debris traps and baffle arrangements.

Hooker's orchid is scattered throughout many parts of the province where it prefers open, dry conditions and is typically found in mixed woods, frequently under conifers (Zinck 1998). It is considered “Secure” by NSDNR and ranked “S3” by the ACCDC. One Hooker’s orchid was encountered in a mature mixedwood forest towards the southern end of the Study Corridor (Figure 5.3). The 2008 pipeline RoW passed through the area where this orchid is present and will likely result in the loss of this plant. Land access issues made it impossible to assess a possible RoW shift to avoid this plant. Given the status of this species as Secure in Nova Scotia, the loss of one plant is not expected to have a substantial effect on the regional population of this species.

Northern clubmoss may be found in a diversity of habitats within the province, including deciduous forests, on hillsides under brush, and within neglected fields (Zinck 1998). The population of this species is considered “Secure” by NSDNR and has been assigned a ranking of “S3S4” by the ACCDC. It was encountered in one location towards the south-central portion of the Study Corridor during field surveys. The 2008 pipeline RoW passed very close to this population and there is a high likelihood that this local population would be adversely affected by pipeline construction. The 2008 pipeline RoW was shifted approximately 230 m to the northeast of this population in order to avoid crossing Wetland 11. This will eliminate the possibility of this population being lost as a result of pipeline construction. There is some potential that the woods road that this species is found near will be used as an access route during pipeline construction. If it is used as an access route, the population will be flagged to prevent accidental disturbance by vehicles.

Secure Species

The vast majority of vascular plant species identified during the field surveys are considered here to have Secure populations within the province. Included here are those whose populations are considered by NSDNR to be “Secure”, “Exotic”, or have not been assessed, and whose ACCDC rank does not qualify them as a Species of Conservation Concern, as previously defined. Of the plants encountered during field surveys which are considered to have Secure populations, 326 have been given a ranking of “Secure” by NSDNR, 66 are considered “Exotic”,

three are “Undetermined”, and the remainder have not been assessed. Species which have been assigned an “Undetermined” status include field pussytoes (*Antennaria neglecta*) and mouse-ear chickweed (*Cerastium arvense*). Both of these plants are ranked as “SNR” by the ACCDC indicating that they are acknowledged to be present within the province, but have yet to be ranked. Field pussytoes is associated with sterile soils in stony pastures, fields, thickets, and roadsides; and was recorded at two locations during field surveys. Mouse-ear chickweed is found in fields and meadows of the province and may not be native to the province – it was recorded once during surveys. Because neither of these species was identified as being of interest during 2007-2008 surveys, they are likely to be more abundantly distributed along the proposed routes than current records indicate. Loss of these populations as a result of construction activities is not expected to have a substantial effect on local or regional populations of these species. Both field pussytoes and mouse-ear chickweed are characteristic of disturbed sites and could potentially colonize the pipeline RoW following construction.

The re-establishment of native plant species on the RoW will be enhanced by temporarily stockpiling and replacing the topsoil from the trenched area. This material would provide a source of viable seed and root systems of these species that would aid in their re-establishment. It is recommended that a variety of species of plants native to the general Project area be used in revegetation efforts. Should seed mixes for herbaceous native species for the area not be available, measures should be taken to use revegetation mixes that are not known to be invasive. Other measures to reduce the risk of introducing invasive species to be used will include: cleaning and inspecting construction equipment prior to use within the Project area (*e.g.,* use of pressure washer to clean vehicles prior to transport); and regularly inspecting equipment prior to, during and immediately following construction in areas found to support purple loosestrife (*Lythrum salicaria)* to ensure that vegetative matter is not transported from one construction area to another.

6.3.5.2 Operation and Maintenance

Vegetation management required along the Proposed RoW and other Project facilities is the operational activity that would have the greatest potential to cause adverse effects on plant species of conservation interest. Vegetation management will be conducted using mechanical means. There is potential for disturbance of plant species of conservation interest that may be present on the Proposed RoW. Blue vervain is the only species that will be purposefully maintained on the RoW; however, a number of the species present in the Study Corridor are characteristic of disturbed habitats and it is likely that at least some of these species will colonize the Proposed RoW during the operational phase of the Project. The adverse effects of vegetation management can be reduced in several ways. Brush cutting will be conducted outside of the growing season, where practical, when plants are dormant to reduce stress on herbaceous non-target species including rare species. Brush cutting will be conducted only when required to keep woody vegetation at an acceptable height for pipeline inspection and maintenance. This will reduce the frequency of disturbance events which will favor the establishment of native plant species.

Provided the mitigative measures are followed, residual adverse environmental effects on vegetation are predicted to be not significant for the operations and maintenance phase of the Project.

6.3.6 Follow-up and Monitoring

A monitoring program will be established following cessation of construction to determine if mitigation measures to re-establish blue vervain on the Proposed RoW and the Stevens Road have been successful.

6.3.7 Summary of Residual Environmental Effects Assessment

With mitigation proposed methods no significant adverse residual environmental effects on rare plants due to construction or operational activities are likely to occur.

6.4 WILDLIFE AND WILDLIFE HABITAT

6.4.1 VEC Identification

Wildlife and Wildlife Habitat was selected as a VEC because of the potential for interactions between Project activities and wildlife, in particular, wildlife that are considered as Species at Risk or Species of Conservation Concern, and their habitat. A number of wildlife species were identified in the Project area, some of which are migratory and/or species of special management concern. All phases of Project development have the potential to affect wildlife and the habitat on which they depend.

6.4.2 Boundaries

The spatial boundary for the Project includes the Study Corridor, where Project activities can most directly interact with wildlife and their habitats (see Figures 5.4A and 5.4B). The environmental effects of the loss of habitat and biodiversity are assessed within the context of the regional biogeoclimatic zone (Central Lowlands Ecodistrict) within which the Study Corridor is found. With respect to Species at Risk and Species of Conservation Concern (defined in Section 4.3 and Section 5.4), population effects are considered on a larger scale outside the Study Corridor and regional biogeoclimatic zone, depending on the particular species.

The temporal boundaries for the assessment of the potential environmental effects of the Project on Rare Vascular Plants include the duration of Project construction, operation and decommissioning of the Project which is expected to last for a minimum of 25 years.

Information used in support of the assessment of wildlife and wildlife habitat, including the potential of the area for harboring species of conservation interest, was obtained from aerial photography, ACCDC, NSDNR, COSEWIC, Maritime Breeding Bird Atlas (online resource), and other information from stakeholders and government departments with applicable expertise.

Field data was gathered in spring and summer of 2007 and 2008. Supplementary data was collected during the fall of 2011.

The temporal boundaries for the assessment of the potential environmental effects of the Project on Rare Vascular Plants include the duration of Project construction, operation and decommissioning of the Project which is expected to last a minimum of 25 years.

Migratory birds are protected federally under the *Migratory Birds Convention Act 1994* which states that “no person shall disturb, destroy or take a nest, egg, nest shelter, either duck shelter or duck box of a migratory bird” without a permit. The *Act* includes prohibition of “incidental take” of migratory birds or their nests as a result of activities such as those required for the proposed Project.

All mammal species not designated as game animals or other harvestable wildlife under the provincial *Wildlife Act and Regulations* are protected at all times of the year. Game and furbearing animals are protected outside of hunting seasons as defined by NSDNR. Harvestable mammals are managed by NSDNR.

Herpetiles which are hunted for food, such as snapping turtles and bullfrogs, are protected from hunting outside of hunting seasons as defined by NSDNR. Other herpetiles of no special status have no legislated protection unless they are found in a protected area such as a provincial park.

6.4.3 Residual Environmental Effects Evaluation Criteria

Multiple significance criteria are required to accommodate the different levels of protection afforded by these various acts, agencies and listings. Definitions of rarity ranks referred to in the significance criteria are summarized in Appendix B.

Species at Risk

A **significant residual adverse environmental effect** on all wildlife species listed in Schedule 1 of *SARA* as “Extirpated”, “Endangered” or “Threatened” or listed by NSDNR as “At Risk” is:

- One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of *SARA*, or in contravention of any of the prohibitions stated in Section 3 of the Nova Scotia *Endangered Species Act*; or

- One that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Central Lowlands Ecodistrict is substantially reduced as a result; or

- One that affects wildlife (*e.g.,* direct mortality, change in migratory patterns, habitat avoidance) or wildlife habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Central Lowlands Ecodistrict, and natural recruitment may not re-establish the population(s) to its original level.

Species of Conservation Concern

A **significant residual adverse environmental effect** on listed wildlife species not under the protection of *SARA* or the Nova Scotia *Endangered Species Act* (*i.e.,* listed as "Special Concern" in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*; or ranked as S1, S2, or S3 by ACCDC; and/or ranked "May Be At Risk" or "Sensitive" by NSDNR (2007c)) is:

- One that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Central Lowlands Ecodistrict is substantially reduced as a result; or

- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure wildlife population(s) within the Central Lowlands Ecodistrict is substantially reduced as a result; or

- In the case of wildlife species of "Special Concern" listed in Schedule 1 of *SARA*, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of *SARA*) that are in place at the time of relevant Project activities.

Secure Species

A **significant residual adverse environmental effect** on all secure wildlife species (including those ranked S4 or S5 by ACCDC, and/or designated as "Secure" by NSDNR) is:

- One that affects wildlife (*e.g.,* direct mortality, change in migratory patterns, habitat avoidance) or wildlife habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Central Lowlands Ecodistrict, and natural recruitment may not re-establish the population(s) to its original level.

6.4.4 Potential Interactions, Issues and Concerns

6.4.4.1 Construction

A number of activities (*i.e.*, clearing, grubbing, topsoil stripping, grading, trenching, drilling, pipe installation, backfilling, and watercourse crossing) associated with Project construction could interact with wildlife. Potential effects on wildlife during construction include habitat loss, fragmentation and noise and related disturbance due to the presence of humans.

Linear developments, like pipelines, have the potential to fragment natural habitats. Fragmentation is the partitioning of habitat into discrete units, where some mechanism (*e.g.*, human presence) impedes or prevents the exchange of wildlife between habitat units. Fragmented wildlife populations have a lowered effective population number. In turn, small populations are more susceptible to decline or extirpation due to natural and anthropogenic stressors and loss of fitness potential due to genetic homogeneity. Species with limited dispersal capabilities are generally most susceptible to habitat fragmentation. However, habitat fragmentation can also affect highly mobile animals such as birds. During the breeding season some species may be reluctant to cross clearings causing populations to be isolated in resultant habitat fragments. Studies of bird use of forest patches in agricultural areas by the CWS in Quebec found that bird movement between patches decreased with increasing distance between patches (CWS Undated). The CWS determined that the influence of edge environmental effects extended as far as 300 m, from the forest edge. It also observed that 97.7% of the movements between habitat patches were concentrated in gaps smaller than 200 m and some species traveled up to three times as far to avoid a gap. Physical isolation of a population combined with the deleterious environmental effects of edge may eliminate species in habitat fragments.

The Proposed RoW will contribute to local habitat fragmentation particularly during the first few years of its existence. Initially, there will be little vegetation on the RoW, which may discourage very small mammals (*e.g.*, mice and shrews) from moving from one side of the RoW to the other due to lack of cover and increased risk of predation. However, vegetation cover including tall shrub cover will be permitted to grow on the RoW providing cover that will facilitate wildlife crossing.

Approximately 12 ha (56.0 %) of the 2008 RoW passed through recent clear-cuts or alongside existing roads. In these areas, the 2008 RoW will not contribute substantially to habitat fragmentation since there is little difference in habitat structure between the RoW and the surrounding habitat (*i.e.*, roads and clear cuts). Human presence and noise during construction may temporarily discourage wildlife species, especially large mammals, from crossing the RoW; however, once the construction phase is over, the presence of humans and human activity is expected to return to baseline levels. Modification of the 2008 reduced adverse effects on various plant and animal species. Much of this was accomplished by shifting the original RoW away from forest and wetland vegetation types and onto existing roads and recent clear-cuts

(refer to Figure 6.1). The area of the current Proposed RoW located within heavily disturbed roads and clear-cuts on this new route is 14.5 ha (68.6 %).

Limited direct mortality of some small wildlife, such as rodents, shrews and herpetiles, is likely to occur during construction activities. Small animals tend to stay in close proximity to cover when exposed to high noise levels, making them vulnerable to injury and death due to heavy equipment during site clearing and grading. Large and medium sized mammals are unlikely to suffer direct mortality from clearing activities as they would flee the area in response to human presence and noise. Such avoidance behaviour by mammals could result in changes in normal movements, migrations and other life history processes. The impacts of such avoidance behaviour would be temporary, as mammals would likely return to adjacent habitats after construction is complete. However, if those habitats are already occupied by that species or a species with a similar niche, the addition of new individuals could result in greater competition for resources and increased levels of mortality as a result of that competition or increased predation.

Some wildlife, such as herpetiles, American black bear, certain bat species, and various rodents hibernate or go through prolonged periods of sleep during the winter months. An animal disturbed during periods of extended winter inactivity may die from exposure or subsequent starvation due to expenditure of energy. Therefore, wildlife species in winter sleep are sensitive to disturbance during construction activities.

Adult birds are unlikely to be killed or injured during construction activities as they would flee the area when exposed to high noise levels. Such avoidance behaviour by adult birds could result in changes in normal movements, migrations and other life history processes. The impacts of such avoidance behaviour would be temporary, as birds would likely return to adjacent habitats after construction is complete provided that this habitat is not already fully occupied by that species or a species with a similar niche. The nesting season is generally the most critical life history stage for birds, since eggs and nestlings cannot move from a source of disturbance. Eggs and nestlings located in areas to be cleared would likely be destroyed. Potential adverse effects due to noise on bird breeding may also result in abandonment of the nest or increased rates of predation and exposure of hatchlings and eggs during temporary abandonment.

6.4.4.2 Operation and Maintenance

Vegetation management along the Proposed RoW will be conducted by mechanical means and no herbicides will be used. During the operational lifespan of the Project, periodic vegetation control along the Proposed RoW may disturb wildlife due to noise and human presence. The maintenance of the RoW throughout the life of the Project will inhibit the natural succession of plant communities on the Proposed RoW. Woody vegetation will be permitted to grow on the RoW but will not be allowed to become more than a few meters tall. The cleared RoW would also increase the accessibility of wildlife habitat to the general public, increasing the likelihood of continued disturbance and hunting.

6.4.5 Analysis, Mitigation and Residual Environmental Effects Prediction

6.4.5.1 Construction

One of the most important forms of mitigation for effects on Wildlife is avoidance of habitat. For the proposed Project, avoidance was exercised during the routing of the preferred pipeline RoW; in particular through modifications from the original 2008 RoW alignment to the current Proposed RoW (see Figure 5.3).

Avifauna

Construction activities will permanently remove some bird habitat types from the cleared RoW. Vegetation on the RoW including tree and shrub species will be allowed to recover following burial of the pipeline; however, it will not be permitted to grow more than a few meters tall. Habitat for bird species that require mature and pole sized forest habitat will be lost for the duration of the Project. A total of 8.8 ha of forest habitat would be lost as a result of RoW clearing on the 2008 RoW proposed alignment. Figures 5.4A and 5.4B show the modified RoW route (*i.e.*, current Proposed RoW) that is proposed to replace the original route. This route will reduce the amount of forest habitat lost to RoW construction from 8.8 ha to 6.5 ha by routing the RoW along woods roads and clear cuts where feasible.

The environmental effects of clearing for wildlife are most severe when these activities are conducted during the period when most bird species are breeding (April 15 to August 31). Clearing at this time could result in the direct mortality of eggs and unfledged nestlings. The killing of birds or the destruction of their nests, eggs, or young is an offence under the *Migratory Birds Convention Act 1994*. Alton plans to conduct clearing during the fall/winter where feasible to avoid potential direct adverse environmental effects on most nesting birds. It is important to note that some species of bird such as White-winged Crossbills, Pine Siskins and Common Ravens nest outside of this period and could be affected by clearing. Other species such as Killdeer nest on bare ground and Dark-eyed Juncos and White-throated Sparrows nest in recent clear-cuts. These species could occupy sites that have been cleared and/or grubbed during the winter months.

Clearing activities will also result in habitat fragmentation. Forest interior birds are particularly sensitive to habitat loss since they are affected both by direct habitat loss and through the adverse effects of habitat edge. Forest interior habitat for the purpose of this report is defined as mature forest that is free of edge and is greater than 10 ha in size (D. Busby, pers. comm. 2006). The distribution of mature forest habitat in the forest interior assessment area was determined using NSDNR forest inventory mapping. The area used for the forest interior assessment included an area extending 2 km on either side of the pipeline corridor. The amount of forest interior habitat in the forest interior assessment area was determined by establishing 100 m buffers around edge producing features such as existing highways and streets, electrical transmission lines, railroads, heavily disturbed non-forested habitat, borrow pits, quarries, woods roads, recent clear-cuts and large areas of recent wind throw. Areas remaining after

buffering these features were classed as forest interior habitat if they were mature forest 10 ha or greater in size. Thirteen patches of forest interior habitat are present in the 4 km wide forest interior assessment area with a total area of 327 ha. The total area of forest interior habitat within the cleared RoW is 1.3 ha. Forest interior habitat is scattered throughout the forest interior assessment area but is most concentrated at the eastern end of the forest interior assessment area (Figure 6.1). Two of the patches of interior forest are traversed by the proposed pipeline RoW both of which are located along the eastern half of the route. The proposed rerouting of the RoW results in only one of the forest fragments being crossed by the RoW. The total amount of forest interior habitat lost as a result of construction of the Proposed RoW is 1.3 ha compared to 1.38 ha for the original pipeline RoW.

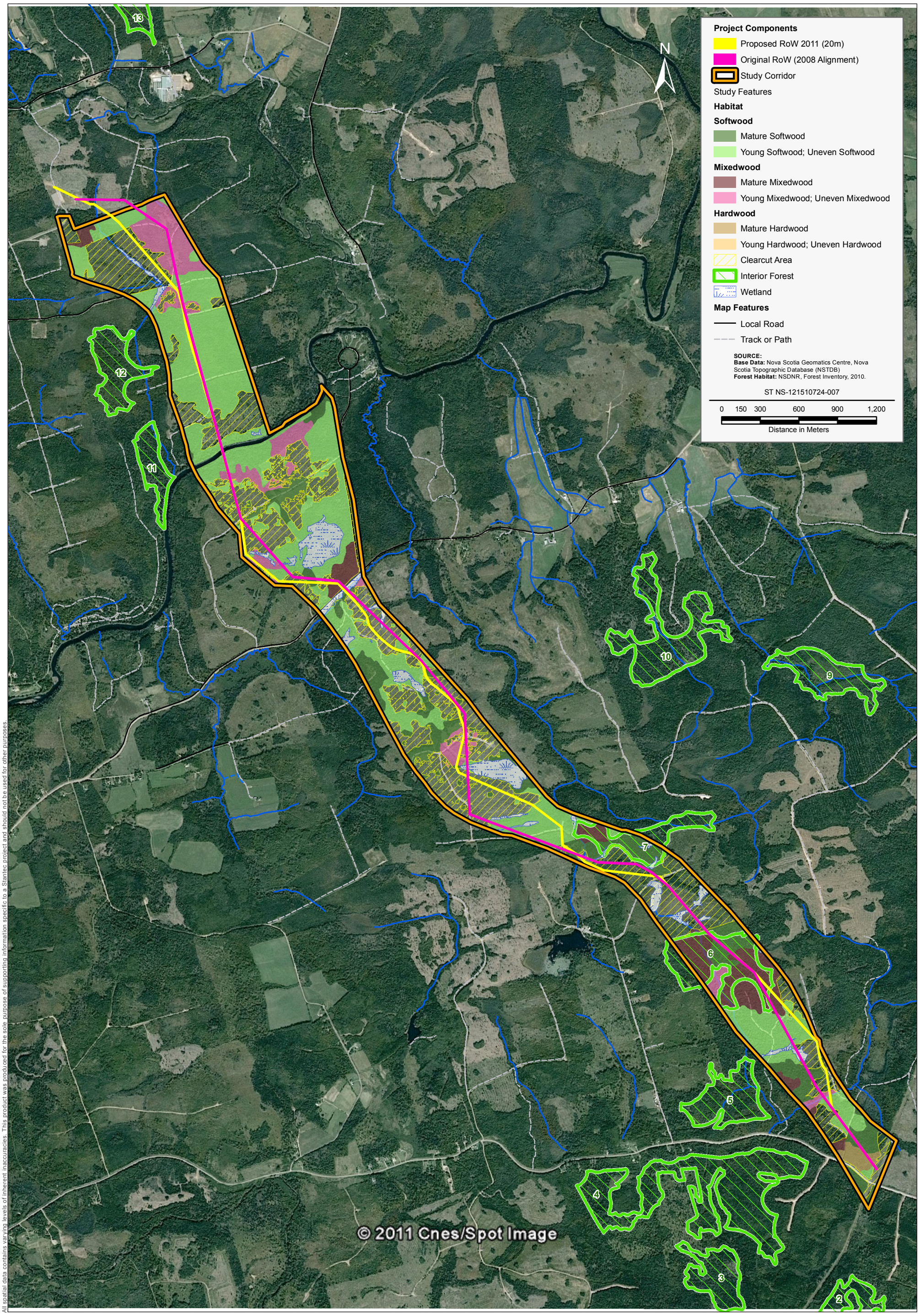
Fourteen species of conservation interest were encountered during the 2007 and 2008 field surveys including Canada Warbler, Common Nighthawk, Olive-sided Flycatcher, Spotted Sandpiper, Killdeer, Wilson's Snipe, Eastern Wood Pewee, Yellow-bellied Flycatcher, Golden-crowned Kinglet, Ruby-crowned Kinglet, Boreal Chickadee, Gray Jay, Black-backed Woodpecker, and Bay-breasted Warbler.

Canada Warbler

Canada Warblers have recently been assigned a "Threatened" status by COSEWIC and are listed under Schedule 1 of *SARA*, but are not listed as a "Species at Risk" under the Nova Scotia *Endangered Species Act*. They are, however, considered "At Risk" by NSDNR and are ranked as "S3B" by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern.

Canada Warblers were encountered at nine locations during the 2011 field surveys (Figure 5.4). All but one of the Canada Warblers records was associated with wetland. Wetland cover types used by Canada Warblers included coniferous treed swamp, mixedwood treed swamp, and tall shrub dominated treed swamp. It is likely that Canada Warblers also make use of the upland forest around these wetlands, particularly when the wetlands are relatively small. The one Canada Warbler record not associated with a wetland was found in dense pole-sized mixedwood forest.

The 2008 route crossed six of the wetlands known to be utilized by Canada Warblers including Wetlands 3, 4, 6, 11, 16, and 18. The modified route (Proposed RoW) avoids Wetlands 3 and 4 by shifting the RoW to the south (Figure 5.4). It is likely that the coniferous forest surrounding Wetland 4 is also used by Canada Warblers. In order to reduce loss of Canada Warbler habitat at this location, the original 2008 RoW has been shifted approximately 150 m to the south. This will avoid Wetland 4 and adjacent Wetland 19 and will cause minimal loss of mature coniferous forest cover and fragmentation of the potential Canada Warbler habitat surrounding Wetland 4.



PREPARED BY: M. Huskins-Shupe	ALTON NATURAL GAS PIPELINE PROJECT	FIGURE NO.: 6.1
REVIEWED BY: M. Crowell		DATE: Jun 05, 2012
alton NATURAL GAS STORAGE LP	**Habitat Overview**	Stantec

File Path: V:\1215\active\121510xxx\121510724_Alton\geomatics\mapping\mxd\ReportFigures\ST_NS_121510724-007_Habitat_Mapping20111123.mxd

The southern end of Wetland 6 was to be crossed at two locations by the original 2008 RoW resulting is potential loss of Canada Warbler breeding habitat in the wetland. The area around the wetland has been recently clear-cut and does not provide Canada Warbler habitat. To reduce adverse effects on Canada Warblers, the 2008 RoW was shifted approximately 20 m to the south of Wetland 6 so that it runs along an existing woods road.

The original 2008 RoW cut across the southern tip of Wetland 11 in which Canada Warbler was detected. It is likely that Canada Warblers in this area make use of the cluster of small wetlands in this area (Wetlands 10, 11, 20 and the two larger NSGC identified wetlands to the south of these wetlands) as well as the upland coniferous and mixedwood forest separating these wetlands. To reduce loss of Canada Warbler habitat, the 2008 RoW was rerouted approximately 90 m north of Wetland 11. The forest in this area is characterized by an open understory which does not provide good Canada Warbler nesting habitat. This will provide a treed buffer between the wetland and the RoW.

Canada Warbler was also found in Wetland 15. The original 2008 RoW did not cross this wetland but passed through mature coniferous forest surrounding the wetland which is probably also used as foraging habitat by Canada Warblers. In order to reduce the amount of potential Canada Warbler habitat lost as a result of RoW construction, the 2008 RoW was shifted 60 m south of Wetland 15 so that it stays in recent clear-cut habitat.

Canada Warbler was detected in Wetland 16 which will be bisected by the proposed pipeline RoW. Wetland 16 extends across almost the entire width of the study corridor. A Canada Warbler was heard singing near the southern end of the wetland. Suitable Canada Warbler habitat is restricted to the southern end of the wetland and it is likely that Canada Warblers also use other nearby wetlands such as Wetland 21 for nesting and foraging. The middle portion of Wetland 16 has been harvested and is flanked by recent clear-cuts. This portion of the wetland is not suitable Canada Warbler habitat. Given that this portion of the wetland is poor Canada Warbler habitat and the southern portion of the wetland plus associated wetlands in the southern third of the pipeline corridor probably provide core habitat for this species, it was believed that the original 2008 pipeline route is probably the best route to reduce adverse effects on Canada Warbler and other sensitive species in this area. The Proposed RoW is located approximately 60 m north of suitable Canada Warbler habitat in Wetland 16 which is expected to provide an adequate buffer during the construction phase. Care will be taken to ensure that trenching and burying of the pipeline do not alter the hydrology of the wetland.

The northern end of Wetland 18 in which Canada Warbler was found is crossed by the original 2008 proposed RoW. It is likely that the mature conifer and mixedwood forest adjacent to the wetland is also used by Canada Warblers. In order to reduce loss of Canada Warbler habitat at this location the original 2008 RoW was shifted approximately 100 m to the northeast of the wetland so that it follows along an existing woods road.

Disturbance of Canada Warbler nesting activity will be reduced by scheduling clearing activities outside of the breeding season (April 15 to August 31).

The shifting of the original 2008 RoW away from wetlands utilized by Canada Warblers will prevent hydrological alteration of these wetlands. Wetland 16 is the only wetland where Canada Warblers were recorded that will not be avoided by rerouting of the original 2008 RoW to the current Proposed RoW. Trench blocks and RoW grading will be used where necessary to prevent the pipeline from affecting wetland hydrology in this area. Similarly, any tree boles or brush used to make a corduroy road across the wetland that are present above the surface of the wetland will be removed so that they do not impede surface drainage. Any tree boles or brush that is forced under the surface of the wetland by vehicle traffic will be left in place to reduce damage to the wetland during restoration.

Common Nighthawk

Common Nighthawks forage on the wing for high flying insects. They nest on the ground in open vegetation free habitats such as recent burns and clear-cuts, rocky barrens, rocky outcrops, grasslands, peat bogs, marshes, dunes, beaches, lake shores and river banks. In urban areas, they also nest on the roofs of buildings with gravel covered roofs.

Common Nighthawks are listed as “Threatened” under *SARA* and as “At Risk” under the *NSESA*. They are also ranked as “At Risk” by NSDNR. The causes of the decline of Common Nighthawk populations are not known. It is believed that the declines may be at least partially attributable to declines in insect populations that are prey for Common Nighthawks. Other birds that specialize in foraging on flying insects such as swallows and flycatchers are also undergoing population declines. Other factors that may contribute to the decline of Common Nighthawk populations include loss or modification of breeding habitat such as reforestation of abandoned agricultural land and logged areas, intensive agriculture, forest fire suppression programs and the gradual loss of buildings with gravel covered roofs.

Common Nighthawks were recorded on five occasions in and near the Study Corridor during the field surveys; however, only one Common Nighthawk was observed during the June breeding bird surveys. The other four birds were observed on August 10 and 14 of 2007. This period corresponds to the period of peak Common Nighthawk migration in Nova Scotia so it is likely that these birds were migrants passing through the area. Suitable nesting habitat in the form of young clear-cuts is present near the area where the Common Nighthawk was observed in June as well as elsewhere in the Study Corridor. No evidence of nesting other than the presence of Common Nighthawks flying over suitable nesting habitat was collected. This species is considered to be a possible breeder in the area.

Common Nighthawks are relatively tolerant of the presence of human activities. They nest and forage in urban areas. Disturbance of nesting Common Nighthawks is not anticipated unless construction activities occur in close proximity to an active nest Clearing of the RoW outside the breeding season for most birds is expected to protect nesting Nighthawks in most cases.

Olive-sided Flycatcher

Habitats where Olive-sided Flycatchers nest include forest clearings such as wooded swamps, the edges of rivers and streams, the edges of clear-cuts, and burned areas containing large numbers of snags. Suitable nesting habitat includes a clearing with scattered snags or tall living trees with adjacent mature forest. The trees or snags in the clearing are used as perching sites by hunting Olive-sided Flycatchers which wait for flying insects to pass by and capture them on the wing. Hymenoptera such as flying ants, bees and wasps are the preferred food although other flying insects are eaten. Nests are situated in trees with conifers such as spruce and fir being preferred.

Olive-sided Flycatchers have recently (2010) been assigned Threatened status by COSEWIC and are listed under Schedule 1 of the *SARA*, but are not listed as a “species at risk” under the Nova Scotia *Endangered Species Act*. They are, however, considered At Risk by NSDNR since 2010 and are ranked as “S3B” by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. BBS data (CWS 2010) indicates that Olive-sided Flycatcher abundance in Canada has declined steadily from the early 1970s until the early 2000s. The abundance of this species has remained relatively stable since then. In Nova Scotia, Olive-sided Flycatcher abundance increased from the early 1970s to 2000 after which there was a substantial decline.

The causes of the declines in Olive-sided Flycatcher populations are unclear but are probably related to loss of habitat. It is unclear if habitat loss on the breeding grounds is a significant factor affecting the abundance of this species since there has been relatively little loss of preferred habitat in the breeding grounds and a general increase in the abundance of some habitat types such as areas harvested for timber. Some research has indicated that breeding success in clear-cuts may not be as high as in natural habitats (*SARA* registry). Habitat loss in the wintering grounds in the montane forests (highland area below the subalpine zone) of the Andes may also be a factor affecting the abundance of this species. It is estimated that approximately 85% of this forest has been significantly altered. However, good estimates of the amount of habitat lost in the wintering grounds are not available. Declining insect populations in either the breeding or wintering areas may also be an important factor affecting the abundance of this species.

Olive-sided Flycatchers were recorded at seven locations during the 2007 and 2008 field surveys. These records form two distinct clusters, one at the western end of the RoW centered around Wetland 1 and the second near the eastern end of the RoW around Wetland 18. Four Olive-sided Flycatcher records were associated with the western cluster. Three of the four records were collected on June 26, 2007 while the fourth record was from June 25, 2008. Two of the three Olive-side Flycatchers observed in this area in 2007 were observed in mixedwood treed swamp habitat in Wetland 1. This linear wetland is flanked on two sides by young clear-cuts. The clear-cut on the western side contains a number of large snags and large living white pine (*Pinus strobus*). The clear-cut to the east contains few snags and no large remnant trees. These trees and snags along with the tall trees in the mixedwood treed swamp would provide

suitable perching sites for foraging Olive-sided Flycatchers. The mixedwood treed stream swamp would provide suitable nesting sites for this species. It is likely that the three records from June 26, 2007 represent one individual singing from multiple sites.

The eastern cluster of Olive-sided Flycatcher observations were situated on the western side of Wetland 18. Wetland 18 has been partially harvested providing open areas for foraging Olive-sided Flycatchers. This clear-cut does not contain any snags or large remnant trees; however, a number of large remnant trees that would provide good perching sites are found along the margin of the clear-cut. The area west of the wetland consists of mature mixedwood forest that would provide suitable nesting habitat for this species. It is likely that the three Olive-sided Flycatcher observations at this location represent multiple records of a single breeding pair of Olive-sided Flycatchers. Males singing in suitable breeding habitat was the only breeding evidence collected during the field surveys and as such this species is listed as a possible breeder in the Study Corridor.

Potential adverse effects can be mitigated in several ways. Clearing will occur outside of the breeding season (April 15 to August 31) in order to prevent direct mortality of Olive-sided Flycatcher eggs and young. At the northern end of the Study Corridor, the existing RoW already avoids Olive-sided Flycatcher nesting and foraging habitat near Wetland 1. However, this 2008 route would have adversely affected a population of a rare vascular plant species so it was necessary to shift the route to avoid this species. The current Proposed RoW runs along the edge of the clear-cut on the eastern side of Wetland 1. This area does not provide good nesting habitat and contains only a few small snags that would provide good feeding perches. The Proposed RoW will run along the edge of the clear-cut and will not result in the loss of trees and snags along the edge of the clear-cut reducing potential loss of feeding perches and reducing habitat fragmentation in this area. Although, habitat loss associated with this route is minimal, there is potential for disturbance of nesting Olive-sided Flycatchers in areas adjacent to the RoW, in particular the eastern clear-cut between the cavern site and the Stevens Road.

Olive-sided Flycatchers are also likely nesting in the vicinity of Wetland 18 near the southern end of the Study Corridor. The original 2008 proposed RoW passes through this wetland resulting in the probable loss of Olive-sided Flycatcher nesting habitat and disturbance of nesting Olive-sided Flycatchers. To reduce adverse effects on Olive-sided Flycatchers the 2008 RoW was shifted approximately 100 m (current Proposed RoW) to the northeast of the wetland so that it follows along an existing woods road. This is the same route alteration used to mitigate adverse effects on Canada Warbler.

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 in the Study Corridor during the field surveys. Six were observed in clear-cuts while the remaining three were observed flying over the Study Corridor. . A pair of 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. Another Killdeer was found in a young clear-cut near the cavern site.

Killdeer are quite tolerant of nearby human activity and could establish a nest in close proximity to construction activity. Once clearing of the RoW has begun, Killdeer could potentially establish nests at various locations along the pipeline route. Clearing of the RoW outside the breeding season for most birds is expected to protect nesting Killdeer in most cases.

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. 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. It is proposed that the Stewiacke River will be crossed by means of HDD so there will be no disturbance of the riparian habitat that Spotted Sandpipers frequent. Given the lack of breeding evidence and no loss of preferred habitat in the area where this species was encountered, no species specific mitigation has been developed for Spotted Sandpiper.

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. Wilson’s Snipe abundance in Canada has generally increased since 1970; however, in Nova Scotia Wilson’s Snipe numbers decreased from the early 1970s to the early 1990’s and have remained relatively stable since then. 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 (winnowing) so this species was listed as a Possible breeder in the Study Corridor. The Proposed RoW does not pass through any graminoid dominated wetlands in the vicinity of the Cloverdale Road. Good nesting habitat is present in a large wetland located approximately 500 m southwest of the proposed pipeline route. Wilson's Snipe often make their flight songs over wide areas so the presence of winnowing Wilson's Snipe at a particular location does not necessarily indicate that they are nesting there. Given the lack of good nesting habitat along or near the Proposed RoW, no species specific mitigation has been developed for this species.

Yellow-bellied Flycatcher

Yellow-bellied flycatchers have also been recently assigned a status of "Sensitive" by NSDNR. In addition, they are assigned a rank of "S3S4B" by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with a variety of habitats, including swamps and damp coniferous woods. Yellow-bellied Flycatcher abundance in Nova Scotia has generally decreased since the mid-1980s.The sensitive ranking assigned to this species by NSDNR is expected to reflect loss of lowland coniferous forest and possible long term loss of coniferous forest habitat as a result of climate change.

Yellow-bellied Flycatchers were common in the Study Corridor with a total of 20 records of this species compiled during 2007 and 2008. Yellow-bellied Flycatchers were encountered in a variety of habitat types including mature and immature softwood forest, mature mixedwood forest, coniferous treed swamp, mixedwood treed swamp, and clear-cuts; however, it was most frequently encountered in mature mixedwood forest. Figure 5.4 presents the distribution of the Yellow-bellied Flycatchers observed in 2008 and those recorded in wetlands in 2007. The locations of Yellow-bellied Flycatchers observed during the breeding bird surveys conducted in 2007 were not georeferenced since this species was listed as secure at that time. Yellow-bellied Flycatchers were generally fairly evenly distributed throughout most of the Study Corridor in 2007. Five Yellow-bellied Flycatchers were observed between the cavern site and the Stewiacke River; three were observed between the Stewiacke River and Wetland 12; and five were observed between Wetland 12 and the Lanesville Road. The presence of males singing in suitable habitat was the only breeding evidence noted for this species and it is therefore listed as a possible breeder in the Study Corridor.

Construction of the original 2008 pipeline RoW would have expected to result in the loss of Yellow-bellied Flycatcher nesting habitat near Wetlands 4, 6, 9, and 15. All of these locations also provide potential nesting habitat for Canada Warblers. The shifting of the original 2008 RoW away from these wetlands (to the current Proposed RoW) to reduce adverse effects on Canada Warblers will also reduce construction related adverse effects on Yellow-bellied Flycatchers.

Eastern Wood Pewee

Eastern Wood Pewees are typically associated with deciduous or mixed wood forest although they often nest in ornamental groves, particularly those dominated by elms. They are often associated with forest edges. This species was listed as Sensitive under the NSDNR General Status Ranks in 2010 ACCDC lists this species as S3S4B indicating that it is an uncommon to fairly common breeding bird species in Nova Scotia. The causes of the decline in Eastern Wood Pewee abundance are poorly understood but are believed to be related to habitat loss.

Three Eastern Wood Pewees were recorded during the 2007 (two records) and 2008 (one record) field surveys. The general locations of the Eastern Wood Pewees recorded in 2007 were one bird just north of the Stewiacke River crossing site and one bird located between Wetlands 8 and 9. The first bird was found in mature softwood forest while the second bird was found in mature mixedwood forest. All of the Eastern Wood Pewees recorded during the 2007 and 2008 field surveys were heard singing in suitable nesting habitat. As such, this species is listed as a possible breeder in the Study Corridor.

Two of the three Eastern Wood Pewee locations are situated at least 100 m away from the proposed pipeline route. Construction activities are unlikely to have an adverse effect on these birds. The Eastern Wood Pewee found at the proposed crossing site for the Stewiacke River could be adversely affected by habitat loss and disturbance associated with the river crossing activities. Clearing of the RoW outside the breeding season for most birds is expected to protect nesting Eastern Wood Pewees in most cases.

Golden-crowned Kinglet

Golden-crowned Kinglets were assigned a status of Sensitive by NSDNR in 2010. The ACCDC assigns a rank of “S4” to this species indicating that although they are fairly common throughout their range in the province, they are of long-term concern. BBS data (CWS 2010) indicate that Golden-crowned Kinglet abundance has declined over the past 20 years although abundance is still within ranges present in the 1970s and 1980s. There are concerns that extensive harvesting of softwood forest in recent decades and other factors such as possible reduction in softwood forest cover as a result of climate change could result in substantial long term reductions in the abundance of this species in Nova Scotia.

Golden-crowned Kinglets are typically found in dense coniferous stands of the province where they are year-round residents. This species was relatively common in the Study Corridor with 14 records compiled during the 2007 and 2008 field surveys. Golden-crowned Kinglets were found only in mature mixedwood and mature softwood habitat types with the vast majority found in the mature mixedwood forest habitat type. The relative lack of Golden-crowned Kinglets in mature softwood forest habitat reflects the fact that there was relatively little mature softwood forest in the Study Corridor while mature mixedwood forest was plentiful. Golden-crowned Kinglets were patchily distributed in the Study Corridor with the greatest concentrations present in areas where large stands of mature mixedwood or softwood forest were present. This is also reflected

in the 2007 records. Newly fledged Golden-crowned Kinglets were observed during the 2007 breeding bird surveys and as such, this species is listed as a confirmed breeder in the Study Corridor.

Adverse effects on Golden-crowned Kinglets associated with pipeline construction include loss of mature coniferous forest habitat, sensory disturbance associated with construction activities and habitat fragmentation. Mitigation measures recommended for other bird species such as the modifications to shift the original 2008 pipeline route to the current Proposed RoW to protect Canada Warbler and Olive-sided Flycatcher nesting habitat will help to reduce the loss of mature conifer forest cover preferred as nesting habitat by Golden-crowned Kinglets, habitat fragmentation and sensory disturbance.

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.

Adverse effects on Ruby-crowned Kinglets associated with pipeline construction include loss of mature coniferous and mixedwood forest habitat, sensory disturbance associated with construction activities and habitat fragmentation. Mitigation measures recommended for other bird species such as Canada Warbler and Olive-sided Flycatcher nesting habitat as well as the proposed use of HDD to cross the Stewiacke River will help to reduce the loss of mature conifer forest cover preferred as nesting habitat by Ruby-crowned Kinglets, habitat fragmentation and sensory disturbance.

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).

All of the Boreal Chickadees recorded during the breeding bird surveys were at least 150 m from the proposed pipeline RoW. No species specific mitigation measures have been developed for this species. Mitigation to reduce loss of mature coniferous forest and habitat fragmentation developed to reduce adverse effects on Canada Warblers such as routing of the original 2008 pipeline to be along existing woods roads near the Cloverdale Road (current Proposed RoW) should help to reduce adverse effects on Boreal Chickadees.

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.

No species specific mitigation measures have been developed for this species. Mitigation to reduce loss of mature coniferous forest and habitat fragmentation developed to reduce adverse effects on Canada Warblers such as routing of the original 2008 pipeline along existing woods roads near the Cloverdale Road (current Proposed RoW) should help to reduce adverse effects on Gray Jays.

Black-backed Woodpecker

Black-backed Woodpeckers are typically found in mature softwood stands and in burned areas where dead trees are plentiful. 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 Woodpecker is listed as a Sensitive species by NSDNR and is ranked S3S4 (uncommon to fairly common) by ACCDC.

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 16. This species is therefore listed as a confirmed breeder in the Study Corridor.

Black-backed Woodpeckers are tolerant of some human modifications to their breeding habitat as evidenced by the fact that they frequently nest in islands of coniferous forest cover in clear-cuts and it is likely that they will remain in the area following the onset of construction activities. The Black-backed Woodpecker in Wetland 16 is located approximately 70 m west of the original 2008 RoW which should provide an adequate buffer to prevent disturbance of the nest. The recommended rerouting of the pipeline route to avoid Canada Warbler and Olive-sided Flycatcher nesting habitat around Wetland 18 should reduce the amount of Black-backed Woodpecker foraging habitat lost as a result of pipeline construction.

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 one location during the 2007 field surveys. One bird was observed in mixedwood treed swamp habitat at Wetland 15. This species is listed as a possible breeder in the Study Corridor (Table C3 in Appendix C).

No species specific mitigation measures have been developed for this species. Mitigation to reduce loss of mature coniferous forest and habitat fragmentation developed to reduce adverse effects on Canada Warblers such as routing of the pipeline through clear-cuts to the southwest of Wetland 15 rather than through mature coniferous forest should help to reduce adverse effects on Bay-breasted Warblers.

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. Figure 5.4 shows 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. The nest site will not be physically disturbed by construction activities but the nest will be exposed to sensory disturbance. The Red-tailed Hawk nest near the cavern site is located approximately 200 m from the original 2008 pipeline route. This would provide a buffer of sufficient distance to reduce disturbance at the nest site. The location of the possible Red-tailed Hawk nest near Wetland 18 is unknown. Rerouting of the original 2008 pipeline to the east along existing woods roads in this area as currently proposed to reduce adverse effects on Canada Warblers and Olive-sided Flycatchers would reduce the likelihood of disturbance of any Red-tailed Hawk nest that may be present in this area.

Mammals

The field surveys and 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*), northern long-eared bat (*Myotis septentrionalis*) and Tricolored bat (*Perimyotis 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. At the present time, Little Brown Bats, northern long-eared bats and tricolored bats are relatively common and are listed as “Sensitive” as a result of the fact that they congregate in large numbers at a relatively small number of known cave or tunnel

hibernation sites where substantial portions of the population are potentially at risk during the late fall, winter and early spring. During the rest of the year, these species are widely disbursed over the landscape and the provincial population is at little risk from any one anthropogenic activity.

Recently, white nose syndrome has been detected in Nova Scotia. This fungal disease of bats has caused large scale mortality in bat populations in the American Northeast and most recently in New Brunswick. It is likely that heavy mortality will also occur at hibernation sites in Nova Scotia. It is expected that the general status rank of hibernating bats will soon change to reflect this new threat.

Pipeline construction activities could potentially adversely affect bats in several ways. If it is assumed that the nearest abandoned mine site provides a hibernaculum for bats, hibernating bats in this hibernaculum could be disturbed by blasting. If hibernating bats are aroused frequently enough they can prematurely use up fat stores resulting in death from starvation. Soils in the Study Corridor are thick and it is anticipated that minimal, if any, blasting will be required. Detailed geotechnical investigations and pipeline design will determine the precise requirements for blasting. Depending on the amount of blasting required and season proposed, additional investigation of risk to hibernating bats and potential mitigative measures will be explored. Ripping of softer rock will also be preferentially used, where feasible, as an alternate to blasting.

Maternity roosts of hibernating bat species are sometimes found in hollow trees. Migratory bats such as Red Bats (*Lasiurus borealis*) and Hoary Bats (*Lasiurus cinereus*) also establish maternity sites in trees. Clearing of tree cover can result in the mortality of young bats in these maternity sites. In order to stay compliant with the *Migratory Birds Convention Act*, clearing of vegetation will occur outside of the breeding season for most bird species (April 15 to August 31). This period also coincides with the breeding season for bats and would be effective mitigation for both bats and birds.

During the construction phase of the Project, sensory disturbance is not expected to have a substantial effect on local mammal populations. The Study Corridor is located in an area of light to moderate human activity including the presence of regularly travelled roads, widespread forestry activities, small housing developments and recreational hunting and fishing activity. Most of the mammal species present in the Study Corridor are quite tolerant of human activities. Mitigation for mammals during the construction phase of the Project is limited to reducing vegetation clearing as far as practical during preparation of the Proposed RoW to preserve habitat.

Amphibians and Reptiles

Wood Turtle was the only sensitive herpetile species encountered in the Study Corridor during the various field surveys; however, Snapping Turtles have also been recorded on the Stewiacke River. 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 (Figure 5.4). 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. The Stewiacke River is proposed to be crossed using HDD, which will result in no disturbance of the bed of the Stewiacke River or the riparian habitat along its banks. Although no wood turtles were noted at locations other than the Little River during the field surveys, this species could potentially occur along tributaries of Little River and the Stewiacke River, particularly during the summer months. As a precautionary measure, it is best to proceed with the assumption that wood turtles are present within the Project area, and may be encountered. If wood turtles are found during construction, they will be picked up and moved just off site, along the same habitat corridor in the direction of travel the turtle was originally oriented. A New York State study (Carroll and Ehrenfeld 1978) showed that 84% of wood turtles displaced less than two kilometres overland were able to return to their home range. Moving the wood turtles 100 m to 400 m from the original site where they were found should not be unduly

disruptive to them. Construction crews will be provided with environmental awareness training and will be educated on the protection of wildlife, including herpetiles.

Snapping turtles have been recorded in the Stewiacke River. Like the wood turtle, this species is long-lived, slow to mature and suffers high egg and juvenile mortality but low adult mortality. Small increases in adult mortality can adversely affect local populations. Snapping turtles are listed as a species of Special Concern under Schedule 1 of *SARA* and COSEWIC. This species is considered to be Secure in Nova Scotia by NSDNR and there is a hunting season for snapping turtles in the province. Snapping turtles are more aquatic than wood turtles and typically emerge from fresh water mainly during the breeding season when they seek out sandy and gravelly sites to lay their eggs. The portion of the Stewiacke River that passes through the Project corridor provides good hibernation and foraging sites but the river banks are generally too steep and muddy to provide good nesting sites. As such, most snapping turtle activity in this area will be concentrated in the water. The Stewiacke River is proposed to be crossed using HDD so there are no anticipated interactions between snapping turtles and the Project.

Trench inspections for trapped fauna will be conducted at the beginning of each working day. If an animal is trapped in the trench, NSDNR will be contacted.

With mitigation methods and proper scheduling, no significant adverse residual environmental effects on herpetiles due to construction activities are likely to occur.

Summary

Based on proposed Project mitigation, including modification of the RoW that has been undertaken, significant adverse residual potential environmental effects on Wildlife and Wildlife Habitat during Project construction are not likely to be significant. In particular, wildlife Species at Risk and Species of Conservation Concern and biodiversity in the theme region will not be substantially affected.

6.4.5.2 Operation and Maintenance

During the operational lifespan of the Project, periodic vegetation control along the Proposed RoW may disturb wildlife due to noise and human presence. The maintenance of the RoW throughout the life of the Project will inhibit the natural succession of plant communities on the RoW. Woody vegetation will be permitted to grow on the RoW but will not be allowed to become more than a few meters tall. The cleared RoW would also increase the accessibility of wildlife habitat to the general public, increasing the likelihood of continued disturbance and hunting.

Vegetation management along the RoW will be conducted by mechanical means.

RoW vegetation maintenance will be conducted outside of the breeding season for most species of birds (April 15 to August 31). In areas where forestry roads intersect the RoW, Alton is prepared to construct locked gates along the RoW if requested, where feasible and in accordance with the wishes of landowners. This would impede vehicular traffic (snow-mobiles,

ATVs, off-road vehicles), and decrease potential disturbance to wildlife along the RoW. Limiting human presence along the RoW would also decrease the likelihood of high risk wildlife encounters and illegal hunting activities.

With mitigation methods, no significant adverse residual environmental effects on Wildlife and Wildlife Habitat due to pipeline operations and maintenance are likely to occur.

6.4.6 Follow-up and Monitoring

No follow-up surveys or monitoring programs are recommended.

6.4.7 Summary of Residual Environmental Effects Assessment

With mitigation methods and proper scheduling, no significant adverse residual environmental effects on Wildlife and Wildlife Habitat due to construction or operational activities are likely to occur.

6.5 WETLANDS

6.5.1 VEC Identification

Wetlands were selected as a VEC because of the potential for interactions between Project activities and wetland environments, and because of the relationship between this VEC and wildlife and other biological and physical environments. Wetlands are an important feature of the landscape, performing many biological, hydrological, social/cultural, and economic functions. Many species of flora and fauna depend on wetland habitat for their survival. Hydrological functions of wetlands include erosion and flood control, contaminant reduction, and groundwater recharge and discharge. Wetlands support various forms of recreational activity, as well as subsistence production, such as harvesting of plants and other wildlife, and commercial production, such as cranberry bogs, forestry, and peat extraction.

6.5.2 Boundaries

The spatial boundary for the Project is the Study Corridor, where activities associated with site preparation, construction, and operation of the Project have greatest potential to result in environmental effects on wetland habitat. Field surveys were conducted along Study Corridor centerlines, including alternate routes. 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).

The temporal boundaries for the assessment of the potential environmental effects of the Project on wetlands are the duration of Project Construction, Operation / Maintenance, and decommissioning of the Project.

6.5.3 Residual Environmental Effects Evaluation Criteria

A significant residual adverse environmental effect on wetland habitat is one that:

- results in the loss of a type of wetland and its associated functions that are unique in the Study Corridor;
- affects a high proportion of wetlands, locally (greater than 25% of wetland area within the Study Corridor); or
- results in an unmitigated loss of wetland area and associated functions.

An environmental effect that does not meet any of the above criteria is rated as not significant.

6.5.4 Potential Interactions, Issues and Concerns

6.5.4.1 Construction

Clearing, grubbing, and trenching within the proposed alignment, as well as vehicle access across wetlands, could result in the direct disturbance of wetland habitat and removal of wetland vegetation and soils. Indirect impacts from construction activities may also affect wetland habitat within and adjacent to the corridor. Blasting, trenching, trench dewatering, and backfilling could result in sedimentation of wetlands and alteration of wetland hydrology.

Wetland-related wildlife could be affected by noise during construction, particularly if they support species that are sensitive to anthropogenic disturbances.

Hydroseeding applications have the potential to alter the quality of wetland habitat. If applied in hydrological source areas for wetlands, hydroseeding applications have the potential to increase nutrient levels in wetlands, which could affect their biological process (*e.g.*, nutrient uptake by plants, decomposition rates, *etc.*). Although hydroseeding efforts would use an approved seed mix, these are typically comprised of non-native species and therefore have potential to negatively influence the composition of wetland communities. Construction activities also increase the susceptibility of wetland habitats to non-native and invasive plants through increased disturbances, proximity to anthropogenic infrastructure, and by promoting their dispersal.

6.5.4.2 Operation and Maintenance

The Stewiacke-St. Andrews River watershed designation (see Figure 5.5) restricts the use of any herbicides within the catchment; thus herbicides will not be used to control vegetation along RoW portion within the watershed, nor will herbicides be used along the rest of the RoW. Mechanical means using bush-cutters will primarily be used, especially on slopes in the vicinity of streams, wetlands, and upstream of water supply catchments. Vegetation control, particularly at streams and wetlands, will be limited to that required to provide access for continuous safe

operation, inspection and maintenance of the pipeline. Where possible, forest roads and other access routes will be used in preference to cutting vegetation on the RoW.

6.5.5 Analysis, Mitigation and Residual Environmental Effects Prediction

This section provides an analysis of the environmental effects of the key Project-wetland interactions by Project phase, including a discussion of planned mitigation.

6.5.5.1 Construction

A mitigative sequence has been adopted as the approach to reducing impacts to wetlands in the Study Corridor with the objective of no net loss of wetland habitat as a result of the Project. The mitigative sequence promotes wetland conservation through the application of a hierarchy of preferred alternatives: 1) avoidance of impacts; 2) reduction of unavoidable impacts; and 3) compensation for residual impacts that cannot be reduced. Within the context of the mitigative sequence, approvals will be sought for unavoidable wetland alterations.

Avoidance

Avoidance of wetland habitat has been implemented at several stages in the planning and design of the proposed pipeline alignment. Due to the abundance of wetlands in the Study Corridor and limitations of other technical and environmental constraints, complete avoidance of impacts to wetlands is not practical. However, the preferred alignment (Proposed RoW) is considered to have effectively reduced effects on wetland habitat.

Construction activities are expected to result in the direct alteration of portions of Wetlands 16 and 17 and to influence approximately 0.08 ha of wetland habitat overall (Table 6.1). The amount of wetland habitat directly affected by Project activities represents less than 0.5% of that identified within the Study Corridor during field surveys. The proposed pipeline alignment has been located within the narrowest point of Wetland 16 and positioned to also reduce disturbance to nearby Wetland 17. The area proposed for direct alteration is approximately 0.03 ha within Wetland 16 and 0.05 ha of Wetland 17, accounting for approximately 1.8% and 18.7% of their total areas, respectively. Although the Proposed RoW crosses Wetland 5, it does so at the location of an existing woods road (*i.e.*, an area which has already been infilled) and no direct impacts to this wetland have been identified here.

The amount of wetland habitat expected to be directly influenced by the Project has been substantially reduced as a result of route modifications (Table 6.1). For example the previously proposed (2008) alignment included direct effects to eight wetlands, accounting for an area of almost three hectares. Re-routing of the initially proposed 2008 alignment has avoided direct impacts to seven of these wetlands.

Additional measures will be taken to avoid disturbance to wetlands which are not crossed by the Proposed RoW. Wetlands adjacent to the Proposed RoW will be documented in the EMP and avoided by construction-related activities. Wetland habitat will not be disturbed without a Water

Approval for Wetland Alteration from NSE. In accordance with the Activities Designation Regulations, the Water Approval application will contain site specific plans for reducing indirect wetland alteration.

TABLE 6.1 Summary of proposed disturbance to wetland habitats (based on 20 m pipeline RoW)

Wetland ID	Area of Wetland (ha)[1]	Initial (2008) Proposed Alignment		Revised (2011) Proposed Alignment	
		Area disturbed (ha)	% of Wetland Disturbed	Area disturbed (ha)	% of Wetland Disturbed
1	0.87	0.00	0.00	0.00	0.00
2	0.16	0.00	0.00	0.00	0.00
3	1.45	0.00	0.00	0.00	0.00
4	0.38	0.02	5.59	0.00	0.00
5	0.75	0.04	5.36	0.00[2]	0.27
6	0.65	0.08	13.00	0.00	0.00
7	0.02	0.00	0.00	0.00	0.00
8	1.75	0.00	0.00	0.00	0.00
9	6.02	0.07	1.10	0.00	0.00
10	0.41	0.00	0.00	0.00	0.00
11	0.41	0.02	4.10	0.00	0.00
12	0.24	0.00	0.00	0.00	0.00
13	0.18	0.02	10.75	0.00	0.00
14	0.32	0.00	0.00	0.00	0.00
15	0.25	0.00	0.00	0.00	0.00
16	1.64	0.03	1.79	0.03	1.79
17	0.29	0.05	18.74	0.05	18.74
18	1.42	0.23	16.28	0.00	0.00
19	0.46	0.00	0.00	0.00	0.00
20	0.18	0.00	0.00	0.00	0.00
21	1.61	0.00	0.00	0.00	0.00
Total	19.46	0.56	2.90	0.08	0.43

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

[2]Although the proposed pipeline alignment crosses Wetland 5, it does so at the location of an existing woods road and no direct impacts to this wetland have been identified here.

Mitigation

A variety of mitigative procedures will be applied during the construction phase to reduce potential indirect impacts to wetland habitat and wetland functions. Restoration of wetland habitat directly affected by construction activities will be conducted and a number of generic and

wetland-specific measures will serve to reduce impacts to wetland habitats during all phases of construction. Mitigation will be outlined in detail in the EMP, and include measures related to vegetation clearing, rare and / or sensitive wildlife, minimal disturbance zones, temporary work room, erosion and sediment control, dust control, operation of machinery, grubbing, grading and topsoil stripping, blasting, trenching, stringing and bending, crossing of watercourses, trench dewatering, and backfilling.

There is some potential for the backfilled pipeline trench to affect adjacent hydrology, including adjacent wetlands. Methods for backfilling the trench that will mitigate this potential effect are provided below.

Wetland restoration efforts along the Proposed RoW will aim to return wetland functionality to a close approximation of their condition prior to disturbance. Restoration activities typically begin immediately after backfilling activities. Wetland mitigation and restoration will involve the following activities:

- Install corduroy or other permanent protective measures to allow continued pipeline access without further wetland alterations;
- Check that pipeline activities do not alter hydrology such that wetland restoration is not possible;
- Where flow through the wetland is parallel to the pipeline, altered hydrology issues should be minimal. Where flow, even sheet flow, is more perpendicular to the pipeline, great care will be needed to maintain that flow through careful backfilling and avoid creating a dam-effect and ponding;
- Salvage wetland vegetation and peat material during initial disturbance of wetlands;
- Grade fill and substrate after pipeline installation to accommodate hydrology and vegetation;
- Replace wetland vegetation and peat material in wetland areas; and
- Undergo monitoring and adaptive management as needed.

More specific methods proposed to restore disturbed wetlands are as follows:

- Grubbing in wetlands will be delayed until necessary for construction access, and will be limited to the trench width;
- Grubbing will include the removal of the upper ~30-50 cm of vegetated topsoil from the wetland area within the trench width. This is to be set aside for salvaging during the wetland restoration;
- Setting aside the top layer of wetland vegetation and soils while pipeline construction is taking place will be done with great care and with the aim of keeping the top 30-50 cm intact so that it can be replaced after the remainder of the pipeline has been backfilled;
- Vegetated topsoil from wetlands will be stored in such a way as to avoid the mixing of topsoil with sub-surface soils;

- Where appropriate, sediment control fences will be installed and maintained along the edges of exposed soils within wetland areas;
- During construction, surface water will be diverted away from wetland areas;
- Subsurface materials excavated during trenching in wetlands will be stored outside the wetland and separately from surface materials;
- Grading materials for backfilling trenches after pipeline installation will be stored along the corridor or in a temporary work room a minimum of 30 m from wetland boundaries where practicable;
- Trench plugs or breakers will be installed where trenches cross wetland boundaries to avoid dewatering, where required;
- Water levels in open trenches will be monitored to evaluate dewatering and overflow issues and the efficacy of trench plugs and breakers;
- Following pipeline installation, backfilling will commence as soon as possible;
- Trench material and vegetated topsoil will be replaced in a way that prevents mixing or loss of materials;
- Grades will be restored as close as practical to pre-construction levels;
- All temporary drainage devices will be removed to restore hydrology;
- Salvaged wetland surface vegetation material will be replaced in wetland areas;
- Temporary access through wetlands will be removed or altered to allow wetland functionality and protection; and
- A wetland specialist will be on site during construction activities within wetlands to aid in the proper restoration of wetland habitat.

Compensation

Approval of wetland alteration normally requires implementation of a wetland habitat compensation program to promote “no net loss” of wetland function as a result of the Project. This goal will primarily be achieved through on-site wetland restoration initiatives, which aim to reinstate wetland habitats that are disturbed during pipeline installation activities. However, compensation requirements may require residual impacts on wetland functions to be compensated by the enhancement, restoration, or creation of additional wetland habitat, at an area ratio commensurate with the loss. A conceptual wetland compensation plan will be included in the Wetland Alteration Approval, upon consultation with NSE.

Consideration of Wetland Functions and Determination of Significance

Wetlands 16 and 17 are considered to contribute to a variety of hydrogeomorphological functions, including surface water detention, stream flow maintenance, nutrient transformation, carbon sequestration, and shoreline stabilization. Assuming successful wetland restoration

within the proposed pipeline corridor, none of these functions are likely to be adversely effected by construction activities.

Two bird species of conservation concern are known to utilize wetlands impacted by the Proposed Alignment: Canada Warbler (Wetland 16) and Black-backed Woodpecker (Wetlands 16 and 17). Although construction activities have potential to disrupt the use of wetland habitat by wildlife, they are not expected to cause important adverse effects to either of these species.

The middle portion of Wetland 16 (through which the Proposed RoW crosses) has been harvested, is flanked by recent clear-cuts, and does not provide suitable Canada Warbler habitat. Suitable Canada Warbler habitat is restricted to the southern end of Wetland 16 and it is also likely that this species utilizes nearby wetlands (such as Wetland 21) for nesting and foraging purposes. The Proposed RoW is located approximately 60 m north of suitable Canada Warbler habitat in Wetland 16 which will provide an adequate buffer during the construction phase. The Proposed RoW reduces the potential for adverse effects on Canada Warbler. This is because the area within Wetland 16 proposed for pipeline crossing provides poor Canada Warbler habitat, and valuable Canada Warbler habitat in the southern portion of the wetland, as well as nearby wetlands, are avoided by the Project.

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 16 and foraging evidence of this species was also observed in association with Wetland 17. Black-backed Woodpeckers are evidently tolerant of some human modifications to their breeding habitat, as they frequently nest in islands of coniferous forest cover in clear-cuts. The Black-backed Woodpecker nest in Wetland 16 is located approximately 70 m west of the proposed pipeline alignment and this distance is expected to provide an adequate buffer to prevent disturbance of the nest. Given these considerations, it is unlikely that construction activities will adversely affect the use of Wetland 16 or 17 by the Black-backed Woodpecker.

Although large purple fringed orchid was encountered within Wetland 16, this species is located outside of the area encompassed by the Proposed Alignment and will not be influenced by construction activities, assuming wetland hydrological properties are maintained.

Considering the mitigation to be implemented including habitat compensation for altered wetlands, the residual environmental effects of Project construction on wetlands are predicted to be not significant.

6.5.5.2 Operation and Maintenance

Mitigative measures involving the flagging of setbacks, and use of mechanical vegetation control (and no herbicides) will be implemented to prevent disturbance to wetland habitats during operations and maintenance. No vehicles will be permitted to operate from within the boundaries of wetlands for vegetation control (*i.e.*, they will be operated from outside the edge of wetlands or hand tools will be used). Further details on the site specific mitigation will be outlined during the Wetland Alteration Approvals process.

The presence of the RoW could increase access to wetlands by individuals other than Project personnel, possibly resulting in increased disturbance to wildlife or physical disturbance of wetland habitat. However, due to the fragmented nature of the area, most of the wetlands within the Study Corridor are already located close to roads. Therefore the establishment of the pipeline corridor is not considered to greatly improve access to the wetlands.

Considering the mitigation to be implemented, the residual environmental effects of Project operations and maintenance on wetlands are predicted to be not significant.

6.5.6 Follow-up and Monitoring

In order to evaluate the success of wetland restoration initiatives and to guide adaptive management initiatives, post-alteration monitoring is proposed. Although details of the monitoring program would be developed during the Wetland Alteration permitting, the approach would include an evaluation of the:

a) Extent and degree of wetland alterations, both direct and indirect.

b) Wetland plant community using a series of semi-permanent plots to characterize the structure and composition of plant communities within the restored wetlands and evaluate impacts of construction activities on their character and integrity.

c) Hydrological character of the wetland.

The frequency, scope, and timing of monitoring will be confirmed through consultations with Alton and NSE. All monitoring will be conducted and interpreted by an experienced terrestrial ecologist or wetland specialist.

Applications for Wetland Alteration Approvals must be supported with details of wetland functions. Although some functional data was collected for wetlands within the Study Corridor, recent developments in the provincial approach to functional assessment are likely to require that more recent surveys be conducted. Specifically, detailed functional assessments will be performed for Wetlands 16 and 17 prior to applying for a Wetland Alteration Approval. A more detailed functional assessment will form the basis for discussion with NSE regarding compensation for any loss of wetland function as a result of Project activities.

6.5.7 Summary of Residual Environmental Effects Assessment

Based on the predicted environmental effects and the mitigation that is proposed, significant adverse Project-related environmental effects on wetlands are not predicted. In summary, the Project will:

- Not result in the loss of a wetland type or associated functions within the Study Corridor - wetlands proposed for direct alteration are both swamps and will be well represented post-construction.

- Not affect a high proportion of local wetlands - less than 0.5% of the wetland area identified within the Study Corridor during field surveys will be disturbed.
- Not result in a permanent loss of wetland area and associated functions - wetland area and associated functions affected by the Project will be compensated for by restoration within or nearby the RoW through restoration, enhancement or creation of wetland habitat (pending discussions with NSE).

Mitigative measures will be employed to reduce potential direct and indirect impacts to wetlands during all phases of the Project. Mitigative measures include avoidance of wetlands, reduction of effects by limiting disturbance activities, adherence to the EMP, awareness training for contractors, and offsetting of wetland alterations through wetland compensation.

6.6 LAND AND RESOURCE USE

6.6.1 VEC Identification

Land and Resource Use is a VEC because of its importance to socioeconomic development and community character. Land and Resource Use includes all existing residential, industrial and commercial land use, as well as settlement areas, lands used for recreation, agriculture and resource use (*e.g.*, forestry, mineral exploration), and other areas of special community or social value. The nature and extent of developed lands, areas used for recreation, and other areas of special value are important determinants of the socioeconomic character of a community.

Traditional Land and Resource Use addresses Mi'kmaq land and resource use and is also presented in this Section.

The Proposed RoW intersects lands identified by NSE's Protected Areas and Wetlands Branch as high-value conservation lands in the Stewiacke River/St. Andrews River. These lands are primarily provincial Crown lands that have recently been identified as potential candidates for future protection. If formally designated as Protected Lands, the Province intends to restore and preserve these areas for their high conservation value, which will contribute to the Province's goal of protecting 12% of the land in Nova Scotia by 2015. Further detail regarding the 12% land protection process is provided in Section 5.7.5 (Protected Areas).

Potential environmental interactions that may be associated with pipeline construction and operation in these candidate 12% provincial conservation areas are considered throughout this report in the context of the environmental and socio-economic effects assessments conducted for applicable VECs, as follows:

- loss of habitat, increased habitat avoidance, fragmentation of habitat, and increased disturbance footprint affecting function of habitat are assessed in Sections 6.2 (Fish and Fish Habitat), 6.3 (Rare Vascular Plants), 6.4 (Wildlife and Wildlife Habitat), and 6.5 (Wetlands);

- increased noise and general disturbance are assessed in this Land and Resource Use chapter as well as the biophysical VEC Sections listed above (refer also to Sections 2.7.2 and Table 4.1 regarding noise);

- increased access via roads and corridors by off-highway vehicles is assessed in this Land and Resource Use Section; and

- inhibition of the natural succession of plant communities within the Proposed RoW is assessed in Section 6.3 (Rare Vascular Plants).

In general, it is noted that candidate 12% lands crossed by the Proposed RoW are currently fragmented by previous forestry activities and other linear developments such as roads and the existing M&NE Halifax Lateral Pipeline RoW.

6.6.2 Boundaries

Spatial boundaries for consideration of the Project effects on land use includes lands within and adjacent to the Study Corridor as well as lands outside the Study Corridor that could potentially be affected by the Project during construction and operation.

Temporal boundaries of the Project effects on land use include the construction and operation phases of the Project. Although most of these potential effects are limited to the construction phase, there are some effects such as restrictions on future land use within the RoW that extend for the life of the Project. Some land uses are seasonal in nature (*e.g.,* recreational) and/or may have seasonal sensitivities (*e.g.,* residential, agricultural) with respect to Project activities, which should be considered in Project planning.

6.6.3 Residual Environmental Effects Evaluation Criteria

A **significant adverse environmental effect** on Land and Resource Use (*i.e.,* residential, industrial, commercial, forestry, mining, agricultural and/or recreational land use) is one where the proposed use of land for the Project is not compatible with adjacent land use activities and the proposed use of land for the Project will create a change or disruption that restricts or degrades present land uses such that the activities cannot continue to be undertaken at current or recent levels for extended periods of time and is not compensated.

A **positive** effect occurs when the Project results in enhanced Land and Resource Use for residential, commercial, forestry, agricultural and/or recreational uses.

6.6.4 Potential Interactions, Issues and Concerns

Potential interactions between the Project and Land and Resource Use relate primarily to changes in land use as a result of the Project. Although most of these potential effects are limited to the construction phase, there are some effects such as restrictions on future land use within the RoW that extend for the life of the Project.

Potential effects may include the following:

- minor air and noise emissions during construction;
- short-term traffic increase during construction;
- permanent loss of merchantable forest resource as a result of construction;
- temporary loss of agricultural land and production as a result of construction;
- short-term reduction in access to hunting, fishing, ATV/snowmobile use during construction;
- restrictions on permissible uses of RoW lands during operations; and
- potential increase in ATV/snowmobile trespass along the RoW during operations.

As discussed in Section 2.4.1, air emissions will include dust and exhaust emissions during construction. Control measures, such as use of dust suppression techniques, will be used in construction zones as required to reduce the impacts from fugitive dust. All air emissions will be maintained within the Nova Scotia Air Quality Regulations (*Environment Act*) and *Canadian Environmental Protection Act* Ambient Air Quality Objectives. Air quality effects on land use are therefore not considered further in this analysis. Noise emissions will not exceed the provincial guidelines at the closest residences (refer to Section 2.4.2) and are not expected to affect land use. Noise emissions are also therefore not discussed further in this analysis.

The MEKS identified Mi'kmaq traditional use activities occurring in the Project Site (approximately 10.8 km RoW) as well in various locations throughout the Study Area (5 km radius of Proposed RoW). Based on the information gathered and presented in the MEKS, it was identified that there is a potential that the Project could affect Mi'kmaq traditional use in the area, especially with regards to trout and salmon fishing. For maps of fishing, hunting and gathering areas that are used members of the Mi'kmaq community, refer to the MEKS in Appendix D.

6.6.5 Analysis, Mitigation and Residual Environmental Effects Prediction

Residential, Industrial and Commercial Land Uses

It is not anticipated that any existing residential housing will be directly affected by the Project (*i.e.,* no houses will require relocation). The closest residence is over 300 m away from the Proposed RoW. According to municipal planners, there are no known planned residential developments for the area. Landowners along the RoW will have land agreements negotiated with the Proponent which will serve to secure the easement for the Project and compensate landowners for any loss of use. The negotiated agreement will also include land use/monitoring conditions for the landowner and Alton.

Other potential effects may include temporary or limited access to residential areas during pipeline installation. There is predicted to be a short-term increase in traffic in residential areas for a portion of the construction phase. Alton and its construction contractors will work to reduce

any traffic interruptions and ensure that traffic continuity is maintained. Any increase to traffic will be temporary and is likely to interact with only a small portion of the population due to its isolated location.

There is no predicted interaction with industrial and commercial land uses during construction. Any minor disruptions due to short-term increases or interruptions of traffic flow will be of relatively short duration.

Prior to construction, Alton will negotiate the easement for the pipeline with each affected landowner. These negotiations will include a covenant which places limits on permissible uses of the easement lands associated with the pipelines. For example, the pipeline easement will prohibit landowners from building permanent structures on the RoW.

The presence of the pipeline will not affect current commercial and industrial land use but could affect future development that involves excavation using mechanical equipment or explosives within 30 m of the pipeline. At this time, however, there are no known commercial/industrial developments planned to occur in the immediate Project area.

The operation and maintenance phase of the Project may have an adverse effect on land use as a result of the limits that the presence of the pipeline may have on adjacent or proposed future activities in proximity to the pipeline for the life of the Project. Regular maintenance along the RoW and maintenance of the pipeline are anticipated to result in short-term, minor effects on Land and Resource Use.

There is the potential that the Project itself may enhance industrial and commercial development in the larger study region (*e.g.,* Stewiacke, Colchester County) associated with the storage and potential increased availability of natural gas in the area.

Agriculture and Natural Resource Use

The proposed RoW does not appear to cross property currently being used for agricultural purposes. Therefore there is no predicted interaction with agricultural land uses during construction. It is noted, however, that some agricultural uses (*e.g.*, pasture) can be accommodated within pipeline developments

Approximately 9.39 ha of forested land will be directly affected by the 20 m RoW. As the RoW will be relatively small compared to the overall forest resources available in Colchester County, it is not anticipated that the Project will result in a significant decrease in the merchantable forest resources and forest resource managers will be able to meet the present and future forestry needs in this area. Alton will work with forestry resource owners to salvage merchantable timber that may be affected by Project construction.

Project interactions with agricultural land use during the operations and maintenance phase are predicted to be limited since the presence of the pipeline does not cross through agricultural lands in the area.

The operations and maintenance phase of the Project will not result in environmental effects on natural resource use (*i.e.,* forestry) beyond those resulting from the construction phase. However, as discussed in Section 6.6.5.1, loss of merchantable timber during pipeline construction will be permanent. Forestry use on the pipeline easement during Project operations would be limited to low growing trees (*e.g.,* Christmas tree plantation) as per the easement covenant that will be negotiated between Alton and forestry resource owners.

Tourism and Recreation

Construction of the Project has the potential to interact with recreational land use within the RoW by limiting access where construction activities are occurring. However, these effects are predicted to be minimal since there are no formal trails within the RoW and recreational facilities, including the Stewiacke River Park and ballfields, are located several hundred metres from the RoW. Signage and fencing will be installed around any open excavation to protect public safety.

Although considered trespass, the operation / existence of the RoW may increase ATV/snowmobile traffic along the RoW. Signage, natural barriers and fencing will be used as per landowner agreements with Alton to reduce trespassing along the RoW. There is not likely to be any significant adverse effects on tourism and recreation as a result of Project operations.

Mi'kmaq Traditional Land and Resource Use

The majority of species traditionally harvested by Mi'kmaq are widely available in other areas; however the Mi'kmaq people continue to undertake traditional use activities within the Study Area. These activities included resource use from both land and water.

Based on the information gathered for the MEKS, it is likely that potential Project interactions with traditional land and resource use will be effectively managed through a variety of mitigative measures that are technically and economically feasible. These include mitigative measures described throughout this environmental assessment to protect other VECs that are of concern to traditional use (*e.g.*, vegetation, wildlife, fish and fish habitat). The MEKS recommended that "the traditional use activities of the Mi'kmaq be reflected upon in the overall environmental presentation and any remediation or Project work consider the interest the Mi'kmaq have in the area."

6.6.6 Follow-up and Monitoring

Environmental/Construction Inspectors working on behalf of Alton will monitor construction to ensure commitments made in landowner agreements are upheld by the construction contractor (see Section 2.2.2). In addition, within the Environmental Management Plan (EMP), Alton will develop an Issues Resolution System which will include a procedure to deal with Project-related complaints/issues from landowners and/or the public. This procedure will ensure complaints are recorded, tracked and resolved in a timely manner. This procedure will also monitor

commitments made to landowners. Specific issues identified through this process may require follow-up and/or monitoring.

6.6.7 Summary of Residual Environmental Effects Assessment

Assuming the implementation of the recommended mitigation measures (including compensation for land easements), there are not likely to be any significant adverse environmental effects on Land and Resource Use as a result of the Project.

The government and public review public review process of the candidate 12% protected lands is currently ongoing. It is the Proponent's view that investigations related to the proposed pipeline development preceded this process and the area currently supports the M&NE Halifax Lateral. This EA report demonstrates the Proponent's commitment to mitigate potentially adverse environmental effects. The Proponent believes that the proposed pipeline can be developed in a manner that is consistent with the conservation objectives of the Province (whether or not the lands are officially designated under the 12% program).

It is predicted that the Project may result in substantial socioeconomic benefits in the larger study region (*e.g.,* Stewiacke, Colchester County) associated with the storage and potential increased availability of natural gas in the area. The Project will also result in provincial benefits by advancing Nova Scotia energy policy.

6.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

6.7.1 VEC Identification

For the purposes of this assessment, archaeological and heritage resources are defined as physical remains that inform us of the human use of and interaction with the physical environment. These resources may be above and below the ground and cover the earliest prehistoric times to the relatively recent past. Archaeological and heritage resources are included as a VEC in this assessment in recognition of the interest of potentially affected Mi'maq people, the general public as a whole, and provincial and federal regulatory agencies in ensuring the effective management of these resources. An archaeological resource is a work of past human activity, or zoological, botanical, geological, or other natural materials found in association with such activity, that:

- is primarily of value for its prehistoric, historic, cultural, or scientific significance; and
- lays on, or was buried or partially buried in land in the province, including land covered by water (Nova Scotia *Special Places Protection Act*).

Heritage resources are generally considered to include historic period sites such as cemeteries, heritage buildings and sites, monuments, and areas of significance to Aboriginal peoples and other groups. Prehistoric refers to the time before the arrival of non-Aboriginal peoples.

Archaeological and paleontological resources in the province of Nova Scotia are protected under the Nova Scotia *Special Places Protection Act* administered by the Nova Scotia Museum of Natural History. Sites considered to be valued as archaeological or paleontological resources may not be disturbed except under strictly controlled conditions imposed by terms of a Heritage Research Permit. The Nova Scotia Museum is also responsible for approving or modifying recommended mitigation measures.

Information regarding archaeological and heritage resources within the Project area was gathered from a variety of sources including: through archival research, examination of archaeological resources files at the Nova Scotia Museum, air photo interpretation, and an archaeological site survey by a qualified archaeologist on July 2006 and May 2011.

An MEKS was conducted for this Project and includes: a review of historic and current Mi'kmaq land and resource use in the vicinity of the proposed Project; a Mi'kmaq Species of Significance Survey; a discussion of potential impacts of the Project on Mi'kmaq land and resource use; and recommendations for further action or mitigation. Further details are included in Section 6.6.

6.7.2 Boundaries

Spatial boundaries for the assessment of archaeological and heritage resources include the pipeline Study Corridor with particular attention to the area immediately adjacent to the Proposed RoW.

Temporal assessment boundaries consider that ground disturbance associated with construction will be short-term. However, any potential adverse effect on archaeological and heritage resources will be permanent, as no archaeological site can be returned to the ground in its original state.

6.7.3 Residual Environmental Effects Evaluation Criteria

A **significant residual adverse environmental effect** on archaeology and heritage resources is one where the disturbance to, or destruction of, an archaeological or heritage resource (including paleontological resources) that is considered by the provincial heritage and archaeological regulators to be of major importance due to factors such as rarity, undisturbed condition, spiritual importance, or research importance, and is an effect that cannot be mitigated.

A **positive** effect is one that results in enhanced understanding of local, regional, or cultural heritage through increased knowledge, or provides physical protection for a site that might otherwise have been destroyed through natural or non-Project anthropogenic events, in the absence of the Project.

6.7.4 Potential Interactions, Issues and Concerns

Activities associated with Project construction (*e.g.*, site preparation and pipeline installation) will cause surface or subsurface disturbances that could affect archaeological and heritage resources sites. These disturbances, if unmitigated, could result in the loss of the resource and the potential knowledge to be gained from its interpretation. The RoW intersects with high potential archaeological areas near the Stewiacke River (see Section 5.8).

6.7.5 Analysis, Mitigation and Residual Environmental Effects Prediction

The development of the Project and related facilities will involve ground disturbance, which could affect any archaeological or heritage sites that may exist within the zone of surface or subsurface disturbance. The Phase 1 Archaeological Impact Assessment and pedestrian survey identified the banks of the Stewiacke River as having a high potential for containing First Nation's archaeological resources. Based on the findings of the pedestrian survey a shovel testing program was conducted on the proposed crossing area. All of the shovel tests were negative and it is recommended that no further archaeology is necessary for the Project to proceed.

Given the potential to discover previously unknown archaeological resources, Alton will develop and implement an Archaeological Contingency Plan as part the Emergency Response and Contingency Plans. This Plan will include procedures for notification (*e.g.*, Curator of Archaeology at Nova Scotia Museum), requirements for work stoppage and conservation of resources. Worker awareness training will address archaeological resources and relevant procedures.

6.7.6 Follow-up and Monitoring

Assuming that recommended mitigative measures are implemented, no follow-up and monitoring is recommended.

6.7.7 Summary of Residual Environmental Effects Assessment

The development of the Project and related facilities will involve ground disturbance, which could affect any archaeological or heritage sites that may exist within the zone of surface or subsurface disturbance. Assuming that recommended mitigative measures are implemented, the overall residual environmental effect of the Project on archaeological and heritage sites is not likely to be significant for construction and operation.

With new information being gathered and made available to researchers, communities, regulators, and other stakeholders, the potential overall effect could be seen as positive.

7.0 MALFUNCTIONS AND ACCIDENTAL EVENTS

7.1 INTRODUCTION

The focus of the assessment of Project-related malfunctions and accidents is on those events considered credible in the context of the Project. Such events are considered to have a reasonable probability of occurring and may have an adverse environmental effect or consequence.

Malfunctions and accidental events that have been identified as requiring specific assessment include:

- spills of fuel or hazardous materials; and
- pipeline rupture resulting in explosion and/or fire (*i.e.,* forest fire).

Hazardous material from equipment maintenance (*i.e.*, oil or fuel spill) could accidentally spill into the nearby environment. Spills would be limited to relatively small quantities, typically broken hydraulic systems or small amounts of spilled fuel from construction or maintenance vehicles or equipment. At most, up to 200 L of diesel fuel (one drum) could be expected to spill. Spills could also result from the proposed HDD process at the Stewiacke River. In the unlikely event that such a spill should occur, a Spill Management Plan and Emergency Response and Contingency Plans will be in place to quickly address environmental risks. For example, these Plans would specify clean-up materials to be kept on site as well as clean-up procedures, notifications and worker training.

There is a possibility of mechanical failure of the pipeline. This could result in high pressure gas escaping into the atmosphere. Since natural gas is lighter than air, the gas would rise upward and dissipate. Wind would affect the area of dissipation. The natural gas (methane) meets pipeline specifications, and therefore will not include hydrogen sulphide. If the escaping gas were to ignite, this could cause a localized explosion and fire. A custody transfer metering station will be constructed at the tie-in point of the 16” to 24” steel gas pipeline and the 12” M&NE Halifax Lateral. This station will measure and control the natural gas flow to and from the storage cavern system. An ESD (Emergency Shutdown) system will allow for the isolation of the Alton Gas Pipeline in case of an emergency. Automatic ESD valves will be located at both the custody transfer meter station and at the storage site. This ESD system may be activated by local controls, by remote signals from the Alton cavern site facilities, or by remote signals from the Maritimes & Northeast pipeline control centre. Equipment will be housed in a lockable building and the site facilities will be fenced.

7.2 ASSESSMENT OF MALFUNCTIONS AND ACCIDENTAL EVENTS

The objective of this assessment is to determine if any malfunction or accidental event could be expected to result in a residual environmental effect considering Project-specific features that

would be available to prevent or control the occurrence itself, as well as to mitigate possible effects of the event. Proposed environmental and safety protection systems are described in Section 2.5. These include measures to mitigate effects of regular construction and operation activities but also encompass management measures to address malfunctions and accidental events (*e.g.*, ESD system, Emergency Response and Contingency Plans). A Hazardous Operations (HAZOPS) review by knowledgeable engineering, operations, safety and environmental design personnel will be performed on the project design after it is largely complete, to further identify hazards due to the implementation and operation of the pipeline. The final design and the operating procedures will include any mitigative corrections arising during that review.

All of the identified malfunction and accident scenarios are of a temporary nature and short duration. With the Project-inherent effect management measures (Section 2.7 and 2.8), malfunctions and accidental events are expected to be rare events and the consequences short-term and subject to immediate clean-up and corrective measures, if required. Public health and safety as well as the VECs that are likely to be affected by accidents and malfunctions are discussed below.

7.2.1 Public Health and Safety

Public health and safety is identified as a public concern and there is potential for the Project to result in adverse effects to the health and safety of the general public.

Due to stringent regulatory requirements associated with the Project design and the comprehensive health and safety policy and procedures adopted for the Alton Project, public health and safety interactions are not expected to result from normal construction and operation and maintenance activities. The only substantive Project interactions with public health and safety would likely be as a result of malfunctions or accidental events.

One of the most significant factors contributing to the safety of pipelines in Canada is the mandatory requirement by all Canadian jurisdictions that the design and operation of pipeline facilities be conducted in accordance with the requirements of the 2011 edition of CAN/CSA Z662 – Oil and Gas Pipeline Systems. The Technical Committee responsible for this standard investigates every pertinent incident worldwide and reviews the latest relevant technology, to ensure that the standard covers all potentially hazardous situations.

Potential environmental effects to public health and safety from an accidental release of natural gas will be mitigated by meeting CSA Standard CAN/CSA Z662 and by implementing Emergency Response and Contingency Plans. Key elements of these Programs have been highlighted in Section 2.8 (Environmental and Safety Protection Systems).

Potential environmental effects to public well-being would likely be limited to persons in the immediate vicinity of the Study Corridor. Open communication with the public, continued public education on the Project and public participation in the consultation process are means to address public concern regarding safety. A dialogue with potentially affected landowners has

been initiated through promoting the open house on the Project, and follow-up by land agents (as described in Section 3.0).

Fires during the Project construction and operations and maintenance phases could have potential environmental effects to public health and safety. Potential environmental effects during the construction phase would result from the fires caused by the equipment and/or materials in construction, and/or forest fires caused by construction activities throughout the Project area. Potential environmental effects during the operations and maintenance phase would result from the unplanned ignition of the natural gas released to the environment in an uncontrolled fashion from a pipeline rupture or leak.

There are two main potential causes of a pipeline rupture and loss of containment, including mechanical contact during third party construction activities and corrosion. Mechanical contact occurs when a construction crew digging for another project is not aware of the existence of the pipeline, and inadvertently strikes it with excavation equipment. Signs will be installed along the route advising of the presence of this high pressure gas pipeline, operator inspections will note construction activity in the area, and the public (particularly nearby residents) will be made aware of the existence and potential danger of the pipeline. Also the local “Call Before You Dig” system will be activated and aware of the line location. These measures will reduce the likelihood of such an incident. Corrosion will be controlled by the use of pipeline coatings, impressed current cathodic protection systems with annual inspections for proper operation, and proper design and installation techniques. The natural gas in the pipeline is non-corrosive, so the only corrosion issue is external. The above measures will provide suitable protection against pipeline rupture.

Alton will have fire prevention and response procedures in place as described in Section 2.8. Because of the potential risk of an on-site leak or rupture and associated fire/explosion to staff that could be present in the immediate vicinity of the event, the potential adverse effects for public health and safety are considered significant. Such a significant effect; however, is considered highly unlikely as demonstrated by the extremely low historical probability.

The potential for significant environmental effects on health and safety due to accidents, malfunctions or unplanned events would require a large release of natural gas resulting in a fire. A major accident, such as a release of gas and fire due to a mechanical failure, is highly unlikely, given:

- the exemplary safety record of CAN/CSA Z662 – Oil and Gas Pipeline Systems and
- the Environmental and Safety Protection System and associated Emergency Response and Contingency Plans.

Given these provisions, it is highly improbable that a fire or explosion of substantial size will occur. Therefore, residual adverse environmental effects of malfunctions or accidental events on public health and safety could be significant, but are very unlikely.

7.2.2 Groundwater Resources

Malfunctions or accidents during any of the Project phases could have some adverse effects on groundwater resources. These may include spills of hazardous materials during pipeline construction and operation, gas leaks during operation, and the use of firefighting chemicals to fight fires.

Accidental releases of petroleum hydrocarbons or other compounds or release of firefighting chemicals could theoretically degrade local and down-gradient groundwater quality to below acceptable criteria specified by the Guidelines for Canadian Drinking Water Quality (Health Canada 1996). The significance of an accidental release would depend on the chemical characteristics and volume of the release, the proximity to wells, and hydraulic properties of the aquifer affected. For example, a spill in an area of thick, poorly permeable soil is less likely to affect aquifers or down-gradient wells than a spill in an area of highly permeable overburden or permeable fractured bedrock.

Several mitigative measures can be applied during the construction and operation stages to prevent release of hazardous substances to the environment. In the event of a spill(there won't be a natural gas spill) , and depending on the size and type of spill, the contractor or operator would be expected to:

- notify NSE for spills exceeding reportable quantities;
- carry out emergency clean-up and/or isolation of the release; (not applicable to natural gas releases) sweet natural gas pipeline!
- carry out hydrogeological assessment of contaminant fate and mobility if wells are at risk; (not applicable to natural gas releases)
- install down-gradient groundwater monitoring between the source and any receptors (wells, streams) or receptors, depending on distance; (not applicable to natural gas releases) and
- provide treatment or replacement of affected water supply, if required. (not applicable to natural gas releases)

Emergency response measures will be described in detail in the Emergency Response and Contingency Plan.

No significant residual environmental effects to Groundwater Resources due to accidental releases during construction and operation are anticipated, provided that the above mitigation measures are followed. Any water supply wells or springs permanently affected by groundwater flow diversion, accidental release of hazardous material, or blasting damages will be replaced to correct the problem.

7.2.3 Fish and Fish Habitat

Malfunctions or accidents during any of the Project phases could cause adverse effects on surface water resources if these occurred close to watercourses. These could occur from spills of hazardous materials during pipeline construction and operation and from the use of firefighting chemicals. Spills that could reasonably be expected to occur would typically be limited to relatively small quantities.

Accidental releases near or into fish bearing waters could cause a degredation of fish habitat and possible fish mortality. The severity of an accidental release would depend on the chemical characteristics and volume of the release, the proximity to a watercourse, and hydraulic properties of the aquifer between the spill site and the watercourse.

Relatively small amounts of fuel and hydraulic fluid spilled during equipment operation are the most likely types of accidental releases of hazardous materials. During most spills of this kind, construction equipment would not be operating near the stream. Several mitigative measures can be applied during the construction and operation stages to further reduce the release of hazardous substances to the environment. In the event of a serious release, the following will occur as applicable:

- notify NSE if release exceeds reportable quantity for the material;
- immediately notify any downstream water supply authorities; (not applicable to natural gas releases)
- carry out emergency clean-up and/or isolation of the release; (not applicable to natural gas releases)
- carry out hydrogeological or hydrological assessment of contaminant fate and mobility if water supplies are at risk; (not applicable to natural gas releases)
- install down-gradient monitoring between the source and any downstream receptors; (not applicable to natural gas releases) and
- provide monitoring, treatment, or replacement of the affected water supply, if required. (not applicable to natural gas releases)

In order to reduce the potential for discharge of hazardous materials into watercourses the maintenance and cleaning of mobile construction equipment, including refueling, will not be carried out within 30 m of watercourses.

Since there exists a potential for significant adverse effects in the event of a major accident or release of a hazardous liquid, a contingency and emergency response plan is required. A Spill Management Plan and Emergency Response and Contingency Plan will be prepared prior to construction. These Plans will also be filed by Alton with the Nova Scotia UARB prior to construction.

Adverse effects could occur from firefighting foams and other accident response activities (not applicable to natural gas releases, except for forest fire fighting and for pipeline repair construction). However, these effects would be naturally mitigated over time, and would likely only temporarily affect the immediate area. Due to natural flushing processes, the watercourse would likely return to normal soon after repairs were completed.

Significant residual environmental effects on surface water resources due to malfunctions and accidents are predicted to be low, provided accidental releases or pipeline leaks are discovered early through routine monitoring and maintenance and are remediated or repaired in a timely manner.

Releases of Drilling Fluids or Hydrocarbon Spills

Drilling fluid used during the proposed HDD process is composed of two basic elements: water and clay particulates. The clay particulate component typically consists of bentonite. The bentonite and water mixture acts to lubricate and cool the drill head, seal and fill the pore spaces surrounding the drill hole, prevent the bore hole walls from collapsing inward, and suspend cuttings (native soil removed during the boring process) within the drill hole.

During typical HDD operations, some drilling fluids are absorbed by the lateral and subterranean fractures within the formation. This is a fairly normal occurrence during HDD operations that does not necessarily mean the drilling fluid is rising to the surface or migrating great distances from the borehole. However, it is possible that drilling fluids may reach the surface by following a vertical fracture in the formation. This event is commonly referred to as a hydro-geologic fracture (frac-out).

The released drilling fluids may contain a lower concentration of bentonite when they surface because they can be filtered as they pass through certain types of ground material such as sandy soils. Materials used to control a frac-out may include straw bale, straw waddle, silt fence, and gravel bag. These materials will be kept at the boring site in quantities sufficient to contain a 15 m perimeter around a frac-out.

The release of drilling fluid from fractures in the earth's surface may be terrestrial or aquatic in nature and vary in quantity. Terrestrial frac-outs occurring in upland areas are typically simpler to contain and therefore result in relatively minor effects to the surrounding environment. Frac-outs occurring in aquatic environments are more difficult to contain primarily because bentonite readily disperses in flowing water and quickly settles in standing water.

During drilling operations, Alton will conduct visual inspections along the bore path of the alignment.

Frac-out procedures will be detailed and documented in a Spill Management Plan and Emergency Response and Contingency Plan.

A spill of hydrocarbons associated with equipment involved in construction and maintenance of the pipeline could cause a variety of adverse effects on fish and fish habitat in the watercourses encountered by the Project. Spill prevention is the most important step in preventing these potential effects. Prevention is based on effective and well-planned procedures and maintenance of equipment. Spills that could reasonably be expected to occur would be limited to relatively small quantities.

In the case of a minor spill, cleanup efforts would begin immediately in accordance with the Spill Management Plan and the Emergency Response and Contingency Plans.

General mitigative measures to avoid the releases of toxic chemicals are as follows:

- limiting areas of disturbance and situating temporary ancillary elements at least 30 m from watercourses;
- equipment/vehicles working within 30 m of a watercourse will be inspected to identify potential sources of hydrocarbon leaks and any defects corrected before work commences;
- wastewater from washing equipment will not be released within 30 m from a watercourse;
- fuel storage and designated fuelling areas will be located at least 30 m from watercourses and wetlands;
- storage of hazardous materials will not occur within 30 m of watercourses.
- refuelling and equipment maintenance required in the field will not be undertaken within 30 m of a watercourse or wetland;
- storage of all hazardous materials will comply with WHMIS requirements, and appropriate material safety data sheets will be located at the storage site.

Based on the nature of materials used during construction and small quantities, mitigation and contingency planning, residual environmental effects due to accidental spills or frac-outs are considered to be not significant.

7.2.4 Rare Vascular Plants

During the construction phase of the Project, plant species of conservation interest, particularly those growing in wetlands or aquatic habitats, could be adversely affected by accidental discharges of fuel or other hazardous materials. Spills associated with construction activity are typically small; however, since the distribution of rare plant populations is generally highly localized, there is a remote possibility that a spill could have an adverse effect on a local population. Mitigative measures to prevent or manage spills should include:

- providing an adequate level of environmental awareness among contractors and workers;
- incorporating site-specific mitigative measures into contract specifications and providing strict on-site control and inspection programs (*i.e.*, with regard to specific locations of plant species of conservation interest);

- maintenance of equipment and machinery in good working order and monitoring for leaks of fuel, lubricants, and other fluids;
- storage of fuels, lubricants, and other hazardous substances in designated areas away from watercourses and wetlands and other areas where plant species of conservation interest are known to be present; and
- implementation of hazardous materials management plans and contingency plans to deal with accidental spills.

Forest fires resulting from careless brush burning, disposal of smoking materials, or pipeline rupture could also adversely affect plant species of conservation interest along the route. A fire would have a significant adverse effect on a plant species of conservation interest population only if it affected a significant proportion of the provincial population. This would require a very large fire or a species that is concentrated in only a few locations. Given that Nova Scotia has well developed forest firefighting capabilities, and that all of the plant species of conservation interest potentially affected by the Project occur in a number of locations in the province, it is unlikely that the provincial population of any rare species would be significantly adversely affected by forest fire. Nevertheless, all reasonable efforts will be made to reduce the probability of a forest fire and the magnitude of any fire that does occur. Mitigative measures to accomplish this goal will include:

- training of personnel in firefighting techniques and the provision of firefighting equipment; and
- implementation of Emergency Response and Contingency Plans for forest fires (see Section 2.8.5).

7.2.5 Wildlife and Wildlife Habitat

Various materials that are potentially toxic to wildlife are necessary to operate heavy equipment required during construction of the pipeline, including: fuels, lubricants, solvents, windshield washer fluid and antifreeze. There is the possibility that these materials could be introduced to wildlife habitat through an accidental spill. The magnitude and spatial extent of impacts is dependent on the location, time of year and severity of the event. In the event of a spill, cleanup efforts would begin immediately in accordance with the Spill Management Plan and Emergency Response and Contingency Plans and contaminated soil and/or water would be remediated to the appropriate standards. Further information on spill prevention and response is provided in Section 2.8 and Section 7.0.

Forest fires along the Proposed RoW could occur during any phase of the Project due to human activities or lightning. A forest fire has the potential to destroy wildlife habitat and cause direct mortality of wildlife species, particularly smaller species with a limited ability to flee fast-moving fires. However, forest fires are often natural events, and periodic burns can contribute to overall forest health. After a fire burns down a swath of woodland, a sequence of ecological succession begins. While the ecological effects and benefits of regular forest fire are debated among

terrestrial ecologists and managers, terrestrial ecosystems of the Proposed RoW would eventually recover from forest fires. Factors influencing the severity of environmental effects include time of year, extent of fire damage and type of fire.

Overall, the residual environmental effect on wildlife and wildlife habitat from malfunctions and accidents is predicted to be not significant.

7.2.6 Wetlands

During construction, wetlands crossed by the Proposed RoW or downstream of a water crossing site could be affected by accidental discharges of fuel, lubricants, hydraulic fluids, or other hazardous substances. Various factors would determine the degree to which wetland ecosystems would be affected by spills, including the quantity of material spilled, its toxicity and solubility, the location of the spill, the interspersion of open water and vegetation in the affected wetland, and the growth form of the plants in, or adjacent to, open water. Spills could cause degradation of water quality and mortality of affected plants or wildlife.

In order to reduce the potential for discharge of hazardous materials into wetland systems, the maintenance and cleaning of mobile construction equipment, including refueling, will not be carried out within 30 m of watercourses or wetland habitat. Additional mitigative measures which will be followed to prevent spills and reduce their effects include:

- Maintaining an adequate level of environmental awareness by contractors and workers.
- Maintaining equipment and machinery in good working order and monitoring for leaks of fuel, lubricants, and other hazardous substances.
- Storing fuels, lubricants, and other hazardous substances in designated areas outside of wetland buffer zones.
- Stockpiling potentially hazardous construction materials away from wetland areas.
- Implementation of Spill Management Plan and Emergency Response and Contingency Plan.
- Storage of spill kits within each vehicle that accesses Project areas.
- Education of contract workers on the monitoring of spills, the application of spill kits, and how to respond to spill situations to reduce contamination.

Accidental discharges of fuel, lubricants, or hydraulic fluids during construction are unlikely to significantly affect wetlands since the amount of these substances spilled in a wetland would be small and environmental effects of accidental spills generally reversible. The time required for wetland systems to recover would depend on several factors, including the type and amount of material spilled, and the type of wetland affected.

Forest fires started as a result of careless burning of brush, disposal of smoking materials, or ignition of a gas leak could affect wetland habitat. However, wetlands are relatively resistant to

fire compared to surrounding forest habitats and the extent to which they may be affected is dependent on the size of the fire and the character of the wetland. Small treed swamps surrounded by forest habitat would be most susceptible to fire, while large untreed wetlands with a high interspersion of open water and vegetation would be less susceptible. Mitigative measures to prevent fires and reduce their potential influence include:

a) Training of personnel in firefighting techniques and provision of firefighting equipment.
b) Regular inspections of the pipeline.
c) The development of contingency plans to deal with leaks, fire, and explosion.

Overall, the residual environmental effect on wetlands from malfunctions and accidents is predicted to be not significant.

7.2.7 Land and Resource Use

Uncontrolled release of hazardous materials spill has the potential to interact with soils and water supplies. These accidental spills could cause loss of crops, timber and property damage.

Spills would typically be limited to relatively small quantities. It is expected that the volume of spilled chemicals or a hazardous material will be less than about 200 L (*i.e.,* one drum). Cleanup efforts would begin immediately in accordance with the Spill Management Plan and Emergency Response and Contingency Plans and contaminated soil and/or water would be remediated to the appropriate standards. Communications with potentially affected landowners is also an important part of addressing the situation. Landowners would be compensated for any long term effects including loss of water supply and agricultural capacity.

8.0 SUMMARY AND CONCLUSIONS

This EA describes and evaluates the potential environmental and socio-economic effects of the Project during all Project phases. The evaluation has included proposed mitigative measures, where required, to reduce or eliminate potential significant impacts arising from Project-related activities. The report is based on information collected during field surveys, modeling, consultation with government and non-government agencies and individuals, background research (including an MEKS report) and professional judgment of the Study Team.

A scoping process was undertaken to identify the VECs most appropriate for this assessment. This scoping included: regulator and stakeholder consultation; regulatory issues and guidelines; research; and professional judgment.

The following VECs were selected for the assessment:

- Groundwater Resources
- Fish and Fish Habitat;
- Rare Vascular Plants;
- Wildlife and Wildlife Habitat;
- Wetlands;
- Land and Resource Use; and
- Archaeological and Heritage Resources.

Each of the VECs selected for the assessment was evaluated for potential interactions between the VEC and Project activities during all Project phases (*i.e.*, construction, operation and maintenance). Malfunctions and accidental events that may occur were assessed separately. These interactions were evaluated for potential significance after application of technically and economically feasible mitigative measures, where appropriate, to reduce or eliminate potential adverse Project-related environmental effects. Environmental monitoring and follow-up measures will be undertaken, where necessary, to ensure compliance with applicable regulations, standards, and guidelines, as well as to verify impact predictions and refine mitigative measures, where required.

In conclusion, the Alton Natural Gas Pipeline Project is not likely to have significant adverse effects on the environment. Adverse environmental effects will be reduced to acceptable levels through the use of technically and economically feasible design and mitigative measures. Some positive effects from the Project are likely, particularly those related to increased economic activity and provision energy infrastructure to enhance the reliability and security of provincial and regional energy supplies.

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