9.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Section 2(1) of *CEAA* defines effects of the environment as any change to the project that may be caused by the environment. Typically, the potential for such effects is a function of project planning, infrastructure design and the influences of nature (*e.g.*, natural hazards, climate change and weather events). The severity of the effects may be moderated or amplified depending upon general site characteristics, such as topography, landform, altitude, exposure, *etc.*

In general, environmental conditions that can affect the Maritime Link Project infrastructure or operations will be addressed through engineering design and industry standards. Project longevity and long-term environmental management are inherent considerations during all aspects of the development process. In particular, loadings and stresses originating from environmental causes are incorporated into detailed engineering design.

The environmental conditions posing a significant risk to the integrity of the Project were determined based upon (i) the level of occurrence and the severity of the potential effects (*i.e.*, risk) and (ii) a review of those conditions in the past and how they are predicted to change in the future (*e.g.*, potential effects of climate change). Based on the issues and concerns identified, the following environmental attributes were selected for consideration:

- Geophysical hazards including:
  - slope instability;
  - geotechnical considerations;
  - karst topography; and
  - seismic events.
- Climate effects including:
  - extreme weather; and
  - climate change.
- Wildfires.
- Marine hazards including:
  - ice bergs/ pack ice;
  - ocean currents;
  - seismic activity and tsunamis; and
  - seabed physiography and geology.

A significant adverse residual effect of the environment on the Project is defined as one that results in any of the following:

- a substantial change in the project schedule (*e.g.*, a delay resulting in the construction period being extended by one season);
- damage to the project infrastructure resulting in a substantial increase in risk to public health and safety;
- damage to the project infrastructure resulting in repairs that are not technically or economically feasible; and/or
- failed mitigation causing environmental damage that cannot be technically or economically corrected or compensated in a feasible manner.

9.1 GEOPHYSICAL HAZARDS

Geophysical hazards including slope instability, karst topography, geotechnical faults, and seismic events can damage or destroy Project infrastructure as well as pose a safety risk to personnel involved in construction, operation, and maintenance activities. Each of the hazards and associated mitigation measures are outlined below.

9.1.1 SLOPE INSTABILITY

Landslides are defined as the movement of rock or sediment down a slope (NRCan 2009) and can be land-based or submarine. Major landslides occur less frequently in the Atlantic Provinces than in other regions of Canada; however, landslides do occur in Nova Scotia, with the Cape Breton Highlands being the most susceptible area due to deep gorges and steep cliffs (Wahl *et al*. 2007, Liverman *et al*. 2004).

9.1.1.1 Potential Project Interaction

Landslides could cause Project components (*e.g.*, tower foundations) built on grades to fail as a result of soil movement, or components could be indirectly affected as a result of falling debris.

9.1.1.2 Mitigation Measures to Minimize Environmental Impacts on the Project

Detailed geotechnical investigations and methods and materials to be used at each location. The construction of landslide barriers and catch ditches in unstable areas will be used so that debris is contained before impacting infrastructure.

9.1.2 GEOTECHNICAL CONSIDERATIONS

Geotechnical stability of areas designated for facility construction must be determined and incorporated into final site planning and design to prevent damage to substation components, transmission structures and power lines.

9.1.2.1 Potential Project Interaction

Unstable ground conditions associated with bogs and wetlands could affect equipment and components leading to structural failure and hazards to workers on the site and members of the public in the vicinity. For example, transmission structures could collapse if they are placed on unstable ground.

9.1.2.2 Mitigation Measures to Minimize Environmental Impacts on the Project

Detailed geotechnical investigations and assessments will be undertaken before construction to determine the stability and composition of the soil and underlying geology, the results of which will be factored into site-specific design and site preparation before construction commences. Construction may include additional stabilizing measures such as replacing *in-situ* materials to increase stability, sub-base preparation, and the use of guy-wires, as required.

9.1.3 KARST TOPOGRAPHY

Karst is a distinctive type of topography in which the landscape is largely shaped by the dissolving action of water on carbonate bedrock (usually limestone, dolomite or marble). This geological process, occurring over many thousands of years, results in unusual surface and subsurface features ranging from sinkholes, vertical shafts, disappearing streams, and springs, to complex underground drainage systems and caves. This type of topography is known to occur in Cape Breton.

9.1.3.1 Potential Project Interaction

Unstable ground conditions associated with sinkholes could affect equipment and components leading to structural failure and hazards to workers and the general public. For example, transmission structures could collapse if they are placed on unstable ground.

9.1.3.2 Mitigation Measures to Minimize Environmental Impacts on the Project

For most of the route the new transmission line will follow an existing transmission corridor. In addition, detailed geotechnical investigations and assessments will be undertaken before construction to determine the stability and composition of the soil and underlying geology. NSDNR will also be engaged to provide information on the known location of karst landforms that might need to be avoided or which would require specific mitigation measures.

9.1.4 SEISMIC EVENTS

Most seismic events, including earthquakes, are caused by shifting of the earth’s crust and tectonic plates. Eastern Canada is located in a stable continental region within the North American Plate and, as a consequence, has a relatively low probability of earthquake activity. However rare, large and damaging earthquakes have occurred here in the past and may occur in the future.

Approximately 450 earthquakes occur in eastern Canada each year. Of these, an average of four will exceed magnitude 4, and thirty will exceed magnitude 3. A seismic event that is greater than magnitude 5 can be anticipated 3 times per decade, on average. A magnitude 3 event can be felt in the immediate area near the centre of the quake, and a magnitude 5 event is considered the threshold for damage (NRCAN 2011).

9.1.4.1 Potential Project Interaction

Seismic events can cause direct damage to the Project infrastructure through shaking and vibration. Structural damage could also be indirectly caused by geotechnical instability. Structural failure of various Project components could also cause a hazard to workers and members of the public in the vicinity.

9.1.4.2 Mitigation Measures to Minimize Environmental Impacts on the Project

To reduce the impact on Project infrastructure, Project components will be designed and installed according to relevant CSA design and National Standards of Canada for local seismic risk (*e.g.*, CAN/CSA-S832-06 (R2011) - Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings). Where required, the construction of landslide barriers and catch ditches in unstable areas will be used so that debris is contained before impacting infrastructure.

9.2 CLIMATE EFFECTS

9.2.1 EXTREME WEATHER

Extreme weather events such heavy wind, precipitation, freezing rain, ice formation, and lightning strikes can occur year round in Atlantic Canada and could potentially have adverse effects on the Project infrastructure and personnel during construction and operation and maintenance.

The thirty-year climatic normals (EC 1971-2000) for Sydney, NS and Port aux Basques, NL based on EC’s climate database (EC 2012b, EC 2012f) are presented below.

In Sydney, average maximum daily temperatures range from -1.9 ºC in February to 22.7 ºC in August, while minimum daily temperatures range from -11.6 ºC in February to 12.6 ºC in August. Extreme temperatures range from 35.5 °C to -27.7 °C. Average monthly precipitation ranges from 86.8 mm in July to 151.8 mm in January, with an annual average precipitation of 1,504.9 mm per year. Extreme daily precipitation has been recorded up to 128.8 mm (EC 2012b).

Average monthly wind speed ranges from 15.1 km/hr in August to 21.3 km/hr in January, with maximum recorded wind gusts up to 161 km/h (EC 2012b).

In Port aux Basques, average maximum daily temperatures range from -13.0 °C in February to 18.3 ºC in August, while minimum daily temperatures range from -9.8 ºC in February to 11.7 ºC in August. Extreme temperatures range from 30.0 °C to -26.1 °C. Average monthly precipitation ranges from 113.9 mm in March to 150.8 mm in October, with an annual average precipitation of 1,569.5 mm per year. Extreme daily precipitation has been recorded up to 111.4 mm (EC 2012f).

Average monthly wind speed ranges from 17.5 km/hr in August to 32.3 km/hr in January, with maximum recorded wind gusts up to 161 km/h (EC 2012f).

Tropical cyclones are intense low pressure systems that form in tropical waters and can occasionally affect weather in areas as far north as Newfoundland and Labrador. Nova Scotia experiences tropical cyclones from June to November, with the most active months being August, September, and October (EC 2009). Since 2000, five hurricanes have made landfall in Nova Scotia or have passed close to shore. The most notable of these were Hurricane Juan (2003), Hurricane Gustav (2002), and Hurricane Earl (2010). Hurricane Gustav, which tracked over southern Cape Breton with winds over 100 km/h, caused power outages, road washouts and coastal flooding (EC 2010a).

Refer to Section 4 for more detail on climate in Newfoundland and Labrador and Nova Scotia.

9.2.1.1 Potential Project Interaction

There are a variety of ways in which extreme weather events can interact with the Project, some of which include those described below.

- During construction, high winds may result in work stoppages for operational or safety reasons, and could limit access. Airborne debris could interact with the cables, causing damage and potential power outages.
- During operation, high winds could add sufficient force on transmission towers and wires to cause structural damage.
- Lightning strikes could cause damage to Project equipment and injury or death to workers.
- Extreme rain events can result in stoppages of outdoor work when it creates unsafe working conditions. It is normal operating practice to conduct work risk assessments prior to the commencement of work.
- Wind and freezing rain can cause ice to build up on one side of the transmission cable thereby interfering with air flow and resulting in an undulating motion of the cable (known as galloping). This motion can induce strain on the cable and associated structures, and may result in a structural damage and outages.

- Freezing rain could lead to ice build-up (*e.g.*, melting conditions after snowfall) affecting operation as Project components may not bear the additional load.
- Breakage of ice buildup can cause potentially damaging vibrations to the cable.
- Ice debris falling from the lines or towers may damage other Project components or nearby structures.

9.2.1.2 Mitigation Measures to Minimize Environmental Impacts on the Project

A variety of mitigation measures will be implemented to offset any negative effects of extreme weather on Project infrastructure and personnel, including those described below.

- Project components will be designed and installed according to relevant CSA design standards and National Standards of Canada (*e.g.*, CAN/CSA-C22.3 No. 1-10 - Overhead Systems and CAN/CSA-C22.3 No. 60826-10 - Design Criteria of Overhead Transmission Lines).
- Work risk assessments are conducted prior to the commencement of work. At-risk work will be suspended during weather events where lightning is a known possibility, and where risk to workers is identified.
- The design and installation of Project components will take into account the potential risk indicated by meteorological data (*e.g*., tower cable sag allowance will consider typical ice loads).
- Rain is an expected work condition and the construction schedule will allow for reasonable rain delays for relevant work activities. The EMP will include provisions for site drainage; sedimentation and erosion control will be designed to withstand extreme rain so that facility structures are not put at risk.
- Erodible soils on the construction sites will be mitigated using appropriate site drainage and sedimentation control measures. Contractors will use the principles of erosion and sedimentation control detailed in Section 2.6.7 at all sites where soil or sub-soil has been exposed and there is potential for erosion.

9.2.2 CLIMATE CHANGE

Predicting the effects of global climate change is extremely complex. Climate models are evolving, but are not yet sufficiently accurate to specifically describe future events and conditions. Numerous climate change-related effects have been observed globally. Many of these effects are anticipated to intensify over the next century, including increasing temperatures, receding glaciers, melting of permafrost, rising sea levels, coastal flooding and changing precipitation patterns.

Using a Statistical Downscaling Model (SDSM) based on two global climate models (CGCM2 and HadCM3), Lines *et al*. (2008) predicted future climate change scenarios for 14 sites in Atlantic Canada. Table 9.2.1 shows the results from both models for the site closest to the Project (Sydney, Cape Breton). As Lines *et al*. (2008) concluded, the variation in results demonstrate that more than one model output should be used to determine appropriate views of future climate.

Table 9.2.1 Annual Projected Increases in Mean Annual Maximum and Minimum Temperature, and Percent Precipitation, for Sydney, Nova Scotia With Respect to 1961-1990 Baseline Period

Years	T max (˚C)		T min		% Precipitation	
	CGCM2	HadCM3	CGCM2	HadCM3	CGCM2	HadCM3
2010-2039	1.06	0.92	1.12	1.03	3	3
2040-2069	1.42	1.15	1.49	1.39	3	-3
2070-2099	2.12	2.17	2.21	2.40	4	4

Source: Lines *et al*. 2008.

Both models agree that temperatures are projected to increase in all seasons. This average temperature change will be gradual over the period and will change precipitation types and patterns. The warmer fall and winter temperatures could mean later freeze up; wetter, heavier snow; more liquid precipitation occurring later into the fall; and possibly more freezing precipitation during both seasons. There is less agreement among the global circulation and regional downscaling models regarding changes in precipitation as shown in Table 9.2.1.

There is a consensus in the climatological community concerning the overall anticipated environmental effects of climate change, in particular since many of the changes are documented as already occurring. For example, over the next 100 years, Atlantic Canada will likely experience warmer temperatures, more storm events, increasing storm intensity, rising sea level, and more storm surges, coastal erosion and flooding (Vasseur and Catto 2008).

Sea level rise in the Maritimes has been occurring since the end of the last ice age, about 10,000 years ago. During the 20th century the sea level at Charlottetown, Halifax, and Sydney has risen at a rate of approximately 0.3 m/century, which included 0.2 m/century of crustal subsidence (Forbes *et al*. 1997). The rate of change in global mean sea level is accelerating in the 21st century due to global warming impacts, notably the melting of polar ice caps. The future global mean sea level rise will likely be greater than 1 m per century, well above 2007 projections from the Intergovernmental Panel on Climate Change (which were up to 0.59 m/century) (Solomon *et al*. 2007). The global mean sea level rise is now predicted to range from 0.9 m to 1.6 m by 2100, if the melting of polar ice caps continues as predicted (Arctic Monitoring and Assessment Program 2011). In Sydney, crustal subsidence may slightly increase the rate of sea level rise, but only by a relatively small amount (approximately 10% or less of the mean sea level rise due to global warming) (Forbes *et al*. 1997).

9.2.2.1 Potential Project Interaction

Projected climate changes may affect operation of the Project in several ways including: increased frequency and intensity of storm surges; increased frequency of extreme storms accompanied by strong winds; increased incidence of flooding and erosion; sea level rise; and increased frequency of heavy precipitation events. Each of these, if not engineered and designed for, could result in damage to infrastructure.

9.2.2.2 Mitigation Measures to Minimize Environmental Impacts on the Project

Potential effects of climate change and sea level rise on construction and operation will be considered and incorporated in the planning and design of Project infrastructure to minimize the potential for long-term damage. Inspection and maintenance programs will prevent the deterioration of the infrastructure and will help to maintain it in compliance with applicable codes and standards.

The following mitigation measures will reduce potential effects of climate change on the Project, as well as potential environmental effects.

- Infrastructure will be designed to a standard appropriate for the level of risk. Overland structures (*e.g.,* towers, grounding site breakwater) will be designed to a 1:50 year return period weather event with potential design enhancements in certain locations depending on climatic conditions (*e.g.*, ice loading, wind, *etc.*). In the marine environment, the subsea cable protection will be designed up to a 1:1000 year contact rate with the potential for enhancements in specific locations depending on factors influencing contact risk (*e.g.*, iceberg, pack ice, local geology, *etc.*).
- Storm water infrastructure will be designed to withstand predicted increases in precipitation.
- The berms constructed as part of the grounding sites facilities will be designed to applicable standards for storm surge and coastal erosion.
- The ERP will include procedures for responding to extreme climate conditions such as storms and flooding to protect workers and the public as well as the security and integrity of infrastructure.

Because the effects of climate change are difficult to predict in advance, an adaptive management program will be developed to monitor early warning signs for structural weakness or risk due to climate change and rising sea levels.

9.3 WILDFIRES

9.3.1 WILDFIRES

The mean danger of forest fires during the fire season in the Nova Scotia portion of the Study Area is rated as moderate (for years 1971-2000); where moderate is defined as creeping or gentle surface fires that are easily contained by ground crews with pumps and hand tools (NRCan 2012b). In the Newfoundland and Labrador portion of the Study Area the mean danger of forest fires during the fire season is rated as low (for years 1971-2000); where low is defined as fires likely to self-extinguish and new ignitions are unlikely. Any persistent fires will be limited to smoldering in deep, drier layers (NRCan 2012b).

9.3.1.1 Potential Project Interaction

While there is potential for natural forest fires to occur in or near the Study Area, it is not likely to have a substantive effect on construction or operation of the Project. Nova Scotia and Newfoundland and Labrador have well-developed forest fire control programs designed to quickly locate and control fires, thereby minimizing the potential magnitude and extent of any fires, and their effects on the Project.

The facility structures will be constructed primarily of concrete and stainless steel, which are not typically affected by fire. Therefore, Project-related infrastructure is not likely to be substantively affected by fire occurring close to facilities.

A forest fire could affect project scheduling through temporary work interruptions, as well as interrupting service during operation. If workers are in the area during a time of a forest fire, their health and safety may also be at risk.

9.3.1.2 Mitigation Measures to Minimize Environmental Impacts on the Project

The ERP will describe fire-related emergency response capability, emergency response plans, and required training. If fire were to break out in direct proximity to the Project, emergency measures would be in place to protect workers and the public and quickly control and extinguish the flames. Work sites and Project facilities will be supplied with fire suppression equipment including water-packs and shovels. If a fire occurs the appropriate personnel and agencies will be notified immediately. Depending on the nature of the fire, site evacuation may be required.

9.4 MARINE HAZARDS

9.4.1 ICEBERGS/PACK ICE

The risk of ice scour has been considered for both the Newfoundland and Labrador and Nova Scotia landfall sites and all portions of the Study Area less than 200 m deep. Sea ice typically forms in the western and northern coastal zones of the Gulf of St. Lawrence during December; by the end of January the sea ice starts to flow through the Cabot Strait under the influence of surface currents and wind. In some years a mixture of locally-formed and drift ice may extend as far to the southwest as Halifax and Sable Island. The spring breakup of ice normally commences in March and recedes to patches within the Gulf of St. Lawrence by mid-April. In severe years, ice may stay on the Scotian Shelf until May or June. Icebergs are extremely rare within the Cabot Strait and are unlikely to affect the Project during installation of the subsea cables or operations (EC 2010b).

9.4.1.1 Potential Project Interaction

Ice scour and gouging associated with pack ice could impact subsea cables in water depths less than 200 m deep as well as shoreline installations including grounding sites.

9.4.1.2 Mitigation Measures to Minimize Environmental Impacts on the Project

The results of a Project-specific iceberg/pack ice study that investigated and modelled potential risks will be considered in Project design and construction. Recommendations of the report will continue to influence various aspects of Project planning and design; for example the cable landfall (HDD), and cable protection (two counter-helical armour layers of galvanized steel wires wrapped in polypropylene or polyethylene for further protection from abrasion). Grounding site equipment will be installed inside protective berms and subsea cables will be buried in areas of potential ice scour as a primary means of protection. The cable design will also incorporate a protective wire outer sheath.

9.4.2 OCEAN CURRENTS

During all seasons there is a southerly surface current flow from the Gulf of St. Lawrence through the Cabot Strait and offshore (Wu and Tang 2011). During the autumn and winter months, surface currents average approximately 15 cm/s, slowing down in the spring and summer months to less than 5 cm/s. There is a constant year-round inflow of water into the Gulf of St. Lawrence through the Cabot Strait at water depths of 50 to 400 m along each side of the Laurentian Channel. During the summer and autumn this deeper water current flows faster on the Nova Scotia slope, and faster on the Newfoundland slope in the autumn. At the bottom of the Cabot Strait at water depths of 450 m there is a year-round outflow to the offshore area, with faster currents during the summer and autumn.

9.4.2.1 Potential Project Interaction

Ocean currents may have direct effects on the subsea cables by causing movement and strain on unsupported cable sections. Strong currents may destabilize *in-situ* rock and structures that provide support and/or protection to the cables. Strong currents may also cause substantial movement of sediment or scouring of the supporting material under the cable, possibly resulting in excessive sag in open spans.

9.4.2.2 Mitigation Measures to Minimize Environmental Impacts on the Project

Subsea infrastructure will be built to withstand ocean currents and storm events typically found within the region. In the nearshore areas in water depths up to 200 m cables will be buried below the seabed to avoid interaction with pack ice. This burial will have a secondary benefit of avoiding scour of supporting materials under the cable due to sediment transfer from strong ocean currents. In water depths up to 20 m, the cable will be routed through conduits installed in boreholes that will be drilled out into the seabed from the landfall locations by HDD.

After cable placement, subsea video inspection with ROVs will be conducted at prescribed intervals to monitor the installation conditions and to determine any maintenance that may be required.

9.4.3 SEISMIC ACTIVITY AND TSUNAMIS AND BAROTROPIC WAVES

Submarine seismic events (earthquakes) can result in ground vibration, landslides and tsunamis (huge ocean waves). Earthquake activity of magnitude 6.0 and 7.2 was recorded in 1929 with epicenters in the Laurentian Slope, offshore of Nova Scotia. Vibration from this earthquake resulted in minor damage in Cape Breton (*i.e.*, fallen or cracked chimneys, minor landslides, blocked highways) and a massive submarine landslide and a tsunami were generated, the effects of which were felt in Newfoundland and Labrador (Fine *et al.* 2005).

Although the continental shelf along Canada's east coast is considered to be stable, the few submarine landslides that occur in this region are typically generated by seismic activity (Mosher 2008). The 1929 earthquake in the Laurentian Slope generated a submarine landslide and a tsunami that struck the Burin Peninsula on the island of Newfoundland and resulted in loss of life and damage/destruction to infrastructure (homes, wharves, telegraph cables) (Fine *et al*. 2005). The tsunami had wave heights of 3 to 7 m in Newfoundland and may have reached heights of more than 1 m in Nova Scotia (Ruffman 2001). While a tsunami may occur due to seismic activity on the Laurentian Slope, it would be rare, and the distance to Nova Scotia would reduce the wave energy (Ruffman 2001).

There have been two isolated incidents involving unusually large waves that struck the southeastern coast of Newfoundland and resulted in flooding and property damage. The incidents occurred on October 25, 1999 and September 25, 2000 and the waves were described as tsunami-like, although there was no evidence of seismic activity, underwater landslides or slumping on either occasion (Mercer *et al.* 2002). The most likely cause of these incidents has since been attributed to barotrophic waves that were a direct result of tropical storms that were active in the vicinity of the Grand Banks earlier on the same day as the respective wave events (*i.e.,* Tropical Storm Jose in 1999 and Tropical Storm Helene in 2000).

Barotropic waves of the type observed in southeastern Newfoundland can be generated by large storm systems traveling rapidly across the open ocean from deeper areas to shallower areas. When a quickly moving system of low atmospheric pressure moves from an expanse of deep water to a shallow region, and is followed immediately by the adjacent higher pressure system outside of the storm, it can contribute to the formation of a large barotropic wave that then propagates towards shore.

Southeastern Newfoundland is more susceptible to barotropic waves than the Cabot Strait due to the proximity to open ocean, the greater frequency of storm tracks offshore, and the bathymetric characteristics of the Grand Banks. Although the likelihood of a barotropic wave occurring in the Cabot Strait is considered lower than for southeastern Newfoundland, at least one barotropic wave has been recorded in the Strait. In September 2006, the passage of Hurricane Florence across the Newfoundland shelf generated a barotropic wave, the amplitude of which along the shore diminished from approximately 45 cm to 12 cm as it propagated from the south coast of Newfoundland to the southern Nova Scotia seaboard (Thiebaut and Vennell 2010). Nonetheless, conditions are such in the Cabot Strait that any barotropic waves that may occur would generally be expected to be of smaller magnitude than those experienced in southeastern Newfoundland and more comparable with wind-driven storm waves. The Hurricane Florence example is consistent with this expectation.

9.4.3.1 Potential Project Interaction

Subsea seismic events have the potential to cause damage to the subsea cables through disturbance of supporting materials, sediment transfer, effects on currents, and the potential for a tsunami. Extreme waves – including intense waves and/or tsunami events triggered by subsea landslides or seismic events, as well as barotropic waves associated with atmospheric and bathymetric conditions – could cause shore scouring and potential damage to infrastructure. Based on research the potential damage from these events on subsea cables are anticipated to be low. Low-lying areas can be at risk of flooding during a tsunami or barotropic wave event, which could lead to direct infrastructure damage or indirect damage through degradation of ground (geotechnical) conditions.

9.4.3.2 Mitigation Measures to Minimize Environmental Impacts on the Project

Project design and construction will consider the risks and potential for seismic events, rogue waves, and/or tsunami events through a review of available information and modeling. Project infrastructure will be designed to withstand seismic events; rogue waves, and/ or tsunami events as prescribed through industry standards.

9.4.4 SEABED PHYSIOGRAPHY AND GEOLOGY

Project design and construction will consider the risks and potential for seismic events, rogue and barotropic waves, and/or tsunami events through a review of available information and modeling. Project infrastructure will be designed to withstand these events as prescribed through industry standards. The use of HDD will protect the subsea cable from several physical factors, including waves in general and ice scour.

The composition of surficial sediments was determined from side-scan sonar data; still images and video; and from detailed grain size analysis of sediment grab samples. Analysis of the side-scan sonar data revealed 18 acoustically distinct bottom types in the Study Area. Underwater video footage confirmed that the differences between the acoustic regions were due to changes in substrate and bedforms. Particle size analysis showed that the substrate types ranged from sandy-silt to sand across the Study Area. On the island of Newfoundland, the substrate is sandy to approximately 7.5 km from shore; the substrate is silty through the central portions of the Study Area; and sandy-silt is present from approximately 15 km east of the Nova Scotia shoreline. Bedrock was noted in the nearshore of the island of Newfoundland up to water depths of approximately 130 m, and off Nova Scotia for water depths up to approximately 37 m.

The Project crosses the depths of the Laurentian Channel, with sediments composed of silt (muddy clay). The area is covered by pockmarks and parallel furrows. Pockmarks are cone-shaped depressions on the seabed resulting from the escape of gas or liquids from the subsurface through the sediments. They can range in size from a few metres to over 1 km in diameter and up to 50 m in depth off Nova Scotia on the Scotian Shelf. For the Study Area, pockmarks begin to occur approximately 38 km from the Newfoundland and Labrador shoreline, at about 460 m water depth, and continue to approximately 53 km off Nova Scotia. A total of 745 pockmarks were observed within the surveyed portions of the Study Area. The average diameter of pockmarks was 42 m along the short axis and 74 m along the long axis. The average depth of the pockmarks is 2.4 m. The smallest pockmarks are approximately 10 m in diameter, with the largest measuring over 300 m.

Sedimentary furrows are linear trenches found in the deep muddy seabed of the Laurentian Channel and are generally found in the same area as pockmarks. The furrows are parallel to one another and begin to occur about 28 km off Newfoundland and continue to be found for a further 43 km along the Study Area. The length of the furrows typically extends beyond the 2 km width of the Study Area. Large areas on either side of the Laurentian Channel show relic scour marks generated by the keels of icebergs from the distant past.

Sand waves and megaripples are bedforms that are generated by flow over the seafloor and their crestlines are oriented in the direction of the current. They are features formed by constructive and erosive processes which accompany sediment transport. Sand waves and megaripples are found within 2% of the Study Area. The largest sand waves have wavelengths of 100 m and amplitudes of 1 to 2 m.

9.4.4.1 Potential Project Interaction

Pockmarks are formed by the forceful venting of gas which could damage cables directly through breakage or shearing; or indirectly by exposing the cables or damaging *in-situ* rock and structures that provide support. Sandwaves and mega-ripples are not static, therefore there is a risk that a cable buried in one of these structures would be moved or exposed by ongoing sediment transfer. Sediment transfer (particularly on the steep slopes of the Laurentian Channel) could affect cable integrity.

9.4.4.2 Mitigation Measures to Minimize Environmental Impacts on the Project

The results of the detailed marine survey completed in 2011 will be used to select a route for the cable to avoid any potentially problematic seabed features. A sediment transport study was completed and results will provide information on the location of physiographic formations within the Study Area. These have been characterized with respect to the potential location (placement and depth) and design of the subsea cables.

9.5 SUMMARY OF RESIDUAL EFFECTS

The environment could potentially have an effect on the Project but this will be mitigated through careful design in accordance with factors of safety, good engineering practice, and adherence to standards and codes. The mitigation measures and strategies described in this EA and the selection of materials that are able to withstand the environmental conditions that can reasonably be expected in the Study Area are considered adequate to address these concerns. Scheduling of activities will allow for weather disruptions.

Based on a consideration of the various strategies and design and mitigation measures described in the EA, it is concluded that any effects of the environment on the Project will be managed by design, monitoring and adaptive management and are, therefore considered to be not significant.

10.0 ACCIDENTS AND MALFUNCTIONS

CEAA requires that all screenings and comprehensive studies include the environmental effects of accidents or malfunctions that may occur in connection with the project as well as the significance of those effects. This section provides an assessment of selected accidents and malfunctions potentially associated with the Project that could, if they occurred, cause environmental effects.

10.1 APPROACH

10.1.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

Project-related accidents and malfunctions (including credible worst-case scenarios) were defined according to the professional judgment of ENL and the Study Team. The general approach to assessing the potential environmental effects of such situations involved the following elements:

- consider the potential Accidents and Malfunctions that may occur during the life of the Project;
- describe the safeguards that have been established to protect against such occurrences;
- consider the contingency/emergency response procedures if an accident or malfunction were to occur; and
- determine the residual environmental effects that may result and the significance of those effects.

The accidents/malfunctions with potential environmental effects considered in this assessment include:

- electrical hazards;
- tower failure;
- hazardous material spills;
- vehicle/vessel/aircraft accidents;
- unexploded ordnances (UXOs); and
- release of HDD drilling fluids.

10.1.2 POTENTIAL INTERACTIONS WITH VECs

A preliminary screening was conducted to determine if any of the VECs would likely be affected as a result of possible accidents or malfunctions associated with the Project. Table 10.1.1

summarizes potential interactions of Project-related accidents and malfunctions with VECs. Criteria used for determining the significance of adverse residual environmental effects with respect to accidents and malfunctions are the same used in the respective VEC sections.

Table 10.1.1 Potential Interactions of Project-Related Accidents and Malfunctions with Valued Environmental Components

Accidents/Malfunctions	Caribou	Species of Conservation Interest	Socio-economic Environment	Archeological and Heritage Resources	Marine Environment	Commercial Fisheries	Current Use of Land and Resources for Traditional Purposes by the Mi'kmaq
Electrical Hazards	✓	✓	✓		✓	✓	✓
Tower Failure	✓	✓	✓				✓
Hazardous Material Spill	✓	✓	✓		✓	✓	✓
Vehicle/Vessel/Aircraft Accidents	✓	✓	✓		✓	✓	✓
Unexploded Ordnances (UXOs)		✓	✓		✓	✓	✓
Frac-out (accidental release of HDD drilling fluids)		✓			✓	✓	✓

10.2 HEALTH, SAFETY AND SECURITY MANAGEMENT PLAN

At Emera Newfoundland and Labrador, the occupational health and safety of people is more important than any business interest. For this reason, occupational health and safety is our number one priority. ENL is committed to meeting our business objectives in a manner which is respectful and protective of the health and safety of people in our workplace, and in full compliance with legal requirements and company policy. This commitment to health, safety and security is grounded in the following principles:

- *Emera is committed to providing a healthy and safe work environment for all employees and contractors employed on its sites.*
- *Emera endeavours to protect the general public against health or safety risks arising from its business activities.*
- *Emera believes that all occupational injuries and illnesses are preventable, that health and safety must be an integral part of every job, and that planning, equipment and appropriate personal behaviour will yield workplace conditions that are accident-free.*

- *Workplace conditions will meet or exceed all applicable regulatory requirements and legislation.*
- *All Emera companies will have detailed safety programs including objectives, measures, reporting, education and monitoring systems.*
- *Emera will communicate with all stakeholders on safety performance in an open manner.*

ENL promotes the highest standards in health and safety to eliminate workplace injury and illness and commits to implementing a Health and Safety Program that is based on the principle that everyone shares the responsibility for health and safety at the workplace and that all incidents are avoidable.

This Health, Safety and Security Management Plan (HSSMP) provides guidance on how the Maritime Link Project work scope will be safely executed. This plan is focused on all levels of ENL Management and specifically identifies the practices that Project personnel will employ so that health and safety performance excellence is achieved. Individual responsibility and total commitment to a strong safety culture are well-defined and established elements for achieving incident and injury-free performance for this Project. The ERP, described in Section 2 is closely linked to the HSSMP.

ENL believes sound health and safety performance is fundamental to successful business performance. It is therefore the requirement and expectation of the ENL Project Management Team that all personnel associated with the Project shall play an integral part in the full implementation of the health and safety management strategy, performing at the highest possible levels and fostering a focus on continuous improvement in health and safety.

The HSSMP defines ENL's expectations for health and safety planning and performance and describes how the Project will establish the Health, Safety and Security Management System and implement the associated initiatives.

10.3 ELECTRICAL HAZARDS

10.3.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

Live high voltage cables pose the risk of injury or death to individuals if contacted directly or indirectly. Mitigation measures to minimize the risk of electrical injuries to those in or proximate to a power transmission corridor are not generally a requirement for 230 kV circuits given the height of conductors, except where completing aerial works for installation of transmission towers (BCTC 2006). The Maritime Link is a high voltage transmission system between 200 and 250 kV; therefore the requirement for additional mitigation is low. Downed conductors can allow for the potential interaction of live electrical cables with personnel in the area or wildlife including caribou and SOCI. Unauthorized access to secure locations can also put individuals at risk of electrocution. Avifauna can also interact with high voltage cables and can become electrocuted in certain circumstances.

The worst case scenario for an incident involving electrical hazards would be the electrocution and death of personnel working on the Project during construction or operation or the electrocution of persons as a result of unauthorized access to secured locations. Another worst case scenario would be the electrocution and death of a *SARA* listed species when coming into contact with live wires.

10.3.2 PROJECT DESIGN AND MITIGATION TO MINIMIZE RISK

The most likely Project accident or malfunction resulting in potential environmental effects from electrical hazards is the downing of conductors which can put humans and fauna at risk of electrocution from live transmission lines. Emera's downed tower response procedures will be included in the ERP. These Procedures may also include but are not limited to the following requirements:

- Transmission towers will be designed and installed according to CSA standards and National Standards of Canada (*e.g.*, CAN/CSA-C22.3 No. 1-10 - Overhead Systems and CAN/CSA-C22.3 No. 60826-10 - Design Criteria of Overhead Transmission Lines).
- Project components will be maintained and potential issues will be identified.
- Safe operating procedures will be established for work activities.
- ENL's safety and environmental policies will be followed.
- Proper signage and public warning will be installed around project components/facilities (*e.g.,* "High Voltage", "No Anchoring").
- Overhead wire markers will be installed across major water crossings.
- Physical safeguards will be implemented such as security fences surrounding facilities.
- Access to facilities will be restricted to authorized personnel only.
- The use of lighting will be incorporated around Project components (*e.g.*, converter stations and grounding sites) to discourage vandalism and loitering.
- The location of cables will be authorized through Transport Canada's Navigable Waters Protection Program. Marine Charts will also be updated to indicate the location of cables.
- A Notice to Mariners will be issued to publish the location of the subsea cables.
- Subsea cables will be protected to mitigate potential contact.
- HVdc and HVac conductor separation distance will be sufficient to prevent accidental electrocution to perching avifauna.

10.3.3 EMERGENCY RESPONSE

Actions that will be taken in the event of an electrical hazard will include the following measures:

- If an electrical hazard is discovered, the appropriate personnel, authorities and ENL will be notified immediately.
- Construction and operational staff will be trained in the proper procedures to manage an electrical hazard.
- The necessary personal protective equipment will be used when managing an electrical hazard.
- A downed live wire will be de-energized until the threat of electrocution is eliminated.
- Protocols for dealing with downed conductors and live wires will be included in the ERP.

10.3.4 POTENTIAL ENVIRONMENTAL EFFECTS AND THEIR SIGNIFICANCE

Depending on location, the electrical hazard could potentially affect members of the public and workers in close proximity to the hazard; birds and wildlife; fish, species of conservation interest; and the marine environment.

In consideration of the mitigation and response measures to be undertaken to prevent and respond to an electrical hazard, adverse residual environmental effects of an electrical hazard are rated to be not significant for all potentially affected VECs.

10.4 TOWER FAILURE

10.4.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

Geophysical hazards and extreme climatic conditions can affect tower infrastructure, in some cases causing catastrophic structural failure.

Geophysical hazards including slope instability, karst topography and seismic events could potentially impede ground stability that could lead to a tower failure. Major landslides occur less frequently in the Atlantic Provinces than in other regions of Canada; however, landslides have been known to occur in Nova Scotia, with Cape Breton Highlands being the most susceptible area due to deep gorges and steep cliffs (Wahl *et al*. 2007, Liverman *et al*. 2004). In addition to landslide events, karst topography could lead to tower failure as a result of sinkhole formations and ground instability. Karst topography is known to occur in areas of Cape Breton. A seismic event could cause substrate vibrations and instability. Eastern Canada is located in a stable continental region within the North American plate and as a result the area has a relatively low rate of earthquake activity.

Extreme weather events such as freezing rain and wind could lead to structural failures. Wind and freezing rain can cause ice buildup on one side of the transmission cable that can interfere with air flow causing an undulation motion that can result in structural damage and power outages. Freezing rain can also lead to ice build-up which can add additional weight to tower components and cause a failure.

The worst case scenario for a tower failure could include human death as a result of electrocution from contact with downed power lines; the death of a *SARA* listed species as a result of electrocution; or human death, property damage, and loss of important habitat for a *SARA* listed species as a result of fire ignition from a downed tower.

10.4.2 PROJECT DESIGN AND MITIGATION TO MINIMIZE RISK

Downed tower response procedures are included in Emera's existing procedures and will be included the Project ERP. Project design and mitigation measures to reduce the risk of a tower failure include but are not limited to:

- Infrastructure will be designed to a standard appropriate for the level of risk. Overland structures (*e.g.,* towers, grounding site breakwater) will be designed to a 1:50 year return period weather event with potential enhancements in certain locations depending on climatic conditions (*e.g.*, ice loading, wind, *etc.*).
- Towers will be designed, built, and installed by experienced and trained industry contractors.
- The EPP will detail the procedures to be followed in case of an accident and will include staff and contractor training requirements as well as emergency contact numbers, including fire responders.

10.4.3 EMERGENCY RESPONSE

Actions that will be taken in the event of a tower failure will include the following measures.

- If an electrical hazard is discovered the appropriate personnel, authorities and ENL will be notified immediately.
- Relevant construction and operational staff will be trained in the proper procedures to manage a tower failure.
- The necessary personal protective equipment will be used when managing an electrical hazard.
- A downed live wire will be de-energized until the threat of electrocution is eliminated.
- Protocols for downed conductors and live wires will be developed for the ERP.

10.4.4 POTENTIAL ENVIRONMENTAL EFFECTS AND THEIR SIGNIFICANCE

Depending on the location of the tower failure, the hazard could potentially affect members of the public and workers in close proximity to the hazard; birds and wildlife; fish; and SOCI.

In consideration of the mitigation and response measures to be undertaken to prevent and respond to a tower failure, adverse residual environmental effects of such an incident are rated to be not significant for all potentially affected VECs.

10.5 HAZARDOUS MATERIAL SPILLS

10.5.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

Hazardous material spills can occur both in terrestrial and marine environments. Fuels, lubricants, hydraulic fluid, paints, and corrosion and fouling inhibitors will be used or stored in small quantities, during all Project phases. These types of materials will be most commonly used throughout the construction phase. However, accidental spills could occur during all Project phases, including maintenance activities, resulting in a release of the hazardous substance into the environment.

A probable scenario for a land-based hazardous material spill would be accidental releases during material transfer (*e.g.*, fueling a vehicle or jerry can), rupture of a hydraulic line, or a vehicle accident. There is no spill scenario that is considered likely; any spill is likely to be small (*e.g.*, several litres or less). Given the expected limited spill volume, spill scenarios, and anticipated effectiveness of response plans (including spill containment), it is assumed that none of these spills would result in a release to adjacent properties. Spills in the marine environment are discussed below. The worst probable case for a land-based hazardous material spill would likely be a rupture of a hydraulic line near a wetland or watercourse. The worst case for a marine spill is a highly unlikely scenario involving a vessel accident resulting in release of fuel oil.

Diesel engines will be used on the cable laying vessel as well as any associated support vessels. A hydrocarbon spill in the marine environment has the potential to occur primarily due one of the following scenarios:

- hydraulic spill onboard the cable laying or support vessels, or small on deck spills;
- fuel spillage during refueling of support vessels; and/or
- a marine accident (*i.e.*, collision, grounding of the cable laying or support vessels) involving a fuel spill.

The worst case scenario for an incident involving a hazardous material spill on land or in the marine environment would include the death of a *SARA* listed species from direct contact, ingestion of impacted potable water, or from shoreline pollution. The worst case would also include widespread oiling of marine species, primarily birds, resulting in considerable mortality.

10.5.2 PROJECT DESIGN AND MITIGATION TO MINIMIZE RISK

Project design and mitigation measures to reduce the risk of a hazardous material spill include but are not limited to:

10.5.2.1 Terrestrial Spills

- Fuels and lubricants will be stored in approved containers in designated areas, located at least 100 m from known watercourses, wetlands, and water supply areas (including the known location of private wells).
- Where possible, refueling in the field will not occur within 30 m of watercourses and water supply areas (including the known location of private wells). Where equipment is located near a wetland and must be refueled at that location, special precautions will be used to prevent spilled fuel from entering any sensitive receptors.
- Permanent storage areas for containers or drums will be clearly identified.
- Storage areas will have secondary containment as required by regulation.
- Storage of hazardous materials will comply with WHMIS requirements. Appropriate material safety data sheets (MSDS) will be located at the storage site.
- Transportation of dangerous goods will comply with Transport Canada's *Transportation of Dangerous Goods Act*.
- Equipment will be kept in good working order, inspected regularly, and leaks will be repaired promptly.
- Spill containment equipment (*e.g.*, spill kits) will be available to construction crews and, in the event of an accident, will be put in place to attempt to prevent the spill from spreading to other environmental receptors.
- The ERP will include spill prevention and emergency response protocols as well as staff and contractor training requirements.
- ENL's Emergency Notification Plan will support notification of appropriate personnel and agencies.
- Depending on the nature of the spill, it may be a requirement to secure and evacuate the site (*e.g.*, in case of risk of ignition).

- Depending on the nature and location of the spill, there may be a requirement to develop ongoing mitigation and remediation measures.

10.5.2.2 Marine Spills

- Vessels used for major Project construction activities will be subject to a pre-mobilization inspection program.
- All vessels will carry an Oil Pollution Emergency Plan, as required by the International Convention for the Prevention of Pollution from Ships (MARPOL).
- Storage of hazardous materials on vessels will be in accordance with applicable regulation.
- Equipment will be kept in good working order, inspected regularly, and leaks will be repaired.
- The ERP will require contractors to provide for spill prevention and emergency response protocols. It also includes personnel training requirements.
- The ERP will require contractor's vessels to have emergency response equipment onboard.
- All marine spills will be reported to the Canadian Coast Guard.
- Depending on the nature of the spill, it may be a requirement to secure and evacuate the site (*e.g.*, in case of risk of ignition).

10.5.3 EMERGENCY RESPONSE

10.5.3.1 Terrestrial Spills

Should a hydrocarbon spill occur, all efforts will be made to ensure the safety of onsite workers and to contain the spilled material.

- The containment and/or remediation of spills or releases that occur on the Project site will be managed under the Project ERP which will include, but not be limited to, the following aspects: training, prevention measures, resources, emergency notifications, and spill response equipment.

10.5.3.2 Marine Spills

Marine spill response procedures are regulated under the *Canada Shipping Act, 2001*. Any incident involving the spillage of oil or petroleum lubricating products into the marine environment must be reported immediately to the 24-hour Spill Report Centre (1-800-565-1633). All Project-related vessels will have a shipboard Oil Pollution Emergency Plan (OPEP) and the capability to respond to small spills. The OPEP will identify the person authorized to implement the plan and will also confirm that the vessel has an arrangement with a response organization certified by the Canadian Coast Guard.

Should a hydrocarbon spill occur, the primary goal is to safety and, if safe to do so, contain the spilled material. If a hydrocarbon spill from a Project vessel is detected, emergency response and clean-up will be implemented as per the OPEP. Oil spill response and clean-up procedures will be developed in consideration of EC's CWS *Oil Response Procedures Manual* and *Oil Response Plan* (CWS 1999).

Following initial response and spill containment, clean-up and reclamation tasks will be undertaken as necessary to restore damaged habitats. Habitat compensation works will be implemented for all harmful loss or alteration to fish habitat, where required. An on-site monitor will be present during all clean-up and reclamation work to monitor the success of any clean-up and reclamation work.

10.5.4 POTENTIAL ENVIRONMENTAL EFFECTS AND THEIR SIGNIFICANCE

10.5.4.1 Terrestrial Spills

Depending on the location of the spill, and type and quantity of material released, hazardous material spills could potentially affect water resources, birds and wildlife, wetlands, rare plants, and freshwater fish and fish habitat.

With protection measures and a trained workforce, spills are unlikely but if they occurred would be expected to be small and rapidly contained and cleaned up. Such spills are likely to be an occasional occurrence during the different phases of the Project. With appropriate mitigation measures in place (as outlined above), the geographic extent of a potential spill is expected to be highly localized with effects of relatively short duration. Relevant staff will be trained to respond to hazardous materials spills and will use onsite spill containment kits to prevent the spread of materials. However, even small spills can have serious effects, particularly on birds and fish and fish habitat.

Proper storage, use and containment of hazardous materials will help prevent a spill from occurring and minimize the extent of effects should a spill occur. In the event of a heavy equipment spill (*e.g.*, ruptured hydraulic hose), hazardous materials will be contained and remediated as part of the ERP as outlined above.

If a spill damages a wetland or watercourse, an assessment will be undertaken and remedial action proposed to restore the wetland or watercourse to pre-spill conditions; alternatively compensatory habitat would be created if the impacted site was unable to be restored. As with any alteration of wetland or fish habitat, government approval is required and no-net loss of habitat function or productivity is a requirement. Spilled material will be quickly cleaned up, and efforts will be made to exclude wildlife from the area of the spill (*e.g.*, fencing or netting) until the product is recovered.

In consideration of the mitigation and response measures to be undertaken, adverse residual environmental effects of a land-based hazardous material spill are rated to be not significant for all potentially affected VECs.

10.5.4.2 Marine Spills

The behaviour of hydrocarbon spills in the marine environment and associated environmental effects depends on a number of factors including the size of the spill, the type of oil spilled (diesel versus gasoline), the location of the spill, the time of year, the wind speed and direction, the air temperature, the tidal cycle and the timing and level of emergency response and clean-up.

A hydrocarbon spill in the marine environment would cause a temporary degradation in water quality and could have subsequent lethal and/or sub lethal environmental effects on marine life in the local area. Crude and diesel oils contain acutely toxic petroleum hydrocarbons and contact with them has been shown to induce mortality in a variety of marine vertebrate and invertebrate species (Peterson 2001, Fuller *et al.* 2004). Following a release, oil will spread out and form a sheen on the surface of the water. It is during this stage that oil presents the greatest risk to marine birds, marine mammals, turtles and fish. Inhaling, digesting or dermal contact with the oil can result in a variety of potential physiological effects. Sub-lethal environmental effects could include avoidance behaviour and disruption of feeding, spawning and migration patterns. Adverse effects on highly mobile marine mammals and fish are unlikely since these species are will probably avoid the area affected by a small spill, and larger spills are considered unlikely.

Plankton, fish eggs and larvae could be affected to different degrees, depending on the severity, timing and location of the spill. Exposure to oil could cause direct mortality of fish eggs or larvae, although exposure to spills related to the Project would be limited spatially and temporally. Sub lethal physiological effects leading to reduced breeding success are also unlikely to be significant. The frequency of such an event is considered to be extremely low, and the effects would be restricted to the immediate vicinity of the accidental event, in contrast to the dispersed nature of fish populations. These potential environmental effects on plankton and zooplankton would be short-lived; their high reproductive rate and high densities, combined with the limited spatial extent of the environmental effect, means that any potentially affected individuals would be replaced in the system quickly. In consideration of a worst case event, effects of a spill would not be expected to affect population recruitment levels of fish species.

Shellfish can be tainted from small diesel spills in shallow nearshore areas. These organisms bioaccumulate the oil but will also depurate the oil over a period of several weeks following exposure.

In the unlikely event of a hydrocarbon spill in the marine environment, direct or indirect mortality of birds through contamination of water or food may occur. Marine birds are at risk of oiling and thermal stress and can be affected by even relatively small spills (Wiese *et al.* 2001). In the event of a spill, contact between marine birds and spilled hydrocarbons at the surface would be probable. Given the relatively high concentrations of marine birds in the vicinity of the cable crossing route, in particular sea bird colonies near Point Aconi, it is possible that a large spill (*i.e.,* from a Project-related ship grounding and release of fuel oil), while highly unlikely, could result in oiling of a large number of birds; such an occurrence could potentially result in a significant adverse environmental effect on marine birds. However, the likelihood of a large spill is extremely low, particularly given the relatively short duration and low number of vessels involved with marine construction and the very low probability that any vessel accident would result in the release of substantial amounts of fuel oil. All efforts will be made to contain and clean up the spill should it occur.

A hydrocarbon spill in the marine environment could also affect fisheries and use of resources for traditional purposes by the Mi'kmaq, as access to fishing and/or traditional use areas could be limited during the spill event and clean-up activities, even if the resource itself is not affected. Depending on the nature of the spill, fishing equipment could be affected and there is potential for tainting or perceived tainting of fishery resources.

While highly unlike, a large spill (*e.g.*, vessel fuel tank spill) could potentially result in a significant adverse residual effect on marine birds. However, given the relatively low Project-related vessel activity and mitigation measures to prevent and respond to marine spills, a large spill scenario in the marine environment is highly unlikely. In consideration of mitigation and emergency response procedures, residual effects on other VECs from marine spills are rated as not significant.

10.6 VEHICLE/VESSEL/AIRCRAFT ACCIDENTS

10.6.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

During the construction and operations phases of the Project various vessels, vehicles and aircraft will be in motion around the Project site. These are all at risk of accidents, including collisions with each other as well as with pedestrians and wildlife.

The worst case scenario for an accident involving a vehicle, vessel or aircraft would be a collision involving injury or loss of life to humans. The worst case for wildlife would be the death of *SARA* listed species which could possibly lead to population level effects. In the event of a vehicle or vessel accident there is also the potential for hazardous materials to be released into the environment (see Section 10.6).

10.6.2 PROJECT DESIGN AND MITIGATION TO MINIMIZE RISK

Project design and mitigation measures to reduce the risk of an accident involving a vehicle, vessel or aircraft include but are not limited to the following.

- Access routes will be identified prior to construction.

- Site access routes including structures (bridges, culverts, *etc*.) and baseline traffic levels will be reviewed, identifying areas with a high risk for accidents (*e.g.*, due to reduced sight lines).
- Signage identifying areas as 'high risk' will be implemented.
- Signage to delineate work areas will be implemented.
- A communications plan for engagement with communities impacted by traffic will be developed and implemented.
- Project-related equipment will follow traffic regulations and posted speed limits.
- Speed in construction areas will be limited based on site conditions.
- Aircraft will meet the ENL requirements for fixed wing planes and helicopters.
- Helicopter contractors will be required to have and implement an aviation safety plan, a health and environmental safety plan, and to be ISO 9001 certified.
- Vehicle accident reporting will follow ENL Incident Reporting System (including near misses).
- Wildlife sightings close to roads will be reported and mitigation will be implemented in high risk areas (*e.g.*, signage, lower speed limits).
- Each work site will have staff trained in First Aid.
- Only trained and licenced individuals will operate equipment.
- For marine work, Transport Canada's Notice to Shipping offices will be notified of work activity and duration.
- Transport Canada and Marine Atlantic will be notified of any work conducted in the marine environment.
- A communication plan for notification of commercial fish harvesters will be developed.

10.6.3 EMERGENCY RESPONSE

Local emergency and response officials will attend to any traffic accident to provide emergency and first aid response as required. ENL will cooperate with local officials in any incident investigation and conduct an internal incident investigation for any Project-related accident. Remedial action will be taken by ENL in accord with the results of the investigations.

If a Project vessel is disabled or grounded, emergency response procedures will be implemented as per the ERP. Following initial response, reclamation tasks will be undertaken as necessary to restore damaged habitats. Habitat compensation works, in the unlikely event it is required, will be implemented for all harmful loss or alteration to fish habitat, where required.

10.6.4 POTENTIAL ENVIRONMENTAL EFFECTS AND THEIR SIGNIFICANCE

A marine vessel collision involving the spill of hydrocarbon is addressed in Section 7.3. A Project-related ship-to-ship collision or grounding of a single vessel involving no release of hydrocarbons may result in damage to vessels and potentially fishing gear. The accident could potentially become an obstruction to local navigation. These outcomes could result in effects on commercial and recreational fisheries as well as current use of lands and resources for traditional purposes by the Mi'kmaq. Based on the planned mitigation (*e.g.,* navigational aids maintained by vessels, standards of seamanship, communication, Notices to Shipping and Notices to Mariners), the potential environmental effects of a ship-to-ship collision during all phases of the Project are rated not significant for all potentially affected VECs. A Project-related vessel accident resulting in damage to the environment or to fishing gear would be addressed through emergency response and include compensation as required.

A Project-related vehicular accident not resulting in a spill is not expected to result in any adverse environmental effects with the exception of potential property damage – the extent of which depends on the severity of the accident. Although public injury or mortality as a result of a trucking accident cannot be ruled out, the likelihood is very low given the mitigation and emergency response prescribed above. In consideration of the safety-related design standards to be applied to the development of all Project-related permanent and temporary access roads, as well as the mitigation and emergency response discussed above, it is predicted that significant adverse residual environmental effects on VECs from a Project-related vehicle accident are not likely.

10.7 UNEXPLODED ORDNANCE (UXO)

10.7.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

Unexploded ordnances (UXOs) are explosive weapons (bombs, bullets, shells, grenades, land mines, naval mines) which have been primed, but did not explode when they were deployed and still pose a risk of detonation. The major issue with UXOs is that over time their detonators degrade, making them more sensitive to disturbance and more dangerous to handle. UXOs can be found in both the terrestrial and marine environments and thus can pose a risk to many aspects of the Project during the construction phase, particularly in the marine environment where ordnances have historically been disposed.

The worst case scenario for an accident involving UXOs would be the detonation of an UXO resulting in the damage to a vessel resulting in loss of life, or the damage/loss of an ROV and cable laying equipment during the subsea cable installation process. The worst case for wildlife would be the death of a *SARA* listed species which could possibly lead to population level effects.

10.7.2 PROJECT DESIGN AND MITIGATION TO MINIMIZE RISK

Project design and mitigation measures to reduce the risk of interactions with UXOs will include but are not limited to the following.

- Pre-construction surveys will provide detailed information about the subsea route.
- Reference to Department of National Defence (DND) UXO database when planning the marine corridor; DND to advise if a site specific risk assessment is required.
- Avoidance of obstacles (*e.g.*, shipwrecks potentially including UXOs).
- The ERP will include emergency response protocols and worker training requirements.
- Site evacuation plans will be initiated if required (*e.g.*, in case of risk of explosion).

10.7.3 EMERGENCY RESPONSE

If UXOs are encountered, emergency response procedures will be implemented as per the ERP, including notification of appropriate personnel and agencies (*e.g.*, Coast Guard, DND).

10.7.4 POTENTIAL ENVIRONMENTAL EFFECTS AND THEIR SIGNIFICANCE

The explosion resulting from a detonation of a UXO could possibly cause worker injury or fatality as well as damage to habitat and wildlife in both the marine and terrestrial environments. It is expected that encounter with a UXO is not likely to occur given the implementation of proposed mitigation and adherence to the policies, practices and procedures described above.

10.8 UNPLANNED RELEASES FROM HDD

10.8.1 IDENTIFICATION OF ACCIDENTS AND MALFUNCTIONS

In the nearshore environment (within 1 km of land), HDD will be used to install the cables beneath the seafloor. HDD requires a drilling fluid (drilling mud) that serves to lubricate the drill bit and downhole assembly as well as to facilitate removal of cuttings from the borehole. The drilling mud will be water based with bentonite added to create the desired level of viscosity for cutting suspension and removal. This water-based bentonite system offers an environmental advantage since it is less toxic compared with other common oil- or polymer based drilling fluids.

One of the risks associated with HDD is the accidental escape of drilling mud into the environment as a result of a spill, tunnel collapse or the release of mud at the exit site of the borehole on the seafloor (referred to as a frac-out).

The worst case scenario for an accident during HDD would be the release of drilling fluids into the marine environment resulting in the smothering of spawning grounds.

10.8.2 PROJECT DESIGN AND MITIGATION TO MINIMIZE RISK

Project design and mitigation measures to reduce the risk of frac-out will include but are not limited to the following.

- Geotechnical assessments to inform HDD borehole design will be conducted prior to drilling.
- The use of specialized trucks at the entry borehole to vacuum the drilling fluid from the drilled hole, thereby preventing a release of drilling muds into the marine environment.
- An emergency frac-out response plan which outlines the protocol to monitor, contain, and clean-up spills will be developed and implemented.
- The conditions laid out in the DFO Statement ‘High-Pressure Directional Drilling’ (DFO 2007b) to protect fish and fish habitat, will be followed.

10.8.3 EMERGENCY RESPONSE

If a frac-out occurs, emergency response procedures will be implemented as per the ERP. Following initial response, reclamation will be undertaken as necessary to restore damaged habitats. In particular, benthic surveys will be conducted to determine the extent of spilled drill fluid in the marine environments. Habitat compensation works will be implemented for all harmful loss or alteration to fish habitat where required.

10.8.4 POTENTIAL ENVIRONMENTAL EFFECTS AND THEIR SIGNIFICANCE

The release of drilling fluid from fractures in the underlying geology could possibly, depending on geology, occur on land or in the marine environment and will vary in quantity. Terrestrial frac-outs occurring in upland areas are typically easy 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. HDD for the Project is planned for the relatively more productive nearshore coastal environments. Bentonite is non-toxic, but smothering of benthic organisms (including fish eggs and larvae) can occur. Such effects would be localized and temporary and would not affect fish on a population level or substantially interfere with commercial fishing activities. In general frac-out is not considered to be a likely occurrence given the geotechnical testing and advanced technical knowledge of the HDD process.

10.9 SUMMARY

The potential for accidents, malfunctions and unplanned events must be considered during planning for any large-scale industrial project such as the Maritime Link Project. Human health and safety is the paramount concern for ENL. Reducing the potential for adverse environmental effects arising from Project-related accidents and malfunctions is also of the highest priority for project planners, stakeholders, and regulatory officials. Compliance with design codes and standards and implementation of mitigation measures summarized in this report will greatly reduce the potential for accidents and malfunctions. A Project-specific Emergency Response Plan, including worker training, will reduce the extent and duration of any accident-related environmental effects. The most common, if any were to occur, Project-related accidents with environmental implications are small spills that will be rapidly cleaned up with no significant environmental effects. In the extremely unlikely event that a Project-related vessel released a large quantity of hazardous material such as fuel into the marine environment, a substantial effort could be required to respond and remediate to pre-spill conditions. Overall, significant, adverse residual environmental effects from Project-related accidents and malfunctions are predicted to be not likely.

11.0 SUMMARY

The Maritime Link is not a unique project from an engineering perspective. The on-land transmission component involves standard engineering practice based on decades of experience supported by well-established standards and protocols. Although there is less experience in North America with HVdc subsea cables, this form of power transmission has been routinely and safely employed in Europe and other countries for over 20 years. That international experience is directly relevant and applicable to conditions in the Cabot Strait.

The environmental assessment (EA) for the Maritime Link, however, is a somewhat more demanding endeavor. First, the Project transects a wide and diverse area geographically, over 500 km from east to west. Second it involves infrastructure situated in terrestrial and marine environments. Third, it requires environmental clearance from three jurisdictions, each with different environmental assessment processes and requirements, and one of which was going through significant legislative change. Nevertheless, none of these challenges pose problems that can not be addressed with standard environmental assessment approaches and methods.

ENL understands that environmental assessment is designed specifically for application at the project planning stage when careful consideration can be given to avoiding or minimizing potential environmental challenges as part of project design. It is also understood that this requires the planning process to be sufficiently advanced to identify and avoid where possible such challenges, but still leaving sufficient flexibility in design to mitigate remaining foreseeable effects. This EA for the Maritime Link follows this phased approach and is designed to enable a smooth transition from the assessment to the subsequent regulatory approval processes (*e.g.*, permitting), wherein precise mitigation measures and monitoring activities specific to certain environmental effects are required before operations may commence.

Engagement with the public is an important aspect, and requirement, of environmental assessment and ENL appreciates the value of early and open consultation with the public concerning its various activities and undertakings. Public and stakeholder consultation for the Maritime Link began in the spring of 2011 for those parties potentially involved with, or interested in, the Project. Stakeholders are identified as regulatory agencies, local residents, landowners, communities, commercial fishers, industry, business community, outfitters, special interest groups (such as hunters and anglers), non-governmental organizations and the general public. In addition to informing the public about the Project, the consultation process, which will continue beyond the environmental assessment process, also enables ENL to address stakeholder issues, concerns and suggestions early in the planning and design process.

ENL places a priority on fostering positive long-term relationships with First Nations based upon positive experiences through our activities within Atlantic Canada. ENL has met with First Nations groups and is committed to meaningful and productive collaboration on this and future projects. With respect to this Project, since 2011 there have been more than 50 exchanges, including meetings, workshops, conversations, collaborative reviews and information exchanges, with Mi'kmaq leadership, organizations, and businesses. Proactive engagement with the Mi'kmaq will continue throughout the EA process and during the permitting, construction and operation phases of the Project.

ENL has based its approach to this environmental assessment for the Maritime Link on the following corporate principles:

- Environmental protection and conservation is a corporate responsibility, on par with providing the general public with the highest level of service possible.
- Good environmental management is good business; costs, risks and inefficiencies can all be reduced with proper environmental planning.
- Engineering design and environmental protection need to share a common information base to ensure optimum project planning, construction and operation.

At the operational level, ENL follows the following priorities:

1) Avoid environmental problems wherever possible;

2) If avoidance is not possible, use best-practice mitigation methods; and

3) Follow-up to determine effectiveness of mitigation, and adjust where necessary.

These priorities provided a backdrop against which the environmental assessment Guidelines jointly issued by the regulators were interpreted and acted upon.

The foundation of any environmental assessment is information. As an initial priority, information is required to focus the EA on the critical environmental, socio-economic and cultural factors to be considered; the so-called valued environmental components (VECs). The following VECs selected for this Project reflect the directions contained in the EA Guidelines as well as concerns and suggestions raised during the public engagement process:

Island of Newfoundland

- Caribou
- Species of conservation interest
- Socio-economic environment
- Archaeological and heritage resources

Cabot Strait

- Species of conservation interest
- Commercial fisheries
- Marine environment
- Current use of land and resources for traditional purposes by the Mi'kmaq

Nova Scotia

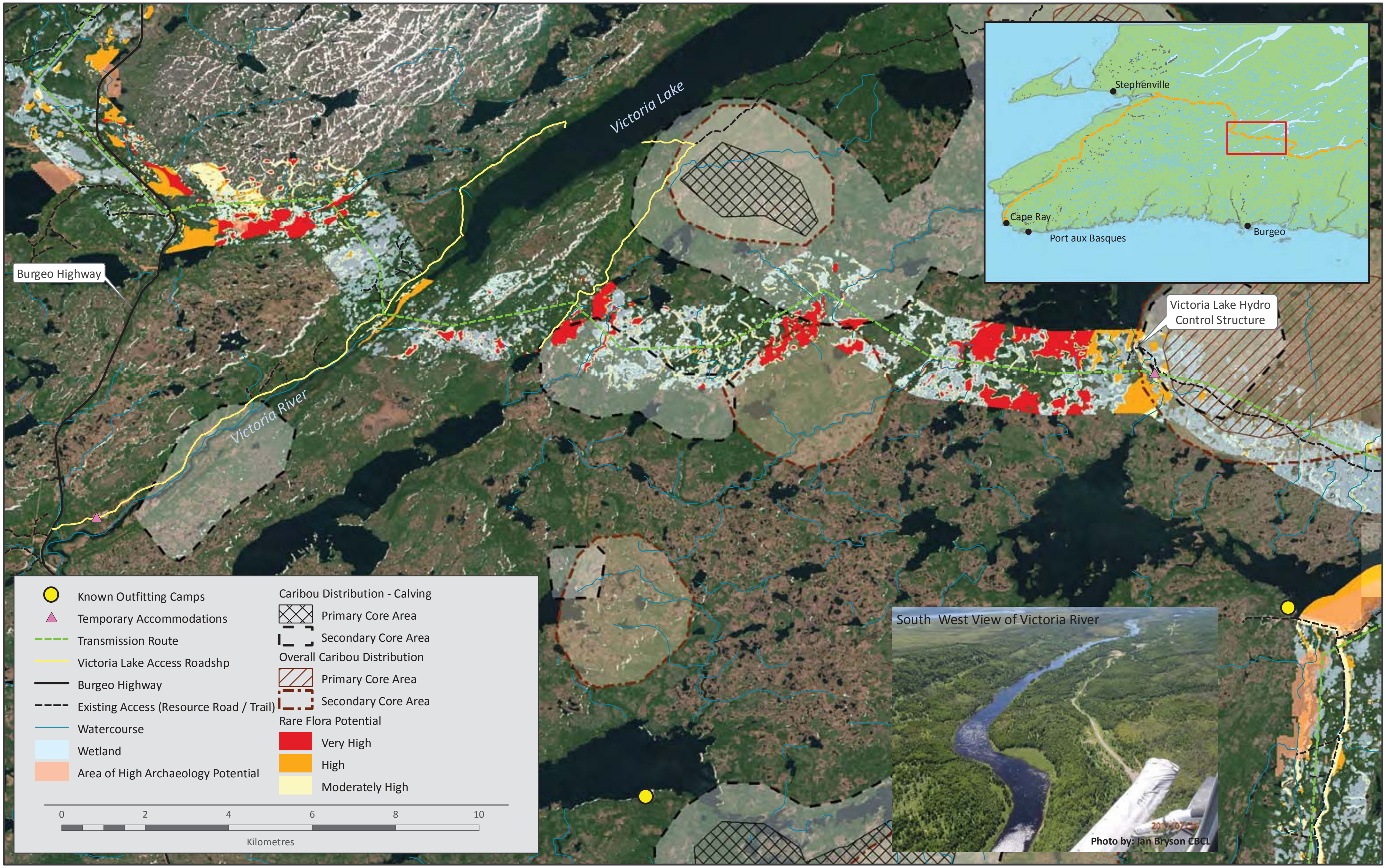
- Species of conservation interest
- Socio-economic environment
- Archaeological and heritage resources
- Current use of land and resources for traditional purposes by the Mi'kmaq

A second priority in the EA process is to obtain sufficient information to determine the significance of the potential effects on these VECs from activities associated with the construction and operation of the Project. To this end, ENL commissioned a wide range of studies on environmental, economic, social and cultural features, systems and processes important for both engineering design and environmental management and protection.

Although the suite of studies thoroughly addressed all of the VECs, somewhat more attention was given to a few concerns of particular interest to regulators and stakeholders. Thus, specific data collection, analysis, planning and design were undertaken to define the nature and extent of potential environmental effects and identify appropriate mitigation measures, with reference to the following situations:

- minimizing potential effects on caribou habitat and distribution, particularly in sections of the transmission route that overlap areas of known caribou use;
- through careful planning and design, limiting new means of access to a relatively undisturbed area in the central part of Newfoundland;
- avoiding or mitigating potential effects on important habitat for commercial fish species in the Cabot Strait; and
- minimizing the potential environmental effects of electromagnetic fields generated by HVdc/HVac transmission.

Throughout the planning and design process the environment and engineering teams shared the constant stream of environmental information and data that resulted from the various field and desk studies underway. This was particularly important in the early stages of project planning, when "mitigation by design" can occur. For example, data from geophysical and benthic surveys enabled engineers to avoid challenging construction areas and were used by the environment team to identify important or sensitive habitats. Figure 11.1.1 provides an excellent example of how this type of information was used to plan the transmission corridor route to avoid various critical environmental features, some of which also posed serious engineering challenges.



Emera Newfoundland & Labrador

Coordinate System:
UTM NAD 83 Zone 21

Scale: 1:125,000
Date: 11/29/12

Data Sources:
-Geobase
-Department of Environment and Conservation National Atlas
-Newfoundland and Labrador Department of Environment (NLDEC)

FIGURE 11.1.1

Constraints In Area of New Access
Island of Newfoundland

ENL0143

Some of the studies involved the development of models which integrated and analyzed data to produce maps useful to both engineers and biologists. For example, data from the ecological land classification (ELC) were used to produce models for wetlands and rare flora. Likewise, the ELC model was also used in engineering design to avoid, where feasible, the placement of towers in sensitive wetland and freshwater habitats. Furthermore, geotechnical surveys and benthic modeling identified bottom types important for commercial fisheries, as well as areas that could possibly pose a risk to the integrity of the subsea cables.

The information and data were used in a structured and proven environmental assessment methodology that has been successfully applied in a number of large private and public projects, including the construction and operation of high voltage transmission systems. This methodology identifies the Project-related risks to important components of the biophysical and socio-economic environments, *i.e.*, the VECs, describes appropriate mitigation measures and assesses the significance of the residual environmental effects against stated criteria or thresholds for each VEC.

As mentioned above, following efforts to avoid environmental problems in the design stage, the next critical step is the application of best-practice mitigation. This assessment focused on two types of mitigation – standard best practice based on years of experience in the industry, and specific mitigation measures designed to address potential environmental effects associated with this particular Project. To a large degree, the outcome of the EA process depends upon the extent to which these mitigation measures, either those integrated into Project planning and design or recommended in the EA report, are effective. Appendix E provides a comprehensive summary of commitments which cover a wide variety of mitigation, follow-up and monitoring, referenced throughout the assessment.

Mitigation must be implemented to be successful. In presenting the mitigation measures in this assessment ENL is making a commitment to ensure that they are implemented in an appropriate and timely manner. To ensure this, the company will develop a number of operational documents focused on reducing various types of environmental risk associated with construction and operational activities. The overarching Environmental Management Plan (EMP) will include Environmental Protection Plans (EPPs) that will clearly set out the environmental protection measures and procedures that must be implemented for each phase and activity of the Project as planned, including mitigation prescribed in required permits, approvals, and authorizations. The EPPs are the primary mechanism for ensuring that mitigation is implemented, as required by applicable agencies through permitting processes, and as determined through the EA review process. An ERP will also be developed as a key document to respond to potential Project incidents and emergencies and limit potential for adverse environmental effects.

In some cases, it may not be possible to fully mitigate Project-related environmental effects. This could happen where a specific resource, or access to a specific resource, will be permanently reduced or lost. For example, as a result of early engagement with commercial and subsistence fishers every effort will be made to avoid or mitigate effects on important fishing areas; however, where permanent loss of habitat results from Project activities negotiations may lead to habitat replacement.

The core of the environmental assessment is the determination of the significance of residual effects after Project planning, design and mitigation have been taken into account. The ranking of significance is based on whether or not the residual effect exceeds a standard, condition or threshold that is pre-defined for each VEC. For the Maritime Link none of the residual environmental effects on the 12 VECs selected across the three geographic regions for this assessment were rated as significant. In addition, a similar approach was taken to assess the potential for significant cumulative environmental effects, *i.e.*, interactions with other planned projects, which were also rated as not significant.

The potential for accidents, malfunctions and unplanned events was included in the environmental assessment. Key considerations were the need for compliance with design codes, standards and mitigation measures presented in this report, as well as the Project-specific ERP, which together will minimize the extent and duration of effects from any major accident, in the unlikely event that such would occur. The assessment determined that there will be no significant, adverse residual environmental effects from Project-related accidents.

Potential effects of the environment on the Project were also considered in the EA Report including: geophysical hazards, climate effects, wildfires, and marine hazards. As would be expected, the long-term structural and operational integrity of the entire transmission system is of highest priority for the proponent. In general, environmental conditions that can affect the Maritime Link Project infrastructure or operations will be addressed through engineering design (including appropriate safety factors) and compliance with relevant codes and standards, including consideration of local weather and geophysical conditions. It is concluded that the effects of the environment on the Project during any phase will not be significant and will be managed through Project design, mitigation and monitoring.

In summary, the results of a comprehensive, thorough and rigorous environmental assessment have shown that the Maritime Link Project is not likely to result in significant adverse residual environmental effects, including cumulative effects, provided that the proposed design features, mitigation measures, and monitoring and follow-up programs are implemented.

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12.1 PERSONAL COMMUNICATIONS

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Fader, G. 2012. Senior Consultant. Role: Subject Matter Expert for Marine Geophysical.

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Lewis, K. 2012. Sustainable Development and Strategic Science, Newfoundland and Labrador Department of Environment and Conservation, St. John's, NL.

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