

8.0 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT

The effect of a project on the environment may not be fully represented by the individual interactions of project components or activities with VECs. In many cases, individual projects and/or project components produce environmental effects that are not significant. However, when combined with the effects of other project components or other projects and activities, these small effects may become a concern, as they may cause a cumulative effect. The basis for the consideration of the cumulative environmental effects are provided in the Responsible Authority's Guide (the Agency, 1994), and supplemented by the Cumulative Effects Practitioners Guide (the Agency, 1999).

The Cumulative Effects Assessment Practitioners Guide (the Agency, 1999) defines cumulative effects as:

“changes to the environment that are caused by an action in combination with other past, present and future human actions.”

The formally remote area where the Keltic Project is proposed has been subjected to past and ongoing human activities such as industrial development, mining, and forestry. A description of the baseline conditions of the site are presented in Section 4.0 of the CSR. This Cumulative Effects Assessment (CEA) has considered potential cumulative effects that may result from Project construction or operation in concert with any other past, present, or foreseeable future projects.

8.1 METHODOLOGY

This CEA incorporates the five key steps outlined in the Cumulative Effects Practitioners Guide:

- *Scoping*: identification of regional issues of concern, VEC's, spatial and temporal boundaries, other unrelated projects, and potential effects of unrelated projects;
- *Analysis of Effects*: analysis of effects of VEC's identified during scoping;
- *Mitigation*: recommend mitigation for effects identified;
- *Evaluation of significance*: determine residual effects and their significance with consideration of land use thresholds and land use objectives and trends; and
- *Follow-up*: identify appropriate monitoring.

8.1.1 Scoping

The objective of scoping is to identify the key environmental areas of concern that should be considered in the analysis of effects for the CEA.

As part of this CSR, direct Project potential effects on VECs identified as within the scope of the CSR are presented, prior to mitigation, and then residual effects determined after mitigation measures were considered (Section 5.0). Provides a summary of the significance of these effects along with other cumulative projects.

8.1.1.1 Regional Issue Identification

The next step for a CEA is to identify regional issues that may also result in environmental effects and to then determine where they overlap with potential residual Project effects identified in this CSR. These include:

- industrial development’s contribution to GHG emissions;
- increased industrial development of the area and associated effects;
- changes in marine fish species assemblages (commercial and non-commercial); and
- loss of tourism resulting from development.

The regional concerns listed have a distinct overlap with the direct effects of the proposed Project, outlined in Section 5.0. These overlapping issues will be assessed in this CEA.

8.1.1.2 Regional VEC Identification

The regional VEC’s assessed in this CEA have been selected based on a thorough understanding of the region that was acquired in the preparation of this CSR. This understanding is based on professional judgement, consultation with regulatory agencies, and stakeholder input. Table 8.1-1 summarizes regional issues, associated regional VEC’s, and example indicators.

TABLE 8.1-1 Regional VEC Summary

Environmental feature	Regional Issue/Concern	Regional VEC	Example Indicator
Hydrology/Freshwater Quality/Quantity	Loss/alteration of fish and fish habitat	Aquatic flora and fauna	Fish species composition and population size, benthic community
Groundwater Quality/Quantity	Ability to use potable water wells	Potable water wells Aquatic flora and fauna	Depth to groundwater in wells, groundwater quality in wells, and surface water quality in Betty’s Cove Brook and the unnamed tributary in Dung’s Cove
Marine Water Quality	Loss of aquatic habitat/direct mortality	Fish	Fish habitat
Soil/Sediment Quality	Soil contamination, topsoil mixing, loss of productivity	Terrestrial flora	Potential receptors for contaminants in aquatic environments
Air Quality	Human health, terrestrial vegetation, wildlife	Residential receptors Terrestrial flora and fauna	NO _x , SO _x , PM
Climate Condition	Global Warming/GHG emissions	GHG regional targets	Stack emissions of CO, CO ₂ , and other GHGs and other Project reported emissions
Vegetation	Loss/fragmentation of habitat	Wildlife, avian resources	Local fauna, resident and migratory birds
Species at Risk	Loss/fragmentation of habitat	Roseate tern habitat	Roseate tern
Fish and Marine Habitat	Loss/alteration of aquatic habitat	Fish, aquatic fauna	Fish species composition and population size
Marine Mammals	Loss/alteration of aquatic habitat	Whales	Whales

Environmental feature	Regional Issue/Concern	Regional VEC	Example Indicator
Wildlife	Loss/fragmentation of habitat	Local fauna	Local fauna
Migratory Birds	Loss/fragmentation of habitat	Migratory birds, seabirds	Avian populations, at risk birds such as Roseate Tern
Wetlands	Loss of wetlands function	Wetlands	Depth to groundwater, vegetation composition
Lighting Conditions	Attracting or repelling wildlife	Avian and terrestrial wildlife	Roseate tern, and local avian and terrestrial populations
Atmospheric and Acoustic Environment	Noise within limits for residents or not affecting wildlife	People, whales	Noise measurement
Traditional Use	Loss of ability to use traditional land	Fisheries, hunting	Community relations
Heritage and Archaeological Sites	Loss of resources	Cemeteries, artefacts	Mitigative resource recovery
Navigation	Increased traffic	Regional shipping	TERMPOL process
Marine and Human Health and Safety	Potential for collisions; Worker and resident Health and Safety	People and vessels	TERMPOL process Incident reporting
Fisheries	Loss of income for fishermen from reduction in fish stocks.	Fisheries - lobster	Compensation agreement
Aquaculture	Impacts to water quality	Aquaculture production	See water quality
Tourism	Loss of tourism resulting from development.	Tourism	Local tourism business receipts

8.1.1.3 Temporal and Spatial Boundaries

Spatial boundaries reflect potential Project impacts and potential interactions with other projects. The local Study Area is the respective watershed as identified previously for aquatic VECs. For atmospheric VECs the Study Area is the regional air shed. For terrestrial VECs, spatial boundaries reflect potential for direct or indirect disturbances (such as noise). For VECs where potential significant effects are more widely distributed, such as impact to a rare species with a regional or national distribution, a larger Study Area (based on the VEC population) is considered. With respect to the assessment of effects related to Country Island, a 25 km boundary was established in accordance with the scoping of the CSR.

Temporal boundaries encompass past projects and activities resulting in the conditions of the existing environment and certain and reasonably foreseeable future projects and activities that could influence the environmental conditions for the life of the Project.

Because of the temporal boundaries set for this CEA, based on the ability to determine certain or likely projects, given the estimated 50 year life, decommissioning is not considered in this CEA.

The CEA addresses cumulative effects between both the Project and other projects and activities, and between Project components. Often the intra-Project assessment is included with the direct effects assessment (Section 6.0) but where some of the Project works and activities are distinctly separated in time, as is the case with the proposed Project, it makes sense to consider potential effects for Project components as being cumulative.

The Project components within the scope of the CSR to be addressed in the CEA are:

- LNG Terminal, marine transfer pipelines, LNG storage tanks and the regasification facilities;
- marginal wharf; and
- Project related shipping within 25 km of Country Island.

Other Keltic Project components, that are not part of the CSR scope but that are included as “other projects and activities” in the CEA include:

- petrochemical facilities;
- co-generation power plant; and
- Meadow Lake impoundment (including and water supply infrastructure).

Regulatory requirements and objectives and Project mitigation are provided in Sections 1.0 and 5.0, respectively. Existing management plans for the VECs, such as EC’s Recovery Strategy for the Roseate Tern in Canada, are incorporated in the consideration of impacts (individual and cumulative) and in development of mitigation.

The rationale and methods for determining significance (magnitude, geographic extent, duration/frequency, and reversibility) are as identified for the direct effects assessment (Section 5.0).

8.1.1.4 Selection of Other Projects and Activities

For the purposes of the assessment, it is assumed that the existing status or condition of each VEC reflects the influence of other past and current projects and activities occurring within or outside of the Project Area. It also assumes (unless there is evidence to the contrary, such as predictable down or upward trends in a population) that these existing activities will continue to be carried out in the future and will have similar effects as are currently observed. The assessment has, therefore, integrated the cumulative effects of these ongoing projects and activities. The CEA thus focuses on the effects of other future projects and activities, as considered and assessed for each VEC.

The future projects considered include planned or reasonably foreseeable projects/development activities in Nova Scotia both onshore and offshore that might interact in a cumulative fashion with activities of the Project. Projects were considered if planned and/or likely to proceed (have initial level of regulatory approval/engagement) and include:

- regional oil and gas developments;
- upgrades or realignments of existing roads and other linear corridors; and
- other Keltic Project components (not included within scope of CSR):
 - petrochemical facility;
 - co-generation plant; and
 - Meadow Lake impoundment.

See Figure 8.1-1 for locations of other projects in relation to Keltic Projects and watersheds.

Regional Oil and Gas and Related Developments

Other planned or reasonably foreseeable future projects related to oil and gas development that, together with the proposed Project, may cause cumulative effects include:

- EnCana Corporation’s Deep Panuke project; and
- M&NP pipeline expansion.

Oil and gas exploration and development in Nova Scotia, in particular the offshore, has slowed in recent years with significantly less exploration related activities occurring or anticipated to occur in the near future as indicated by the decrease in EAs under consideration by the Canada Nova Scotia Offshore Petroleum Board (Table 8.1-2).

TABLE 8.1-2 Number of Environmental Assessments (EAs) Considered by the Canada Nova Scotia Offshore Petroleum Board, 2001-2005

Activity	Seismic Surveys	Other Geophysical Surveys	Drilling Programs	Totals ¹
2004-2005	2	3	1	7
2003-2004	13	4	10	29
2002-2003	7	4	8	21
2001-2002	8	7	2	18

Totals include a small number of Strategic EAs and other studies

The one exception to this trend is EnCana Corporation’s Deep Panuke project which has entered the Development Plan approval stage. This Project is addressed in the CEA. Key concerns for potential cumulative effects relate to effects on the marine environment, navigation, and air quality.

In addition to the Keltic proposal, one other LNG project is currently under consideration outside the CEA boundary at Bear Head, Nova Scotia. This Project has received an initial Permit to Construct from the NSUARB but is currently on hold.

Potential for additional gas delivery via offshore Nova Scotia or LNG sources may require the expansion of the M&NP pipeline capacity through additional compression or looping of the current pipeline. The expansion is contingent on the amount of gas that will be delivered by Deep Panuke and the KDP as well as the gas generated from ExxonMobil’s Sable project. Expansion by compression will occur outside the CEA boundary.

In addition to the further development of offshore natural gas resources and the importation of LNG, Nova Scotia has experienced an increase in exploration for onshore natural gas; however, none of these activities are within the spatial boundaries of this assessment.

Road Upgrades and Realignment

The only road project that may cause cumulative effects together with the proposed Project is the realignment of Route 316. Key issues for consideration include habitat fragmentation and potential adverse effects on fish and habitat as a result of stream crossings and potential discharges to surface water environments.

Other Keltic Project Components

Other Keltic Project components relevant for the CEA are:

- petrochemical plant;
- co-generation plant; and
- impoundment of Meadow Lake.

The three components are described in detail in the provincial EA Report (AMEC, 2006). Key issues relevant for the CEA are related to climate conditions (contributions to GHG emissions) water quality (fresh and salt water), air emissions, loss, and impairment of terrestrial habitat and wetlands and changes in lighting conditions.

8.1.1.5 Potential Effects of Other Projects and Activities

The key potential effects associated with other projects and activities, having the potential to affect VECs, include:

- loss/alteration of fish and fish habitat;
- loss of habitat and behavioural changes for the roseate tern;
- loss/alteration of aquatic habitat;
- loss/fragmentation of habitat;
- loss of tourism resulting from development; and
- loss of income for fishermen from reduction in fish stocks.

8.1.1.6 Summary of VECs Interacting with Other Projects

Subsequent sections discuss potential cumulative effects on each VEC. Potentially affected VECs include: aquatic, atmospheric, terrestrial, and various socio-economic environment components. Aquatic interactions occur primarily through water quality effects of storm or process discharges within the local watershed. Air quality interactions occur through contribution of emissions to local or regional air quality issues including GHGs. Socio-economic interactions typically occur through resource interactions or disturbance. In the initial scoping of the potential for cumulative interaction with a given VEC, the following criteria were applied:

- a measurable environmental effect within the Study Area related to the Keltic Project component and reasonably foreseeable Project components was identified as acting on the VEC; and
- the environmental effect in question is demonstrated to act cumulatively.

Potential cumulative interactions between Projects and VECs and relative timing of Projects are identified in Table 8.1-3 and Table 8.1-4 respectively.

TABLE 8.1-3 VEC Pathway Interaction Matrix

Other Projects/ activities Considered	VECs																					
	Hydrology/ Freshwater Quality/Quantity	Groundwater Quality/Quantity	Marine Water Quality	Soil/Sediment Quality	Air Quality	Climate Condition	Vegetation	Species at Risk	Fish & Marine Habitat	Marine Mammals	Wildlife	Migratory Birds	Wetlands	Lighting Conditions	Atmospheric and Acoustic Environment	Traditional Use	Heritage and Archaeological Sites	Navigation	Marine and Human H&S	Fisheries	Aquaculture	Tourism
Keltic Petrochemical Plant, Co-generation Facility, Meadow Lake Impoundment, Road	F	F	FW	FWS	F	F	X	FWS	FWS	FWS	F	FWS	F	FW	X	X	FW	FW	F	FWS	FWS	FW
Other Regional Oil and Gas development	F	X	FW	FWS	F	F	X	FWS	FWS	FWS	F	FWS	F	FW	FWS	X	FW	FWS	FS	FWS	FWS	FW

Notes: F = LNG Facilities, W - Marginal Wharf, S - Shipping = Potentially significant cumulative effects likely.

X = Potentially significant cumulative effects not likely (i.e., interaction screened from further investigation) LNG Terminal, Marine Transfer Pipelines, LNG Storage Tanks and the Regasification Facilities

TABLE 8.1-4 Proposed Schedules for Keltic and Other Project Construction*

Other Projects	Summer 2007	Fall 2007	Winter 2007/8	Spring 2008	Summer 2008	Fall 2008	Winter 2008/9	Spring 2009	Summer 2009	Fall 2009	Winter 2009/10	Spring 2010	Summer 2010	Fall 2010	Winter 2010/11	Spring 2011	Summer 2011	Fall 2011	Winter 2011/12
Keltic Project - LNG Terminal, Marine Transfer Pipelines, LNG Storage Tanks and the Regasification Facilities				█	█			█	█	█	█	█	█	█	█	█	█	█	█
Keltic Project - Marginal Wharf				█															
Keltic Project - Related Shipping within 25 km of Country Island (OPERATIONS)															█				
EnCana Corporation's Deep Panuke project (onshore facilities)									█	█	█	█	█	█	█	█	█	█	█
Bear Head LNG Project (ON HOLD)																			
M&NP pipeline expansion (compression and looping if conducted)									█	█	█	█	█	█	█	█	█	█	█
Realignment of Route 316									█	█	█	█	█	█	█	█	█	█	█
Petrochemical plant																			
Co-generation plant																			
Impoundment of Meadow Lake																			

8.2 LNG MARINE TERMINAL, MARINE TRANSFER PIPELINES, LNG STORAGE TANKS, AND THE REGASIFICATION FACILITY

8.2.1 Assessment

8.2.1.1 Hydrology

Potential cumulative effects to surface, freshwater, groundwater, and marine water quality are addressed in Sections below.

8.2.1.2 Freshwater Quality/Quantity

The principal interaction between the Project activities and surface waters (of Betty's Cove Brook and Unnamed Tributary to Dung Cove) is associated with land disturbance during construction and commissioning of the Project. The three principal types of water discharge expected at the site during construction are:

- clean and possibly sediment-laden storm-water;
- construction wastewater (hydrostatic test waters, concrete wash water, storm-water that has been in contact with uncured concrete); and
- sanitary waste water (worker sites and field offices).

During construction, TSS concentrations in storm-water, residual hydrocarbons, and/or metals in hydrostatic test waters, or the concentration of lime in concrete production wastewaters, could exceed the water quality guidelines for the protection of aquatic life published by the CCME (1999).

The principal interactions between the Project activities and surface waters during the operation phase of the Project are associated with wastewater and storm-water discharges. The largest discharge component by volume is expected to be storm-water.

The principal types of water discharge expected during operations for the component of the Project include:

- potentially oily storm-water from some process complexes (paved or hard surfaces), process water, cooling water blow down;
- clean storm-water from some process complexes and general areas, either paved (hard surface) and unpaved (soft surface); and
- domestic-type or sanitary waste water (some from process complexes and some from common-user utilities).

With the mitigation measures outlined in Section 5.1.2, effects on water quality during construction are anticipated to be minor (not significant) based on the small magnitude and infrequency of large runoff flows. Any effect will be temporary and reversible. During operation, mitigation measures will be used to attenuate peak flows to watercourses and maintain base flows in watercourses. Proper modeling and design of the storm-water management system will

ensure maintenance of flows in watercourses. Any residual effect is minor (not significant), temporary and reversible.

The Project construction overlaps with the foreseen construction schedules with the Deep Panuke on-shore facilities, possibly the M&NP pipeline expansion, and the Keltic Petrochemical plant and co-generation plant (Table 8.1-2), all which will have similar construction issues that could potentially affect water quality in Betty's Cove or the Unnamed Tributary to Dung Cove. The realignment of Route 316 and the Meadow Lake Impoundment are not located within the same sub-watershed as the facility and thus do not act cumulatively on freshwater VECs.

With respect to water quality, the Keltic facilities not covered in this CSR will implement similar mitigation measures during construction. It is also expected that other projects implement similar mitigation measures during construction, including adherence to the "Erosion and Sedimentation Control Handbook for Construction Sites" (Nova Scotia Department of the Environment, 1988). The offset staging of construction periods for identified projects will also reduce construction period effects. As such, the cumulative effect on water quality in Betty's Cove and the Unnamed Tributary to Dung Cove is anticipated to be minor, short-term, and reversible.

Although the footprint of the Project is relatively small, it will result in an increase in impervious cover, which will reduce the amount of recharge area, which can cause drier conditions and longer dry periods between flow events in streams. The net effect is a possible increase in stream erosion and channel straightening over time, accompanied by reduced water and aquatic habitat quality. The Project will mitigate this effect by maintaining as much vegetation as possible in the stream-bed and through the design of the storm-water facility.

Construction of other Keltic facilities and the Deep Panuke on-shore facilities, which is expected to modify drainage within over 50% of the watershed, will also alter the flow regime, in particular within Betty's Cove Brook. However, with a similar commitment to proper storm-water design and maintaining riparian vegetation, the cumulative effect on water quantity is anticipated to be minimal, long-term, and reversible, and to comply with regulatory requirements.

Monitoring for the operation phase of the Project will consist of annual qualitative/quantitative sampling of the benthic-invertebrate community at one station on both Betty's Brook and the unnamed tributary to Dung Cove during post construction years 1, 2, 3, and 5, and every 5 years thereafter. Annual reports based on survey results (ephemeroptera/ plecoptera/ trichoptera index, taxon dominance, density, species diversity, hilsenhoff biotic index, etc.) will be prepared and the results compared with previous years. This monitoring will ensure that significant cumulative effects on water quality and quantity are not of a magnitude to effect aquatic habitat.

Table 8.2-1 summarizes the cumulative effects discussed for freshwater quality/quantity.

TABLE 8.2-1 Cumulative Summary – Freshwater

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm-water discharges in combination with other discharges from other project s in fresh-watershed	Minor	Storm-water discharges within the watershed from other Keltic Project components and other oil and gas projects are designed to meet regulatory limits.	Low	Betty's Cove Brook watershed	Storm events	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.3 Groundwater Quality/Quantity

The issues regarding the quality and quantity of groundwater are the effects that the plant construction and operation may have on water supply wells, and the effects that changes to the groundwater regime may have on surface water bodies, streams, and wetlands adjacent to the Project.

The field reconnaissance indicates that there are approximately 40 wells located within 1 km of the site boundaries of the Keltic Development Proposal. There are also two streams within the site boundaries (Betty's Cove Brook and the unnamed tributary to Dung Cove) which may have groundwater supplies interrupted by excavation associated with site preparation and construction.

Based on the projected gravitational groundwater flow lines shown in Figure 4.1-6, possible surface water receptors include Betty's Cove Brook, and associated wetlands, the unnamed tributary to Dung Cove, Dung Cove, and Stormont Bay. Possible receptor wells, depending upon the final site configuration, are likely to include wells west of the site within a zone that extends along Highway 316 between Webbs Cove and Dung Cove, the degree and significance of which would depend on the exact locations and nature of the source, well type, nature of the surficial and bedrock geology present between the source and the well, and distance to the well. Depending upon facilities locations, other wells north of this zone could, to a lesser degree, also become receptors.

The severity of the water supply well impacts are expected to be a function of well type (spring, dug well, drilled well), age of the well, well construction method, distance from the site boundaries, overburden thickness, and the hydraulic properties of the soil and bedrock.

With respect to groundwater quantity, the main concerns related to plant site construction are:

- potential loss of well yield or lowered water level in dug wells (this is not expected to be significant due to the relative distance and small number of wells involved);

- possible damage to, or loss of drilled wells during blasting operations; and
- possible reduction in base flow at on-site streams and reduced (or increased) discharge at wetlands.

With respect to groundwater quality, the main concerns related to plant site construction are:

- chemistry changes in down-gradient wells due to uncontrolled runoff;
- temporary siltation of dug wells during heavy equipment operations; and
- accidental release of hazardous materials up-gradient of wells or streams.

Although similar concerns exist for any construction activity, including other Keltic facilities, the Deep Panuke Project, and the M&NP pipeline expansion, with proper site grading, improvements as required to affected wells, as outlined in Section 5.1.3.2., and the implementation of the Emergency Management Plan, cumulative effects on groundwater and secondary effects such as effects on wells, are anticipated to be minimal.

As construction work progresses, follow-up well sampling will be done, as required, to adequately assess general groundwater and specific well water supply quality. No follow-up is required for the operations phase.

Table 8.2-2 summarizes the cumulative effects discussed for Groundwater.

TABLE 8.2-2 Cumulative Summary – Groundwater

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Project affects on local wells or surface water/wetlands	Minor	Wells are typically downgradient and will be monitored during construction	Low	Local ground watershed	project	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.4 Marine Water Quality

Storm and process water discharges from the regasification plant, terminal, and LNG Storage tanks (including hydrostatic test water) as well as portions of the co-generation facility, Petrochemical plant, and proposed Deep Panuke Facilities may contribute contaminants to the nearshore marine environment either directly or indirectly. Storm-water is dealt with separately in Section 8.2.1.2 and is anticipated to have a minimal significant effect.

At maximum capacity (18 billion m³/year) the LNG facility will discharge approximately 490,000 m³/year consisting of purge water from SCVs and cooling water from the BOG compressor. Discharges of purge and cooling water to the marine environment may introduce contaminants to the marine environment and cause thermal pollution in the vicinity of the discharge point. Only other potential sources for effects on the marine water from the LNG facility may result from accidental spills of contaminated material. Potential effects from accidental events and malfunctions are described in Section 10.0.

Significant cumulative impacts from construction activities are not expected to occur due to effective mitigation measures, and effects that are short term in nature, reversible and involving relatively small volumes from the various projects at one time within the watershed.

Coastal and marine development such as the Deep Panuke pipeline may also affect marine water quality in the same general area through addition of contaminants on a chronic or acute basis. Construction of other projects in the immediate vicinity is not expected to occur concurrently and is not considered cumulative. In addition, ongoing contributions of contaminants are anticipated in the general marine area due to runoff from historical mining areas. While not quantified, mining contributions are expected to be minor due to the limited area of impact. Contaminants may also be released into the marine environment on an ongoing basis from the historical deposition of mine tailings or other contaminants in sediment. Cumulative sources of marine water contaminants to the general marine area are limited in extent, have low concentrations, are not known to include substances that bioaccumulate, and are not expected to result in significant cumulative effects. Table 8.2-3 summarizes the cumulative effects discussed for marine water quality.

To ensure the adequacy of the mitigation measures and the proper functioning of the process water treatment, monitoring of effluent quality (including temperature) and quantity at the point of discharge will be conducted. Details of the program will be established in consultation with the provincial regulator during the permitting stage and detailed design.

8.2.1.5 Soil/Sediment Quality (terrestrial and marine)

Sediment quality in the adjacent watercourses (fresh and marine) can be affected by addition of storm-water/process water from the Project facilities and other Keltic components, and the proposed Deep Panuke facilities as noted above for water quality. As no significant water quality cumulative effects are anticipated, sediment effects are unlikely. Marine sediment sampling in the wharf and terminal area found no indications of existing contaminants. Other potential sources of contaminants in the general area are small as development is limited. Although existing contaminants were found (arsenic, mercury) in Isaac's Harbour, neither of these metal are components of the Project and cumulative impacts are not anticipated.

It is of note that in compliance with EA approval conditions (Item 1.5) established by NSEL (NSEL, Environmental Assessment Approval. March 14, 2007 - http://www.gov.ns.ca/enla/ea/kelticpetro/KelticPetro_Conditions.pdf), Keltic will generate a plan to mitigate human health and environmental impacts of contaminated mine tailings and/or soils

TABLE 8.2-3 Cumulative Summary – Marine Water Quality

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in combination with similar discharges from other projects to same general marine area	Minimal	<ul style="list-style-type: none"> All process and storm-water discharges from other Keltic Project components and oil and gas projects to the immediate marine watershed are designed to meet regulatory limits. Low concentrations of contaminants in existing environment; not bioaccumulating substances in either. 	Low	Local to the mixing zone adjacent the Study Area	Storm or mixing events	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

and sediments on the Project Site, via remediation or risk management. This will be consistent with the Nova Scotia Guidelines for the Management of Contaminated Sites. The Remediation Action Plan and /or Risk Management Plan will be approved by NSEL prior to commencement of construction. Upon completion of the remediation or risk management work, Keltic will submit a certificate of Compliance to NSEL to demonstrate that the work has been completed and/or the Risk Management is effective.

In accordance with Item 2.10 in the NSEL EA approval conditions, a plan will be developed and implemented to monitor environmental effects for all relevant chemical and biological parameters that are expected to enter the environment or be remobilized as a result of Project activities in all receiving environments, including those which may impact human health and/or organisms (NSEL, 2007).

Mitigation for accidental spills and malfunctions is presented in Section 10.0. Table 8.2-4 provides a summary.

8.2.1.6 Air Quality

Construction types of air emissions of the Keltic Project and any of the identified other planned and future projects will occur over a relatively brief period of time, will have only very localized and reversible impacts, and are not expected to act cumulatively. Typically, in rural settings, air emissions, in particular dust, are not monitored during construction. If concerns are expressed on site related to occupational health and safety, portable PM₁₀ monitors may be used for real time measurements of PM by field inspectors. If concerns are expressed regarding dust levels off-site, Keltic may elect to employ high-volume samplers to determine particulate levels at specific receptors.

TABLE 8.2-4 Cumulative Summary – Soil/Sediment Quality

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in combination with similar discharges from other projects to the landscape or downstream receiving waters	Minimal	<ul style="list-style-type: none"> All process and storm-water discharges from other Keltic Project components and oil and gas projects to the immediate marine watershed are designed to meet regulatory limits. Low concentrations of contaminants in existing environment; not bioaccumulating substances in either. 	Low	Local to the mixing zone adjacent the Study Area	Storm or mixing events	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

During facility operation, effective emission control measures will be employed at all identified Keltic emissions sources and will ensure that concentrations of air emissions remain within applicable government standards and guidelines. Cumulative effects may occur with emissions from the SOEI gas plant and metering station, other Keltic components, local traffic, regional transport of air pollutants, and the proposed Deep Panuke Facilities. However, the site is rural, traffic in the area is low, and cumulative effects of air emissions are expected to be not significant at off-site locations. Air quality modelling conducted for this Project included SOEI emissions to verify Nova Scotia Air Quality Regulations and CEPA Ambient Air Quality Objectives would be met. Modelling confirmed a negligible contribution to regional emissions of ozone, with the precursors to ozone, NO_x and VOCs, representing 2.8% and 0.5% of the provincial totals.

It is anticipated that Project's air emissions from its operations, including all components (LNG delivery and natural gas send-out, co-generation, petrochemical operations and feed/product shipping), will not result in exceedances of the provincial and CCME ambient air quality objectives/regulations. This will be confirmed through monitoring programs described in the following section. Air emissions from the LNG facility will mainly concern NO_x, CO, and C_xC_y (unburned hydrocarbons) caused by flue gas combustion in the submerged combustion vaporizers. To suppress the NO_x emissions, the submerged combustion vaporizers will be fitted with low NO_x burners. As process design progresses, the Proponent will take all practical measures to further reduce the air emissions discussed above, including both energy efficiency measures and improvement in emission-control technologies.

As outlined in the NSEL Terms and Conditions for Environmental Approval, under Condition 2.3, a project air monitoring program will be developed. Based upon the results of the air monitoring program, necessary modifications to mitigation plans and/or operations will be implemented to prevent unacceptable environmental effects. The locations of the air monitoring stations for the

air monitoring program will be based on the location of sensitive receptors, air dispersion modelling results, and meteorological data.

The other main contributor to potential air quality effects is the SOEI gas plant. Total contributions to air quality indicators including NO₂, SO₂, TSP, PM_{2.5}, CO and Ozone were modelled and results presented in Section 5.1.6. The results indicate that total emissions for the two projects collectively comply with provincial air quality guidelines.

In summary, the increase in localized industrial development will result in a cumulative increase in air emissions. However, it is anticipated that these cumulative air quality emissions will comply with provincial and CCME ambient air quality objectives/regulations. In the event of exceedances, additional mitigation measures will be implemented as required, possibly including energy saving measures and improvement in emission control technologies. This will ensure that the cumulative effect on air quality is minor.

Table 8.2-5 summarizes the cumulative effects discussed for air quality.

TABLE 8.2-5 Cumulative Summary – Air Quality

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational air emissions in combination with other projects with similar emissions to same airshed	Minor	<ul style="list-style-type: none"> All oil and gas project emissions within the immediate airshed are designed to meet regulatory limits. Contribution to regional emissions of ozone negligible. 	Low	Very Local	Frequent	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.7 Climate Conditions

Greenhouses gases are an increasingly important issue and an important consideration for how power is to be generated in Nova Scotia. The Keltic facilities main contributor to GHG will be the 200 MW co-generation plant however, regasification of LNG is also a source. The release of CO₂ will be greatly minimized when compared to the alternative of taking power off the NSPI grid. Typically, one would expect CO_{2eq} to be approximately 1,000,000 t/year from the 200 MW co-generation facility, whereas the equivalent from a utility coal-fired plant would be in the order of 1,700,000 t/year (not including allowances for transmission losses). This is due to both the inherent advantages of using natural gas as compared to coal and Bunker C, the avoidance of transmission losses, as well as the energy efficiencies gained from a combined cycle facility. The annual release of some 270 t of VOCs will also contribute to GHGs; however, until specific compound speciation is known, i.e. between methane and non-methane VOCs, the actual CO_{2eq} cannot be appropriately estimated. These figures can be set in the context of Nova Scotia's total annual emissions of approximately 23,000,000 t of CO_{2eq} per year (EC, 2004).

Keltic will implement energy-efficiency measures throughout its facilities including the use of low pressure fuel or waste heat. The Proponent will also take steps to promote energy savings by its employees on both an individual and collective basis, including the potential of car pooling for those commuting to the workplace. Further planning and implementation of measures related to climate change issues will be described in Keltic’s Sustainable Development Plan required under Condition 1.1 of the NSEL Conditions of Approval and as the Federal and Provincial Governments move forward with policy/legislative guidance.

Larger potential sources for GHG occur in other future projects, such as the proposed Deep Panuke Facilities (primarily offshore) and include activities such as flaring, venting, shipping and construction/ maintenance, which would result in a cumulative increase in GHG. The Environmental Assessment Report for the Deep Panuke Project concluded that its GHG emissions represent only 0.7% of Nova Scotia’s total GHG emissions (EnCana Corporation, 2006).

As such, due to mitigation efforts of all projects considered in this CEA to reduce GHG emissions and their contribution to Nova Scotia’s total contribution, the cumulative effect on global warming is anticipated to be minor.

Table 8.2-6 summarizes the cumulative effects discussed in the above section.

TABLE 8.2-6 Cumulative Summary – GHG

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational air emissions of GHG in combination with other Keltic Project components and other future projects with similar emissions regionally / nationally	Minor	<ul style="list-style-type: none"> Energy-efficient measure minimizing GHG. Contribution to total of regional GHG negligible. 	Low	National	Frequent	No	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.8 Vegetation (terrestrial and marine)

Potential impacts to terrestrial vegetation will result from the loss of land required to construct the Keltic facilities, Deep Panuke (on shore), and the M&NP expansion. Construction of the components of the Keltic Project covered in this CSR will result in the removal of 149 ha of local forest. Given the type of vegetation involved (mostly clear-cut brush and barrens, old agricultural fields, and some conifer stands), and the presence of large tracts of land adjacent to the Project Site, no significant residual effects on vegetation are likely to occur during construction. There are no terrestrial plant species of special status within the LNG Facility Area.

Construction of other Keltic facilities, Deep Panuke on-shore facilities, the SOEI gas plant, and possibly the M&NP pipeline expansion, will result in a local cumulative effect on vegetation, however, given the remote nature of the site and the amount of undisturbed surrounding vegetation of greater ecological value (i.e. not clear-cut brush and old agricultural fields), the regional cumulative effect on terrestrial vegetation is anticipated to be minor to minimal.

In compliance with NSEL EA approval conditions (Item 2.7) (NSEL, 2007), the Proponent will also implement a wildlife and vegetation monitoring plan during Project realization. This plan will provide details on effects levels and the effectiveness of vegetation rehabilitation, where applicable.

Potential impacts to marine vegetation could occur through surface water or sediment contaminants, although this is unlikely to be a significant pathway. Cumulative effects were not noted for these pathways and thus are not anticipated for marine vegetation.

8.2.1.9 Species at Risk

Potential species at risk identified for the general Facility site include Boreal Felt Lichen (not confirmed or likely at the property given lack of mature forest habitat), Wood turtle (not confirmed for area but if present could use terrestrial habitat in general area), Short-eared Owl (observed for wetlands along Betty's Cove Brook), Terns (foraging in general area) and moose (known for general area but no evidence observed on site). As well, habitat for Gaspé shrew and long-tailed shrew was identified although these species are not known in area. Bats are expected to feed in the general area of the Project. Semi-palmated plover migrate along shore. Four-toed salamander may occur in wetlands and Atlantic salmon historically occurred in the general area.

Given available habitat/populations are limited, there is potential for significant cumulative effects if losses/impact occurred with the Project. However, the facility site has not been identified as important habitat for species at risk based on field investigations undertaken to date and therefore, the impact assessment does not identify impacts to species at risk or their habitats in the construction / operation of the LNG Facility.

There is potential for combined impacts from the M&NP and Encana Deep Panuke projects which, as currently proposed, could impact foraging terns through disturbance, spills, and habitat loss. The Proponent has committed to the development and implementation of an Adaptive Management Plan (AMP), consisting of various elements. To address concerns with potential cumulative impacts to foraging Roseate Terns in Country Harbour, it is expected that the AMP will include coordination with EnCana and other stakeholders to monitor and manage potential cumulative effects on the Roseate Tern.

Additional field surveys for species at risk are planned for all Project components prior to Project implementation. It is anticipated, that, if any such species is identified at or near the site, appropriate mitigation measures will be developed and implemented in consultation with the relevant provincial and federal agencies. The Project therefore, is not expected to cause significant adverse effects on species at risk.

The future road alignment is not expected to cause adverse effects on Species at Risk due to the limited geographic extent of the undertaking, existing disturbances related to forestry and

the SOEI gas plant. The on-shore portion of the proposed Deep Panuke project is not expected to interact with Species at Risk as it will be largely associated with existing facilities. Table 8.2-7 provides a summary for at risk species (excluding migratory birds).

Potential interactions with species at risk migratory birds are discussed separately below.

TABLE 8.2-7 Cumulative Summary – Species at Risk

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Loss of habitat or species	Minimal	<ul style="list-style-type: none"> Additional field surveys. Potential for at risk species low. Development of mitigation and compliance with recovery plans. 	Low	Depending on species regional to national	Variable	R or Not depending on species	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.10 Fish and Fish Habitat (Marine and Freshwater)

Potential for cumulative effects to fish and fish habitat related to the proposed Keltic facilities and other future projects could occur through surface water quality pathways (cumulative storm/process water discharges) within the Betty’s Cove Brook watershed and directly or indirectly to the adjacent marine environment. Another potential for cumulative effects relates to the potential physical interference of fish migration routes by one or more of the proposed developments. Impacts to water quality are not expected to be significant (see Sections 8.2.1.2 and 8.2.1.4).

Fish migration to Isaac’s Harbour is not expected to be restricted by the presence of the proposed Keltic LNG Terminal, Marginal Wharf or any of the Deep Panuke project components. The Meadow Lake impoundment will be designed to maintain fish passage. Consequently, cumulative effects to fish and fish habitat are not expected to be significant.

Habitat loss associated with pond infilling will be addressed through habitat compensation and cumulative effects are not anticipated. Fish habitat lost as a result of the construction, operation, and decommissioning phases of the Project construction of marine facilities will not result in a significant impact on fish resources in the area. None of the habitat lost is in anyway unique to the Bay, nor does it provide a critical function to the ecosystem. The loss of production of lobster, and other fish species, would be dwarfed by local variations in environmental factors such as water temperature and larval drift into the area. Provided the proposed mitigative measures are implemented as suggested, no significant adverse residual environmental effects on fish and fish habitat are likely to occur. The potential exists for the Deep Panuke project to also affect marine water quality in the Bay by temporarily increased localized SPM during pipe laying, and through the release of hydrostatic testing water.

However, given the localized nature of the increase in SPM, and EnCana Corporation’s commitment to Screen chemicals through Offshore Chemical Selection Guidelines (OCSG) and to conduct bioassay tests and plume dispersion modelling in consultation with EC to minimize potential environmental effects, cumulative marine water quality effects are anticipated to be minimal. Table 8.2-8 below summarizes the cumulative effects discussed for fish and fish habitat.

TABLE 8.2-8 Cumulative Summary – Fish/Habitat

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in combination with other Keltic Project components and other future projects with similar discharges to same general marine area affecting habitat quality	Minimal	<ul style="list-style-type: none"> Water quality impacts are minimal. 	Low	Betty's Cove Brook watershed and local marine environment	Frequent	R	Not significant		
Fish access to Isaac's Harbour and other migratory patterns could be disrupted by terminal and other existing/ proposed marine facilities in the area	Minimal	<ul style="list-style-type: none"> The majority of the access to the harbour is still available. 	Low	Local terminal area	Constant	Yes	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

Construction of other facilities such as the other Keltic facilities could impact marine water through sediment loading and storm-water discharge effects, with the pathway being Betty's Cove Brook and the unnamed tributary to Dung Cove. However, provided the proposed mitigative measures are implemented as suggested, the effects on water courses due to erosion, sediment loading, and storm-water discharges will be low in magnitude and reversible. Therefore, no significant adverse residual environmental effects on fish and fish habitat are likely to occur.

Compensation (if required) will be offered for HADD of fish habitat for the construction of the LNG Terminal and jetty to compensate for loss of habitat and for potential disruption of fishery. DFO will require replacement of the area of fish habitat lost with habitat of similar or higher type and quality.

It is of note that the Proponent will also undertake further baseline work and effects predictions relevant to fish and fish habitat (both freshwater and marine). In compliance with the NSEL EA approval conditions (Item 1.10) the work will entail baseline data collection for all relevant chemical parameters which are expected to enter the environment or be remobilized as a result of Project activities in all receiving environments (including freshwater and marine environments). Baseline data and information will then be used by the Proponent to predict the

assimilative capacity of all receiving environments and assessments of potential effects and/or risks on human health and organisms (including freshwater and marine biota).

8.2.1.11 Marine Mammals

Marine mammal (whales and seals, excluding at risk species - see at risk section) use of the general area is occasional (feeding or haul out). Potential for cumulative effects to marine mammals through cumulative effects from the future projects could occur through surface water quality pathways (cumulative storm/process water discharges) within the adjacent marine environment or physical interference. Potential cumulative impacts to water quality/habitat or physical interference of marine mammals are not expected to be significant (see Sections 8.2.1.2 and 8.2.1.4). Given the large size of Stormont Bay, the proposed Keltic LNG Terminal, marginal wharf and Deep Panuke near-shore pipeline and landfall structures are not expected to limit the movement of marine mammals.

Construction-related adverse effects on marine mammals are also possible. The National Marine Fisheries Service (NMFS) has suggested that sound pressure levels that exceed 190 dB re 1 μ Pa may cause threshold shifts or temporary hearing impairments in marine mammals. Research on marine mammals shows that under certain circumstances underwater noise can cause a variety of effects. This includes behaviour modifications, tissue rupturing or haemorrhaging at close range to the acoustic source, and temporary or permanent hearing loss. In addition new noise sources can mask other sounds important to survival, such as those made by calves, mates, or predators (Richardson et. al., 1995).

During the operation of the Project, vessel traffic is expected to increase. 83% of the underwater acoustic field surrounding large vessels is the result of propeller cavitation (Southall, 2005). Noise from vessels may contribute to masking of sounds important to the survival of mammals. However, marine mammals have been known to adapt to masking sounds by changing the intensity and frequency of their vocalizations. Little underwater acoustic energy is transmitted into the water from on-board machinery or movement of the vessel through the water.

Construction of the Deep Panuke Project, in particular laying of pipelines and pile driving, will also contribute to underwater noise. However, this effect will be temporary and noise during operation will be significantly reduced.

Given the low importance of the marine environment at the Project Site for marine mammals, and with the implementation of the proposed mitigative measures identified in Section 5.1.11, cumulative effects on marine mammals are anticipated to be temporary, reversible, and of minimal significance.

Table 8.2-9 below summarizes the cumulative effects discussed for marine mammals.

TABLE 8.2-9 Cumulative Summary – Marine Mammals

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in combination with other projects with similar discharges to same general marine area affecting habitat quality	Minimal	<ul style="list-style-type: none"> Water quality impacts are minimal. 	Low	Local marine environment	Frequent	R	Not significant		
Marine mammal movement in the area could be disrupted by terminal and other existing/ proposed marine facilities in the area	Minimal	<ul style="list-style-type: none"> The majority of the access to the harbour is still available. Not likely to affect populations. 	Low	Local terminal area	Constant	Yes	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.12 Wildlife and Wildlife Habitat

Potential impacts of the Project to wildlife and wildlife habitat are not significant. Deer wintering areas (which will be lost) were only noted in the vicinity of the LNG storage tanks. Although other wildlife habitat loss will also occur with other regional development, known projects are not expected to significantly reduce available habitat in the region and cumulative effects are not anticipated.

8.2.1.13 Migratory Birds and Migratory Birds Habitat

Birds and their habitat may be affected during construction through loss of nesting habitat either directly or through disturbance including noise or habitat fragmentation, by mortality associated with strikes related to lighting of structures, interference with feeding areas along the coast and inland, food chain contaminants or oiling impacts from accidental releases. As with general wildlife habitat, the foreseeable future developments in the region will not significantly reduce available bird nesting and foraging habitat. The majority of the development is within an area surrounding the Keltic and SOEI complex and the proposed Deep Panuke facilities including associated easements /transmission lines, flares and the Meadow Lake impoundment. This concentrates the disturbance to one location and combines easements where possible. This limits the extent of the potential effect, but may increase the duration and intensity, particularly for potential light attraction and collision risk.

It is of note that the Proponent will generate a lighting plan, which will incorporate a program to monitor impacts to birds. This work will be undertaken by the Proponent in compliance with Item 1.6 of the NSEL EA approval conditions (NSEL, 2007). In accordance with the NSEL conditions, the plan must be submitted to NSDNR, CWS, and TC for review and approval. Based on the results of the monitoring programs, the Proponent must make necessary

modifications to the mitigation plans and/or operations to prevent any unacceptable environmental effects, to the satisfaction of NSEL, based on consultation with NSDNR and CWS.

Keltic will work with CWS to implement mitigation (as outlined in Section 5.0, such as EC's recommendations for Interactions with Lights and Flares and Storm-Petrel stranding protocol as well as monitoring for seabirds from ships), review of monitoring programs, and identify the potential for large scale events such as weather conditions or migratory conditions that may concentrate birds or include species at risk species use in the area and increase the risk of bird collisions/mortality. Mitigation measures such as reducing lighting during vulnerable periods may be required to minimize potential cumulative effects.

With the implementation of mitigation measures for terrestrial wildlife (Section 5.1.12) and the mitigation implemented for lighting, the potential for the Keltic Project to contribute to cumulative effects on migratory birds will be significantly reduced. It is nonetheless possible that collisions of birds with project structures could occur, although unlikely in numbers sufficient to affect bird populations. With the implementation of monitoring, and as necessary, working with CWS to mitigate further identified effects on migratory birds, cumulative effects are anticipated to be of minor significance.

Table 8.2-10 summarizes the cumulative effects discussed for migratory birds.

8.2.1.14 Wetlands

Wetlands were identified for the Dung Cove Pond area and adjacent to the Facilities along Betty's Cove Brook. Loss of regional wetlands may also occur from Meadow Lake impoundment and the proposed re-alignment for Route 316. Potential impacts to wetlands will be addressed through habitat compensation and no cumulative effects are anticipated.

It is of note that the Proponent will detail the impacts to wetlands in compliance with Item 1.2 of the NSEL EA approval conditions for the Keltic Development Proposal (NSEL, 2007). This work will address methods and plans for avoidance, mitigation, and/or compensation and will be developed in consultation with NSEL and NSDNR.

8.2.1.15 Lighting Conditions

Other local sources of light include the SOEI plant, existing roadways, other Keltic facilities, and proposed Deep Panuke facilities. The LNG storage tanks and flare stacks from the petrochemical plant may be visible from Stormont Bay and the general site may have 'skyglow' which may contribute to overall appearance of industrialization of the area. Given the limited number of receptors and the designation of the site for industrial use, this is not anticipated to be a significant impact. Table 8.2-11 below summarizes the cumulative effects discussed for lighting.

TABLE 8.2-10 Cumulative Summary – Migratory Birds

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Construction habitat loss / disturbance within the local area from oil and gas development and easements	Minor	<ul style="list-style-type: none"> Habitat loss small portion of overall available area and not identified as critical for species present. 	Low	Terrestrial Study Area	One time	No	Not significant		
Interference with feeding areas of future marine infrastructure in the general area	Minor	<ul style="list-style-type: none"> Habitat disturbance small portion of overall available area and not identified as critical for species present. 	Low	Terrestrial Study Area and local marine environment	Constant	No	Not significant		
Collision mortality from future infrastructure in the general area	Minor	<ul style="list-style-type: none"> Mitigation/ Monitoring to be undertaken in cooperation with CWS. 	Low	Local terminal area	Constant	No	Not significant		
Food chain contaminants or oiling impacts from acute or chronic water quality contaminants in general area	Minor	<ul style="list-style-type: none"> No significant levels of non-bioaccumulating contaminants. Oil spill response planning. 	Low	Regional area	Infrequent	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

TABLE 8.2-11 Cumulative Summary – Lighting

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Local increase in light in the general area from all development	Minor	<ul style="list-style-type: none"> Consistent with industrial development for the area as identified in the regional plan. 	Low	Local	Frequent	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.16 Atmospheric and Underwater Acoustic Environment

Atmospheric effects are addressed under air quality and climate change.

Noise impacts may be associated with construction (pile driving) of the terminal which may result in disturbance in the marine environment. This is a short term effect and no other marine disturbances are known to combine with this activity to result in cumulative effects over the construction period.

The underwater environment may be affected by noise impacts from construction activities for the development for the LNG Terminal and the LNG Tanks. Although there is not an extensive use of the nearshore waters by cetaceans and seals, these species may be susceptible to damage from the underwater noises generated using conventional pile-driving techniques. The underwater noise impacts on marine mammals are further discussed in Section 8.2.1.11.

There will be some overlapping construction activities with the other Keltic components. The detailed design for all of the Keltic components has not been completed and therefore noise modelling has not yet been conducted. Noise modeling will be completed for the Project as a whole (LNG, petrochemical facility and co-generation plant) once the details are complete. If it is determined from the modeling that the Canadian Mortgage and Housing Corporation (CMHC) levels will be exceeded, then measures will be taken to acoustically shield components to ensure the noise does not exceed CMHC levels. Therefore cumulative noise effects are anticipated to be short-term (construction), reversible, and local in nature (within 500 m of source), and of minor significance.

The Proponent will initiate a monitoring program that will consist of sampling noise levels over a 24-hour period following commissioning. Noise sampling will be conducted quarterly and the results evaluated on an annual basis. Should noise levels be consistent over the first year, noise sampling would subsequently be conducted on a complaint basis or following process or equipment changes. This will include monitoring of ship noise, vehicle movement, heavy equipment operations, emergency operations, and normal operating modes.

8.2.1.17 Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

Mi'kmaq continue to undertake traditional activities throughout the Keltic Development Proposal Study Area. Medicinal plant gathering sites and areas were identified adjacent to wetlands within the Project Site. The construction may result in some filling, excavating, and otherwise disturbance of wetlands, in addition to some loss of wetland vegetation.

Some of the reported hunting and fishing areas overlap with the proposed LNG facility; which will result in an unavoidable loss of traditional resource area. However, the affected area (approximately 149 ha) is a very small proportion (less than 2%) of one hunting area out of approximately 10 large traditional hunting areas in Guysborough County; which encompass very large areas of land and includes entire waterways. Therefore, the construction activities will result in minimal impacts to the land and resource use. As well the marine environment was a potential urchin harvest area. Alternative resources are available outside this and other project study areas. Use of the urchin harvest area is presently limited by a decline the population.

Wetlands within the LNG facility, if affected, will be rehabilitated and/or compensated to achieve “no net loss” in wetland functions. As required by the NSEL Terms and Conditions for Environmental Assessment Approval, wetland plans for avoidance, mitigation and/or compensation will be developed in consultation with NSEL and NSDNR.

For the effects on fishing, the draft FHCP outlined in Appendix 5 includes enhancement of benthic habitat within the same urchin licence area. This is predicted to offset any loss of sea urchin production and/or access once the species returns to commercial levels.

To meet the requirements of Item 4.3 in the NSEL EA approval conditions, Keltic will develop a Mi'kmaq Communication Plan for the Project which will include but not be limited to:

- Processes for communicating Project details and seeking input from the Mi'kmaq community.
- Plans for Mi'kmaq involvement in EEM and other Project aspects. The plan will be developed in cooperation with the Mi'kmaq Community. Also, in accordance with Item 4.4 of the NSEL EA approval conditions, Keltic will take steps to further assess traditional Mi'kmaq use of the Project Site lands. The Proponent will develop the proposed steps in cooperation with the Mi'kmaq Community and will submit the results to NSEL.

Similar potential effects exist for the development of other Keltic facilities, the SOEI gas plant, and the Deep Panuke project. However, Keltic anticipates being able to mitigate any negative effects through its consultation with the Mi'kmaq and therefore expects a minimal cumulative effect on traditional land use.

8.2.1.18 Physical and Cultural Heritage

Construction of the LNG Terminal may have effects on physical and cultural heritage. Due to previous excavation and removal of burials at Red Head in 2000 and 2001, complemented by subsurface testing in October 2004, there is confidence that no burials remain in the cemetery and, therefore, the site is no longer believed to be of high archaeological sensitivity. However, due to its association as the final resting place of the first Black Loyalists in Goldboro and Isaac's Harbour, it remains to be of cultural significance to the nearby Black community at Lincolnville.

Prior to construction, an agreement with the Department of African Nova Scotia Affairs will be entered into for the establishment of a memorial at the Red Head Cemetery site. A Cultural Heritage Plan will also be developed to ensure that Project development and operations proceed in a manner that respects the cultural heritage value of the Red Head Cemetery site to the community, and that public access to the site will be maintained. The plan will be reviewed and approved by NSEL. An archaeology and heritage resources monitoring and contingency plan will also be prepared in consultation with Mi'kmaq stakeholders, African Nova Scotia Affairs, and the Nova Scotia Museum.

A potential positive cumulative effect for cultural heritage relates to an overall increase of the understanding of the heritage of the area with the research undertaken for this Project and other projects in the general area.

8.2.1.19 Structures/Sites of Archaeological, Paleontological or Architectural Significance

There is a probability that Mi'kmaq artefacts could be found during construction, and in such cases, construction workers should be made aware that this is a possibility. This may include cultural resource awareness training for construction workers. In the event that artefacts are found during construction activities, construction activities in the area of the discovery will be suspended and the discovery be reported to the Nova Scotia Museum and the Executive Director of the Union of Nova Scotia Indians immediately. In accordance with Item 4.5 and 4.6 in the NSEL EA approval conditions, a complete archaeological assessment of the entire Keltic Development Proposal site will be submitted for review by NSEL. This submission will also include an archaeological monitoring plan. A contingency plan for the discovery of archaeological or cultural resources will be included in the EPP. Also, as requested by Item 4.9 in the NSEL EA approval conditions, a plan will be developed to ensure the Keltic Development Proposal construction and operations proceed in a manner that respects the cultural heritage value of the Red Head Cemetery and that public access to the site will be maintained.

In accordance with Item 4.9 in the NSEL EA approval conditions, a plan will be developed to ensure the Keltic Development Proposal construction and operations proceed in a manner that respects the cultural heritage value of the Red Head Cemetery and that public access to the site will be maintained (NSEL, 2007).

Construction activities any of the Projects identified in this CEA have the same potential for affecting structures/sites of archaeological, paleontological or architectural significance; however, with similar mitigation measures as proposed for the Keltic Project, cumulative effects are anticipated to minor.

A potential positive cumulative effect for sites of significance relates to an overall increase of the understanding of the heritage of the area with the research undertaken for this Project and other projects in the general area.

8.2.1.20 Navigation

Three fishing vessels are reported for Isaac's Harbour (1999 data). The wharf/marine terminal and associated facilities were not identified as significantly affecting access to and from the harbour. The Proponent has initiated the TERMPOL process, which, in part, will be used to resolve navigation conflicts as they relate to the Project. Cumulative interference is not anticipated with underwater facilities such as the SOEI pipeline and proposed Deep Panuke pipeline, and effects are anticipated to be minimal.

8.2.1.21 Marine Safety and Security

The TERMPOL process is intended to result in the operation of the facilities to protect public and environmental safety and security. Through this process the potential risks associated with accidents will be identified and plans developed to mitigate these risks. Keltic will also adhere to the *Marine Transportation Security Act* and regulations. As a result, the Project is not expected to cumulatively affect marine safety or security.

8.2.1.22 Human Health and Safety

Potential risks associated with accidents and in particular with increased vehicular traffic for the area may be cumulative in relation to several projects in the area with respect to human health and safety. The Proponent is completing a QRA for the Project, which will identify overall risk associated with the LNG Terminal, and provide mitigating measures.

With respect to traffic, a significant cumulative increase in terms of demands on infrastructure and the additional traffic may result in more vehicle collisions on an annual basis. A traffic impact study and a traffic infrastructure study will be undertaken as part of the Project design process. These studies will identify the measures that will need to be taken to maintain safety and to minimize the potential cumulative traffic related health effects.

As discussed in Section 8.2.1.6, all cumulative air quality parameters will meet regulatory requirements, and as such, health effects from dust emissions and stack emissions are not expected to result in a cumulative health effect.

Table 8.2-12 below summarizes the cumulative effects discussed for health and safety.

TABLE 8.2-12 Cumulative Summary – Health and Safety

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Traffic and infrastructure requirements in the general area	Minimal	<ul style="list-style-type: none"> Traffic impact study as part of Project design phase. 	Low	Local	Frequent	R	Not significant		
Operational air emissions in combination with other projects with similar emissions to same airshed	Minor	<ul style="list-style-type: none"> All oil and gas project emissions within the immediate airshed are designed to meet regulatory limits. Contribution to regional emissions of ozone negligible. 	Low	Very Local	Frequent	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.1.23 Fisheries

The construction of marine facilities will affect fishing at or near the construction sites. The construction of the marginal wharf/marine terminal will affect one local fisher. The effects of the LNG Terminal construction and operation will be mitigated by the development of a compensation plan for local fishers who hold licences for that area. A FHCP (Appendix 5) has been developed and will be implemented in consultation with the DFO. The proposed Deep Panuke facilities are expected to have comparable minimal effect on near-shore fisheries and to

implement similar compensation schemes for affected parties, if applicable. Both projects are expected to have very localized effects on fish habitat and effects on fish or lobster stocks in the Bay as a whole are not anticipated. As a result, cumulative effects on fisheries are anticipated to be minimal.

8.2.1.24 Aquaculture

Potential for cumulative effects to aquaculture related to the Facilities could occur through surface water quality pathways (cumulative storm/process water discharges, mine legacy effects) within adjacent marine environment. Impacts to water quality are not expected to be significant, existing aquaculture sites are located at a distance and no leases are proposed for the area. Cumulative effects to identified aquaculture sites are not anticipated.

8.2.1.25 Tourism

Impacts of the Facilities on tourism are expected to be minimal over the short term and potentially beneficial over the long-term. Other likely regional projects/developments are expected to have similar effects and are focused within areas designated for industrial development. Although the Project will be visible from Route 316 to tourist traffic, it only makes up a small proportion of the broader visual landscape when viewed from Route 316, and is not likely to affect tourist's decision to visit the area. The cumulative impact of increasing industrialization of the area will be mitigated by appropriate regional planning and is expected to be balanced by economic benefits to the private and public sector, which will facilitate tourism infrastructure improvements. Table 8.2-13 summarizes the cumulative effects discussed for tourism.

TABLE 8.2-13 Cumulative Summary – Tourism

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Industrial development in the Project Area	Minimal	<ul style="list-style-type: none"> Regional planning. Inceased investments in tourism infrastructure. 	Low	Regional	Constant	No	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.2.2 Conclusion

Based on the review of potential effects and identification of available mitigation measures, it is unlikely that the construction and operation of the Keltic LNG Terminal and associated infrastructure will result in significant adverse environmental or socio-economic impacts, including cumulative effects.

Some cumulative effects have been identified in Section 8.2 and mitigation for the Project effects on the affected VECs will also mitigate cumulative effects to some degree (such as reductions in emissions of GHGs); however, no significant cumulative effects have been identified for which special mitigation is necessary.

8.3 MARGINAL WHARF

8.3.1 Assessment

8.3.1.1 Hydrology

The wharf does not interact with regional hydrology.

8.3.1.2 Freshwater Quality/Quantity

The wharf does not interact with the freshwater watershed.

8.3.1.3 Groundwater Quality/Quantity

The wharf area is expected to be a groundwater discharge zone and cumulative effects are not anticipated.

8.3.1.4 Marine Water Quality

Storm and process water discharges in the wharf area may contribute contaminants to the marine environment, primarily during construction. Marine water quality is primarily a concern in relation to marine biological organisms. Other projects may also contribute to the near-shore marine environment contaminants in the vicinity of the wharf. Sediment may be contributed by development (whether oil and gas or road realignments) within onshore contributing watersheds. Significant cumulative impacts from construction activities are not expected to occur due to the short term nature, reversibility, and relative volumes expected to be produced.

As per the Provincial EIA commitments, visual monitoring, silt screens, curtains and containment booms surrounding the construction area will be utilized to reduce the potential siltation/sediment loading impacting fish populations (especially sensitive species that may frequent the area) and benthic communities. These measures will also help mitigate any negative effects from other projects being constructed at the same time. These commitments will also assess if loads are deemed to be out of the ordinary for Isaac's Harbour. Construction techniques will be designed to minimize the disturbance of sediment and the use of appropriate erosion and sediment control measures will be implemented to also minimize the disturbance of sediment. Turbidity will be monitored during construction of the marginal wharf and will continue 2 to 3 days after. Construction of other facilities such as the Deep Panuke onshore facilities and the SOEI gas plant will implement similar erosion control measures and as such, sedimentation effects are likely to be infrequent, reversible, and of minor significance.

Coastal and marine development such as the proposed Deep Panuke pipeline may also affect marine water quality through addition of contaminants on a chronic or acute basis in the event of a leak, or through the discharge of hydrostatic testing water. Contaminants may also be released into the marine environment on an ongoing basis from historical mine tailings

deposition in sediment. Cumulative sources of marine water contaminants to the general marine area are limited in extent, have low concentrations, are not known to include substances that bioaccumulate and are not expected to result in significant cumulative effects. Table 8.3-1 summarizes the cumulative effects discussed for marine water quality.

TABLE 8.3-1 Cumulative Summary – Marine Water Quality

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in the wharf area in combination with other projects with similar discharges to same general marine area	Minimal	<ul style="list-style-type: none"> All oil and gas project process and storm-water discharges within the immediate marine watershed are designed to meet regulatory limits. Low concentrations of contaminants, not bioaccumulating substances. 	Low	Local to the mixing zone adjacent the Study Area	Storm or mixing events	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.3.1.5 Soil/Sediment Quality (Terrestrial and Marine)

Sediment quality in the adjacent watercourses (fresh and marine) can be affected by addition of storm-water/process water in the wharf area, other Keltic components, and the proposed Deep Panuke facilities. As no significant water quality cumulative effects are anticipated (see above 8.3.1.4), sediment effects are unlikely. Marine sediment sampling in the wharf and terminal area found no indications of existing contaminants. Other potential sources of contaminants in the general area are small as development is limited. Although existing contaminants were found (arsenic, mercury) in Isaac’s Harbour, neither of these metal are components of the Project and cumulative impacts are not anticipated.

8.3.1.6 Air Quality

Air quality related impacts associated with the wharf are very localized and not expected to interact with other projects or result in cumulative effects.

8.3.1.7 Climate Conditions

Wharf operation is not expected to contribute to cumulative GHG impacts.

8.3.1.8 Vegetation (Terrestrial and Marine)

Terrestrial vegetation is not present in the wharf area. Potential, although unlikely, impacts to marine vegetation could occur through surface water or sediment contaminants. Cumulative effects were not noted for these pathways and thus are not anticipated for marine vegetation.

8.3.1.9 Species at Risk

There is potential for the construction of the marginal wharf to effect the foraging of roseate tern individuals. Although no foraging sites are known to be located within or adjacent to the marginal wharf location, one individual roseate tern was observed flying near the shore of the south terminal area. The closest documented foraging site is located approximately 3 km from the Marginal Wharf Project Site, on the shore of Harbour Island. Construction of the marginal wharf will be short term.

No adverse environmental effects are anticipated, as collisions of roseate terns with the marginal wharf and marine terminal are unlikely to occur. These species are agile flyers and very rarely collide with large stationary objects such as lighthouses, bridges, light poles, communication towers or with large moving objects such as ships, even when they are brightly lit (Kerlinger and Hatch, 2004).

None of the construction for other projects considered in this CEA are documented foraging sites for the roseate tern and with additional mitigation measures being implemented for migratory birds (Section 5.1.13.2) and those being implemented for the other respective projects, cumulative effects on the roseate tern are anticipated to be minimal. Interactions with migratory birds are discussed further in a separate section, below

There is however, potential for combined impacts from the M&NP and Encana Deep Panuke projects which, as currently proposed, could impact foraging terns through disturbance, spills, and habitat loss. The Proponent has committed to the development and implementation of an Adaptive Management Plan (AMP), consisting of various elements. To address concerns with potential cumulative impacts to foraging Roseate Terns in Country Harbour, it is expected that the AMP will include coordination with EnCana and other stakeholders to monitor and manage potential cumulative effects on the Roseate Tern.

As outlined in the NSEL Terms and Conditions for Environmental Approval, under Point 2.7, a project wildlife and vegetation monitoring program will be developed in consultation with NSDNR and CWS.

8.3.1.10 Fish and Fish Habitat (Marine and Freshwater)

An impact on marine environments from the wharf facility and other marine infrastructure in the area includes loss of direct and indirect benthic habitat, through disturbance.

Fish access to Isaac's Harbour is not expected to be restricted by the terminal and other nearby marine infrastructure. The Deep Panuke Project will not adversely affect fish passage and the inclusion of fish passage structure for the Meadow Lake impoundment will ensure that it does not restrict fish passage. As a result, cumulative effects to fish and fish habitat are not expected to be significant. Existing mine legacy issues and other development storm and process water

may contribute to negative effects on surface water quality and heavy metal contamination in the marine environment. However, sampling indicated no concern for existing contaminants in the area of the wharf. Measures have been taken to minimize Project effects on surface water quality and fish and marine habitat. Cumulative effects on fish habitat are not expected to be significant.

As outlined in the NSEL Terms and Conditions for Environmental Approval, under Point 2.7, a project wildlife and vegetation monitoring program will be developed in consultation with NSDNR and CWS. Table 8.3-2 below summarizes the cumulative effects discussed for fish and fish habitat.

TABLE 8.3-2 Cumulative Summary – Fish/Habitat

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in combination with other projects with similar discharges to same general marine area affecting habitat quality	Minimal	<ul style="list-style-type: none"> Water quality impacts are minimal. 	Low	Local marine environment	Frequent	R	Not significant		
Fish access to Isaac's Harbour and other migratory patterns could be disrupted by wharf and proposed marine facilities in the area	Minimal	<ul style="list-style-type: none"> The majority of the access to the harbour is still available. 	Low	Local terminal area	Constant	Yes	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.3.1.11 Marine Mammals

Marine mammal (whales and seals, excluding at risk species - see at risk section) use of the general area is occasional (feeding or haul out). Potential for cumulative effects to marine mammals related to the wharf and other projects could occur through surface water quality pathways (cumulative storm/process water discharges) within adjacent marine environment or physical interference (cumulative disturbance of Keltic marine infrastructure and proposed Deep Panuke facilities). Potential cumulative impacts to water quality/habitat or physical interference of marine mammals are not expected to be significant. Table 8.3-3 summarizes the cumulative effects discussed for marine mammals.

8.3.1.12 Wildlife and Wildlife Habitat

Potential impacts of the Project to terrestrial wildlife and wildlife habitat are not significant (bird and marine habitat is discussed in separate sections). Deer wintering areas were noted in the vicinity of the wharf area. Although other wildlife habitat loss will also occur with other regional

development, known projects are not expected to significantly reduce available habitat in the region and cumulative effects are not anticipated.

TABLE 8.3-3 Cumulative Summary – Marine Mammals

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational storm and process water discharges in combination with other projects with similar discharges to same general marine area affecting habitat quality	Minimal	<ul style="list-style-type: none"> Water quality impacts are minimal. 	Low	Local marine environment	Frequent	R	Not significant		
Marine mammal movement in the area could be disrupted by wharf and other existing/ proposed marine facilities in the area	Minimal	<ul style="list-style-type: none"> The majority of the access to the harbour is still available. Not likely to affect populations. 	Low	Local terminal area	Constant	Yes	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

A monitoring program to assess wildlife populations will be established prior to commissioning and will continue 3 to 5 years following commissioning. The surveys will be carried out at appropriate times of the year as shown in Section 7.0 Table 7.2-2.

Evidence of wildlife presence and activity, and vegetation condition requiring attention, will be monitored during the surveys.

8.3.1.13 Migratory Birds and Migratory Birds Habitat

As discussed in the context of the LNG facility (Section 8.2.1.13) there is a potential for cumulative effects of the identified future projects on migratory birds. Keltic will work with CWS to implement mitigation (as outlined in Section 5.0, such as: EC’s recommendations for Interactions with Lights and Flares, and Storm-Petrel stranding protocol as well as monitoring for seabirds from ships), review of monitoring programs, and identification of potential for large scale events such as weather conditions or migratory conditions that may concentrate birds or result in species at risk species use of the area thus increasing the risk of bird collisions/mortality. Mitigation such as specialized lighting during vulnerable periods may be required to minimize potential cumulative effects.

As was the case with the LNG facilities, the lighting regime for the entire Project Area will be illuminated with downward facing white lights to minimize visual disorientation of nocturnal migrants as well as diurnal species migrating in inclement weather. It is thought that this type of lighting will not attract even night migrating songbirds (Kerlinger, 2004). It is advisable not to

use illuminated structures taller than 50 feet (15 m), as these have been demonstrated to disorient birds. It is further recommended that fast-blinking strobes be used when feasible.

It is of note that the Proponent will generate a lighting plan, which will incorporate a program to monitor impacts to birds. This work will be undertaken by the Proponent in compliance with Item 1.6 of the NSEL EA approval conditions (NSEL, 2007). In accordance with the NSEL conditions, the plan must be submitted to NSDNR, CWS, and TC for review and approval. Based on the results of the monitoring programs, the Proponent must make necessary modifications to the mitigation plans and/or operations to prevent any unacceptable environmental effects to the satisfaction of NSEL, based on consultation with NSDNR and CWS.

Table 8.3-4 below summarizes the cumulative effects discussed for migratory birds.

TABLE 8.3-4 Cumulative Summary – Migratory Birds

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Construction disturbance within the local area from oil and gas development	Minimal	<ul style="list-style-type: none"> Habitat loss small portion of overall available area and not identified as critical for species present. 	Low	Terrestrial Study Area	One time	No	Not significant		
Interference with feeding areas of proposed marine infrastructure in the general area	Minimal	<ul style="list-style-type: none"> Habitat disturbance small portion of overall available area and not identified as critical for species present. 	Low	Terrestrial Study Area and local marine environment	Constant	No	Not significant		
Collision mortality from proposed infrastructure in the general area	Minimal	<ul style="list-style-type: none"> Mitigation/ Monitoring to be undertaken in cooperation with CWS. 	Low	Local terminal area	Constant	No	Not significant		
Food chain contaminants or oiling impacts from acute or chronic water quality contaminants in general area	Minimal	<ul style="list-style-type: none"> No significant levels of non-bioaccumulating contaminants Oil spill response planning. 	Low	Regional area	Infrequent	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.3.1.14 Wetlands

Wetlands are not affected by the proposed wharf and cumulative effects are not applicable.

8.3.1.15 Lighting Conditions

As discussed in the context of the LNG facility (Section 8.2.1.15) there is a potential for cumulative effects of the identified future projects on lighting conditions. However, given the limited number of receptors and the designation of the site for industrial use, this is not anticipated to be a significant impact. Impacts related to birds are discussed in the migratory bird section above. Table 8.3-5 below summarizes the cumulative effects discussed for lighting.

TABLE 8.3-5 Cumulative Summary – Lighting

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Local increase in light in the general area from all development	Minor	<ul style="list-style-type: none"> Consistent with industrial development for the area as identified in the regional plan. 	Low	Local	Frequent	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.3.1.16 Atmospheric and Underwater Acoustic Environment

Atmospheric effects are addressed under air quality and climate change.

Noise impacts may be associated with construction of the wharf which may result in disturbance in the marine environment. Research on marine mammals shows that under certain circumstances underwater noise can cause a variety effects. This includes behaviour modifications, tissue rupturing or haemorrhaging at close range to the acoustic source, and temporary or permanent hearing loss. In addition new noise sources can mask other sounds important to survival, such as those made by calves, mates, or predators (Richardson et. al., 1995).

The disturbance of marine life through noise emissions transmitted through the underwater environment (from activities such as conventional pile driving) (David, 2006) will be mitigated by the implementation of alternative techniques for pile driving such as vibratory pile-driving, adjusting the timing around sensitive periods and conducting driving during low tide. In addition recreational and commercial fishery representatives will be conferred with to develop seasonal and daily schedules to minimize disruption of fisheries.

Any residual effects will be short-term and no other marine disturbances, with the exception of the LNG Marine Terminal, are expected to combine with this activity to result in cumulative

effects over the construction period. The Deep Panuke project construction is not anticipated to begin until after completion of the Keltic marginal wharf construction. Although the Deep Panuke construction will extend the period that the underwater acoustic environment will experience elevated noise, cumulative effects on the acoustic environment are anticipated to be of minor significance.

There will be some overlapping construction activities with the other Keltic components. The detailed design for all of the Keltic components has not been completed and therefore noise modelling has not yet been conducted. Noise modeling will be completed for the project as a whole (LNG, petrochemical facility and co-generation plant) once the details are complete. If it is determined from the modeling that the CMHC levels will be exceeded, then measures will be taken to acoustically shield components to ensure the noise does not exceed CMHC levels.

8.3.1.17 Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

The general area of the wharf site was identified as a potential urchin harvest area. The draft FHCP outlined in Appendix 5 includes enhancement of benthic habitat within the same urchin licence area. This is predicted to offset any loss of sea urchin production and/or access once the species returns to commercial levels.

8.3.1.18 Physical and Cultural Heritage

Physical and cultural heritage resources are not expected to be affected by the Project. Access to the former Red Head cemetery location may be affected by project infrastructure or site security requirements. The Proponent has committed to working with the Black Loyalist community to provide access to Red Head. Cumulative effects associated with cultural heritage relate to an overall increase of the understanding of the heritage of the area with the research undertaken for this Project and other projects in the general area. Construction of other projects such as other Keltic facilities, the SOEI gas plant, the M&NP pipeline expansion, and the Deep Panuke Project (on-shore facilities) also have the potential to adversely affect this resource.

In compliance with NSEL conditions of approval, prior to construction, an agreement with the African Nova Scotia Affairs will be entered into for the establishment of a memorial at the Red Head Cemetery site (Item 4.8) and a Cultural Heritage Plan will also be developed to ensure that the Keltic Development Proposal construction and operations proceed in a manner that respects the cultural heritage value of the Red Head Cemetery site to the community, and that public access to the site will be maintained (Item 4.9). The plan will be reviewed and approved by NSEL. Additionally, an archaeology and heritage resources monitoring and contingency plan will also be prepared by engagement with Mi'kmaq stakeholders, African Nova Scotia Affairs, and the Nova Scotia Museum (Item 4.6).

With the implementations of these measures for each of the projects, cumulative effects are anticipated to be of minor significance.

8.3.1.19 Structures/Sites of Archaeological, Paleontological or Architectural Significance

Construction of the Marginal Wharf may have effects on several archaeological features. However, due to previous excavation and removal of burials at Red Head in 2000 and 2001, complemented by subsurface testing in October 2004, there is confidence that no burials remain in the cemetery and, therefore, the site is no longer believed to be of high archaeological sensitivity. However, due to its association as the final resting place of the first Black Loyalists in Goldboro and Isaac's Harbour, it remains to be of cultural significance to the nearby Black community at Lincolnville. This site lies within the impact zone and is expected to be heavily disturbed.

To meet the requirements of the NSEL EA approval conditions (Item 4.7) (NSEL, 2007), if an archaeological site or artefact is discovered, the work will be halted and the Curator of Archaeology at the Nova Scotia Museum, and the Executive Director of the Union of Nova Scotia Indians will be contacted immediately. Should the find be deemed significant, the work is not to resume until further steps and protective measures are discussed in consultation with the archaeologist and regulatory authorities.

A complete archaeological assessment of the entire Keltic Development Proposal site will be completed prior to construction as requested in the NSEL EA approval conditions (NSEL, 2007). Also, in accordance with Item 4.6 of the NSEL EA approval conditions, an archaeology and heritage resources monitoring and contingency plan will be developed prior to construction. The plan will be developed in consultation with Mi'kmaq stakeholders, African Nova Scotia Affairs, and the Nova Scotia Museum.

Also, an agreement will be entered into with the Office of African Nova Scotia affairs for the establishment of a memorial at the site. The agreement and the Cultural Heritage Plan will be implemented in accordance of Items 4.8 and 4.9 in the NSEL EA approval conditions (NSEL, 2007).

With these mitigation measures in place, construction and operation of the marginal wharf is not anticipated to have a significant cumulative effect on Structures/Sites of Archaeological, Paleontological or Architectural Significance.

Cumulative effects associated with sites of significance relate to an overall increase of the understanding of the heritage of the area with the research undertaken for this Project and other projects in the general area.

8.3.1.20 Navigation

Three fishing vessels are reported for Isaac's Harbour (1999 data). The wharf/marine terminal and associated facilities were not identified as significantly affecting access to and from the harbour. The Proponent has initiated the TERMPOL process, which, in part, will be used to resolve navigation conflicts as they relate to the Project. Cumulative interference is not anticipated with underwater facilities such as the proposed Deep Panuke pipeline.

8.3.1.21 Marine Safety and Security

The Project will be operated under safety policies and procedures that meet or exceed industry standards. Keltic will also adhere to the *Marine Transportation Security Act* and regulations. Potential risks associated with accidents for the area may be cumulative in relation to several projects in the area. The TERMPOL process is intended to result in the operation of the facilities in a manner that will protect the public and ensure environmental safety and security. Through this process the potential risks associated with accidents will be identified and plans developed to mitigate these risks. As a result, the Project is not expected to cumulatively affect marine safety or security.

8.3.1.22 Human Health and Safety

Safety during construction and operation of the marginal wharf is governed by the NSEL. In addition, the Project will be operated under safety policies and procedures that meet or exceed industry standards. The same measures implemented for the LNG facilities will be implemented to ensure cumulative effects on human health and safety is not significant.

8.3.1.23 Fisheries

The construction of the marginal wharf will affect fishing at or near the construction sites. This construction will affect one local fisher. Keltic will negotiate compensation for the economic loss. The proposed Deep Panuke facilities are expected to have comparable minimal effect on near-shore fisheries and to implement similar compensation schemes for affected parties, if applicable. Cumulative effects are not anticipated.

8.3.1.24 Aquaculture

Potential for cumulative effects to aquaculture related to the wharf could occur through surface water quality pathways (cumulative storm/process water discharges, mine legacy effects) within adjacent marine environment. This potential effect is assessed in the freshwater quality section and the cumulative effect was not deemed to be significant. As a result, impacts to water quality are not expected to be significant and cumulative effects to aquaculture are not anticipated.

8.3.1.25 Tourism

Construction of the marginal wharf will contribute to a visual change in the shoreline, which will also be affected by construction of other Keltic facilities. However, as discussed with respect to discussion of the LNG facilities, no cumulative effects are anticipated related to tourism (Section 8.2.1.25). Impacts of the marginal wharf on tourism are expected to be minimal over the short term and potentially beneficial over the long-term. Other likely regional projects/developments are expected to have similar effects and are focused within areas designated for industrial development. The cumulative impact of increasing industrialization of the area will be mitigated by appropriate regional planning and is expected to be balanced by economic benefits to the private and public sector, which will facilitate tourism infrastructure improvements.

8.3.2 Conclusion

Based on the review of potential effects and identification of available mitigation measures, it is unlikely that the construction and operation of the wharf and associated infrastructure will result in significant adverse environmental or socio-economic impacts, including cumulative effects.

Some cumulative effects have been identified in Section 8.3 and mitigation for the Project effects on the affected VECs will also mitigate cumulative effects to some degree (such as mitigation for bird strikes); however, no significant cumulative effects for which special mitigation is necessary have been identified.

8.4 PROJECT RELATED SHIPPING WITHIN 25 KM OF COUNTRY ISLAND

8.4.1 Assessment

8.4.1.1 Hydrology

Shipping does not interact with regional hydrology.

8.4.1.2 Freshwater Quality/Quantity

Shipping does not interact with freshwater quality/quantity.

8.4.1.3 Groundwater Quality/Quantity

Shipping does not interact with groundwater quality/quantity.

8.4.1.4 Marine Water Quality

Shipping both related to the Keltic Project and to other projects in the area may affect marine water quality through discharges of wastewater, chronic releases, or accidents. This may also be cumulative with limited surface water discharges of contaminants from land based sources in the general area. Approximately 300 – 400 ships per year (half of which are tankers at one every two to four days, half are support vessels) are expected to use the facility. This is reported to be half the existing volume of ships over 100 m length (not including harbour tug, fisheries vessels, and other small vessels) presently managed in the region. On average this would be about two ships a day in the area. There is potential for a cumulative effect on marine water quality however, this is expected to be limited in duration, intensity, and extent by mitigative measures by all parties to protect fish and fish habitat, and is not expected to result in a significant cumulative impact.

The MARPOL addresses and protects the marine environment from pollution by oil, chemicals, harmful substances in packaged form, sewage, and garbage. Since Project shipping will conduct all activities in strict adherence to MARPOL, no potentially significant effects are anticipated from routine releases (if any). Table 8.4-1 summarizes the cumulative effects discussed for marine water quality.

TABLE 8.4-1 Cumulative Summary – Marine Water Quality

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Operational waste water discharges in combination with other projects with similar discharges to same general marine area	Minimal	<ul style="list-style-type: none"> All oil and gas project process and storm-water discharges within the immediate marine watershed are designed to meet regulatory limits. Low concentrations of contaminants, not bioaccumulating substances. 	Low	The 25 km Study Area	Moderate	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.4.1.5 Soil/Sediment Quality (Terrestrial and Marine)

Similar to marine water quality above, the potential effects on marine sediment quality related to shipping are limited to accidental spill of fuel or other contaminants from vessels during the construction, operation and decommissioning of the LNG Terminal or marginal wharf. Shipping discharges, both related to the Project and to other ventures in the area as noted above, as well as limited surface water discharges of contaminants from land based sources in the general area may affect marine sediment quality.

To reduce the sediment disturbance from the vessels, large vessels will be berthed with the support of tugs. A plan to mitigate the human health and environmental impacts of contaminated mine tailings and/or soils and sediments due to the Keltic Development Proposal will be developed. The plan will be consistent with the Nova Scotia Guidelines for the Management of Contaminated Sites. As outlined in the NSEL EA approval conditions (NSEL, 2007), when any remediation or risk management work is completed, which includes any required monitoring, a Certificate of Compliance to demonstrate the remediation or risk management work is completed and effective. A detailed erosion and sedimentation control plan will also be developed in accordance with Item 2.4 in the NSEL EA approval conditions (NSEL, 2007).

With these measures in place, shipping is not expected to add significantly to existing marine sedimentation and associated quality and cumulative effects are not anticipated. Bottom disturbances were not identified as having potential for remobilization of contaminants. Shipping does not interact with terrestrial soil quality.

8.4.1.6 Air Quality

Air quality related impacts associated with shipping are very localized and not expected to interact with other projects. The use of natural gas/electric engines for tankers reduces this

contribution further. The incremental contribution is not expected to result in a cumulative effect.

8.4.1.7 Climate Conditions

The additional shipping that will occur within 25 km of Country Island is not expected to appreciatively contribute to cumulative GHG impacts within the airshed. Tankers are expected to contribute approximately 63.7 t/year of CO₂ (based on similar projects). Larger potential sources for GHG occur in other Keltic components such as the Co-generation Facility and the SOEI gas plant and proposed Deep Panuke facilities offshore. Shipping emissions are insignificant in relation to other sources. As assessed in Section 8.2.1.7, cumulative effects are anticipated to be of minor significance.

8.4.1.8 Vegetation (Terrestrial and Marine)

Terrestrial vegetation will not be affected by shipping. Potential impacts to marine vegetation could occur through surface water or sediment contaminants. Cumulative effects were not noted for these pathways and thus are not anticipated for marine vegetation.

8.4.1.9 Species at Risk

Species at Risk that may potentially interact with Project shipping and other shipping activities include a variety of marine mammals (whales, dolphins) as well as the Roseate Tern colony at Country Island.

The roseate tern, designated as “Threatened” under the SARA; is located within 25 km of the proposed Project. The proposed Recovery Strategy for the roseate tern identifies “critical habitat” as defined in SARA and recommends that critical habitat be identified as:

- Sites that currently support more than 15 pairs of roseate terns (The Brothers and Country Islands, Nova Scotia).
- Tern colonies in areas that have supported small but persistent numbers of nesting roseate terns for over 30 years (Sable Island, Magdalen islands, Chenal Island).

This designation includes the entire terrestrial habitat of all islands as well as aquatic habitat 200 m seaward from the mean high tide line of each island.

A colony of roseate tern has been identified on Country Island, about 9 km from the proposed LNG site. Additionally, one roseate tern was observed flying near the shore south of the proposed site. Foraging occurs along the mainland and island shores, predominantly on sand lance (A. Boyne, CWS, pers. comm.; Rock, 2005). No foraging site has been identified for the areas associated with the Project.

Shipping will not occur within 200 m of Country Island. Due to the large foraging area of the roseate tern, there is still potential for interaction between the shipping and the species. In the event that a foraging roseate tern encounters an LNG ship, the tern could change course leaving the chicks vulnerable for longer periods or even abandon the effort entirely, returning back to the nest without food.

No adverse environmental effects are anticipated, as collisions of roseate terns with shipping are unlikely to occur. These species are agile flyers and very rarely collide with large stationary objects such as lighthouses, bridges, light poles, communication towers or with large moving objects such as ships, even when they are brightly lit (Kerlinger and Hatch, 2004).

There is potential for combined impacts from the Encana Deep Panuke project which, as currently proposed, could impact foraging terns through disturbance, spills, and habitat loss. Development of the Deep Panuke project and other Keltic Project components will result in increased boat traffic, both during construction and operation, as there are numerous fishing boats travelling in this area, the increase in boat traffic from these projects will not significantly increase the number of boats in this area. The Keltic Project will result in an additional 5-7 boats per week. Furthermore, although it is possible that the roseate tern alters its behaviour to avoid boats, this has not been scientifically demonstrated. Nonetheless, Keltic understands the importance of protecting endangered species and is committed to their protection. In addition to the mitigation measures discussed in Section 8.4.1.13 Migratory Birds, Keltic will explore follow up measures in consultation with CWS and EC, which could include such measures as contributions to monitoring programs to help identify roseate tern foraging areas.

The Proponent has committed to the development and implementation of an Adaptive Management Plan (AMP), consisting of various elements. To address concerns with potential cumulative impacts to foraging Roseate Terns in Country Harbour, it is expected that the AMP will include coordination with EnCana and other stakeholders to monitor and manage potential cumulative effects on the Roseate Tern.

With the implementation of mitigation measures, the uncertainty that the roseate tern is influenced by encounters with boats, and the scale of increase of navigational traffic, cumulative effects are anticipated to be minimal.

8.4.1.10 Fish and Fish Habitat (Marine and Freshwater)

Potential cumulative interactions for marine ecosystems from the shipping components occur in combination with concurrent commercial fishing activities and oil and gas exploration and production activities. The cumulative impact of these effects is most likely additive but likely insignificant in relation to the continued impact of the fishing mortality from commercial fisheries. No freshwater habitat impacts are associated with shipping.

The potential effects on marine water quality related to shipping are limited to potential releases such oil, chemicals, harmful substances in packaged form, sewage and garbage or accidental spill of fuel or other contaminants from vessels during the construction, operation and decommissioning of the LNG Terminal or marginal wharf.

As stated in Section 5.3.4.1 above, the International Convention MARPOL will be followed by all Project shipping; therefore, no potentially significant effects are anticipated from routine releases (if any).

8.4.1.11 Marine Mammals

Marine mammals (excluding at risk species identified in previous sections) may be cumulatively affected by Project and other shipping activities through increased potential for noise

disturbance and collisions. Stormont Bay is not an important area for cetaceans. Whales or seals may enter the area following schools of herring or mackerel from spring to fall and seals frequently haul out on the shoreline. Shipping effects on cetaceans are not expected to be significant as their use of the area is limited and cumulative effects are limited to short-term construction noise from the Deep Panuke Project, and releases sedimentation and accidental release from other chemical facilities and the SOEI gas plant, which can be readily mitigated through the proposed measures.

8.4.1.12 Wildlife and Wildlife Habitat

Shipping activities are not expected to interact with wildlife habitat (other than marine habitat addressed in other sections) and cumulative effects are not anticipated.

8.4.1.13 Migratory Birds and Migratory Birds Habitat

Noise impacts (including interference with feeding areas along the coast and inland), physical disturbance, lighting related collisions, food chain contaminants, and oiling impacts from chronic or acute accidental releases may be associated with shipping impacts to migratory birds.

Keltic will work with CWS to implement mitigation (as outlined in Section 5.0, such as: EC's recommendations for Interactions with Lights and Flares and Storm-Petrel stranding protocol as well as monitoring for seabirds from ships), review of monitoring programs, identify the potential for large scale events such as weather conditions or migratory conditions that may concentrate birds or result in species at risk species use of the area and increase the risk of bird collisions/mortality. Mitigation measures such as specialized lighting may be required to minimize potential cumulative effects. Oil Spill contingency plans are discussed in Section 10.0. Table 8.4-2 summarizes the cumulative effects discussed for migratory birds.

8.4.1.14 Wetlands

Shipping activities are not expected to interact with terrestrial wetlands and cumulative effects are not anticipated.

8.4.1.15 Lighting Conditions

Lighting associated with ships is not expected to have cumulative effects (potential effects on birds are addressed in Migratory Bird section).

8.4.1.16 Atmospheric and Underwater Acoustic Environment

Atmospheric effects are addressed under air quality and climate change.

Noise impacts may be associated with shipping or marine facilities and may result in disturbance in the marine environment (affects on birds including species at risk terns are discussed in the Migratory Bird section). The total number of ships known for the area is limited. Cumulative interactions may occur with the short term construction (pipe-laying) for the Deep Panuke Project. Table 8.4-3 below summarizes the cumulative effects discussed for underwater acoustic.

TABLE 8.4-2 Cumulative Summary – Migratory Birds

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Noise interference with feeding areas of marine infrastructure (existing and proposed) in the general area	Minimal	<ul style="list-style-type: none"> Shipping lanes distant from feeding areas or other critical habitat. 	Low	Terrestrial Study Area and local marine environment	Constant	No	Not significant		
Collision mortality (existing and proposed) in the general area	Minimal	<ul style="list-style-type: none"> Mitigation/ Monitoring to be undertaken in cooperation with CWS. 	Low	Local terminal area	Constant	No	Not significant		
Food chain contaminants or oiling impacts from acute or chronic water quality contaminants in general area	Minimal	<ul style="list-style-type: none"> No significant levels of non-bioaccumulating contaminants. Oil spill response planning 	Low	Regional area	Infrequent	R	Minimal		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

TABLE 8.4-3 Cumulative Summary – Underwater Acoustic

Cumulative Project – Environment Interaction	Residual Project Impact with Mitigation (Section 5.0)	Mitigating Factor	Magnitude*	Geographic Extent	Duration/ Frequency	Reversibility	Significance**	Likelihood of Significant Cumulative Occurrence***	Level of Confidence***
Noise of shipping in addition to Deep Panuke construction	Minimal	<ul style="list-style-type: none"> Short term (bird impacts to be addressed with CWS as in Migratory Bird section). 	Low	Local to the Deep Panuke Project work	Short term	R	Not significant		

*For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 2.5

** For definition of levels of significance (major, medium, minor, minimal) refer to Section 2.5

*** Only addressed for significant effects

8.4.1.17 Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

No impacts were identified for this VEC in relation to shipping in combination with other projects.

8.4.1.18 Physical and Cultural Heritage

Marine heritage components were not specifically identified and cumulative effects are not anticipated. Any wrecks in the area are not expected to be affected by ships with a draft of approximately 14 m and the focus of shipping will be in the shipping lanes/designated areas.

8.4.1.19 Structures/Sites of Archaeological, Paleontological or Architectural Significance

Marine structures/sites of archaeological, paleontological, or architectural significance were not specifically identified and cumulative effects are not applicable.

8.4.1.20 Navigation

The total number of ships known for the area is limited; navigation routes are well established and controlled. Controls will be developed in consultation with Atlantic Pilots Association, TC, and the Canadian Coast Guard using the TERMPOL process and a simulation study as guidance. Navigation routing considers other ship movements and minimizes potential for cumulative effects.

8.4.1.21 Marine Safety and Security

Potential risks associated with accidents including potential for ship collisions in the area may be cumulative in relation to several projects in the area. Keltic will also adhere to the *Marine Transportation Security Act* and regulations. The TERMPOL process is intended to result in the operation of the facilities in a manner that will protect the public and ensure environmental safety and security. Through this process the potential risks associated with accidents will be identified and plans developed to mitigate these risks. As a result, the Project is not expected to cumulatively affect marine safety or security.

8.4.1.22 Human Health and Safety

Potential risks associated with accidents and in particular with increased ship traffic for the area may be cumulative in relation to several projects in the area, including Deep Panuke construction (pipe-laying) activity. A risk assessment is currently being undertaken for the Project. Risk will be managed based on the study to minimize potential for cumulative effects.

8.4.1.23 Fisheries

Potential cumulative effects related to shipping within 25 km of the Project Site are expected to be not significant. There were 49 fishing boats identified within the general area (1999 data). Keltic will provide advance notice of ship arrivals and departures and Keltic will consult with fisheries groups. Interaction with the level of shipping associated with the Project and other known oil and gas development shipping should not interfere with fishing operations. In

addition, Keltic has committed to developing a compensation plan for gear damage and related loss of income due to Project activities.

8.4.1.24 Aquaculture

Several aquaculture operations occur along the shoreline within the 25 km Study Area. These sites are primarily located within Country Harbour. Shipping routes stay clear of aquaculture sites, appropriate ballast water and discharge water control and antifouling protocols will be undertaken, and the cumulative effects are not anticipated.

8.4.1.25 Tourism

The low level of shipping associated with the Project is unlikely to interact with tourism either by itself or with other low level shipping activity.

8.4.2 Conclusion

Based on the review of potential effects and identification of available mitigation measures, it is unlikely that the shipping (within 25 km) associated with the Project will result in significant adverse environmental or socio-economic impacts, including cumulative effects.

Some cumulative effects have been identified in Section 8.4 and mitigation for the Project effects on the affected VECs will also mitigate cumulative effects to some degree (such as mitigation for Migratory Birds in consultation with CWS); however, no significant cumulative effects have been identified for which special mitigation is necessary.

8.5 OVERALL CUMULATIVE SUMMARY

Table 8.5-1 provides the summary of previous assessments of impacts on Project VECs (or approximate Project VECs) and of the cumulative impact assessment.

TABLE 8.5-1 Summary of Impact Assessment Significance for Cumulative Projects

	Ecological / Social Cultural Context ¹	Keltic LNG (Construction) ¹	Keltic Marginal Wharf (Construction) ¹	Keltic Shipping 25 km from Country Island (Construction) ¹	Keltic LNG (Operation) ¹	Keltic Marginal Wharf (Operation) ¹	Keltic Shipping 25 km from Country Island (Operation) ¹	Deep Panuke ²	Other Keltic Projects ³	M&NP Expansion ⁴	Factor in Cumulative Assessment Significance	Overall Cumulative Significance
Hydrology	Included in water quality/ quantity VECs below	Minor	NAEE ⁵	NAEE	Minor	NAEE	NAEE	Not Significant (On Shore VEC)	Minimal to Minor	Minimal to Minor	<ul style="list-style-type: none"> Included in water quality/ quantity VECs below 	Not Significant
Freshwater Quality/ Quantity	Watersheds shared by projects -Betty's Cove Brook; Dung Cove/Crusher Brook and direct to marine environment	Minor	Minimal	Minimal	Minor	None	Minimal	Not Significant (On Shore VEC)	Minimal to Minor	Minimal to Minor	<ul style="list-style-type: none"> Betty's Cove Brook only local watershed for cumulative projects with water user (limited valued recreational fishery) Cumulative clearing of significant portion of local watershed occupied by cumulative projects may potential affect surface water runoff at a low level Construction from several projects potentially occurring concurrently. Storm-water to meet regulatory requirements and effects reversible and generally minimal to minor Operations discharges from all facilities to meet regulatory quality requirements and effects minimal to minor Storm water design incorporates watershed development character Cumulative mitigation to moderate changes to water quality / quantity to meet regulatory standards Monitoring of water quality and aquatic habitat 	Not Significant
Groundwater Quality/ Quantity	Down-gradient groundwater users and contribution to down-gradient surface water/ wetland discharge	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Not Significant (On Shore VEC)	Minimal	Minimal to Minor	<ul style="list-style-type: none"> No down-gradient groundwater users identified for Keltic Project limits cumulative interactions Potential effects for all projects minimal to minor Projects include local well pre/post construction monitoring 	Not Significant
Marine Water Quality	Marine environment	Minimal	Minimal	Minimal	Minor	Minimal	Minimal	Not Assessed	Not Assessed	Minimal to Minor	<ul style="list-style-type: none"> Construction and operations discharges for cumulative projects minimal to minor impacts from onshore works Historical contribution of historical mining expected to be low level and not bioaccumulative Contributions from project small in volume and concentrations compared to assimilative capacity Monitoring of discharge from Keltic Project to be undertaken and expected similar requirements for other projects 	Not Significant

	Ecological / Social Cultural Context ¹	Keltic LNG (Construction) ¹	Keltic Marginal Wharf (Construction) ¹	Keltic Shipping 25 km from Country Island (Construction) ¹	Keltic LNG (Operation) ¹	Keltic Marginal Wharf (Operation) ¹	Keltic Shipping 25 km from Country Island (Operation) ¹	Deep Panuke ²	Other Keltic Projects ³	M&NP Expansion ⁴	Factor in Cumulative Assessment Significance	Overall Cumulative Significance
Soil/ Sediment Quality	Existing site not productive agricultural soils; known historical mining impacts	Minor	Minimal	Minimal	None	Minimal	Minimal	Not Significant (On Shore VEC)	Not Assessed	Minimal to Minor	<ul style="list-style-type: none"> No direct soil users (i.e. agriculture) Potential effects for cumulative projects minimal to minor Remediation Action Plan / Risk Management Plan to address existing contaminants for Keltic Projects 	Not Significant
Air Quality	Rural area limited local air pollutants Nearest residence 300-500 m.	Minimal	Minimal	Minimal	Minor	Minor	Minimal	Not Significant (On Shore VEC)	Minimal to Minor	Minimal to Minor	<ul style="list-style-type: none"> Monitoring if concerns during construction (air quality is by nature cumulative and monitoring will reflect other activities within the local air shed at the time) Air quality monitoring included SOEI emissions and identified as having negligible contributions 	Not Significant
Climate Condition	Regional targets for GHGs	As above	As above	As above	As above	As above	As above	Not Significant (On Shore VEC)	As above	Minimal to Minor	<ul style="list-style-type: none"> Cumulative GHG emissions including Deep Panuke predicted to be minor contribution to Nova Scotia's total GHG 	Not Significant
Vegetation	Extensive areas of similar baseline vegetation present; large portions previously disturbed (forestry, mining)	Minimal to Minor	Minimal to Medium (loss of Project footprint)	NAEE	None	Minimal	NAEE	Not Significant (On Shore VEC)	Medium	Minimal to Minor	<ul style="list-style-type: none"> Area within Project footprint not identified as having species of special status Wildlife and vegetation monitoring plan and rehabilitation as required for Keltic Project 	None
Species at Risk	Species specific context for respective critical habitat types	Medium (un-common horsetail) to Minor	Minimal	Minimal	Minor	Minimal	Minimal	Not Significant (On Shore VEC)	Minor	Minimal to Minor	<ul style="list-style-type: none"> At risk species not confirmed at site Uncommon / rare horsetail in LNG area not designated as Species at Risk Migratory birds considered separately Monitoring programs to be undertaken and if identified development of management plans/mitigation in consultation with regulatory authorities Coordination of monitoring program with other stakeholders 	Not Significant
Fish and Marine Habitat	Fresh water – small drainage; Marine – not major fishery	Minimal	Minimal	Minimal to Minor	Minimal	Minimal to Minor	Minimal to Minor	Not Assessed	Minor to Medium (fresh water) Minimal	Minimal to Minor	<ul style="list-style-type: none"> Cumulative impacts not expected for water quality / habitat Compensation required to meet No Net Loss of fish habitat for any project with potential habitat losses Further monitoring proposed to address assimilative capacity 	Not Significant
Marine Mammals	Important marine mammals not known for area	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Not Significant	Minimal	Minimal to Minor	<ul style="list-style-type: none"> Low importance of Project Area for marine mammals Onshore construction generally separated in time from marine Deep Panuke construction Construction related effects expected to be reversible Operation related vessel noise not expected to cause significant effect 	Not Significant

	Ecological / Social Cultural Context ¹	Keltic LNG (Construction) ¹	Keltic Marginal Wharf (Construction) ¹	Keltic Shipping 25 km from Country Island (Construction) ¹	Keltic LNG (Operation) ¹	Keltic Marginal Wharf (Operation) ¹	Keltic Shipping 25 km from Country Island (Operation) ¹	Deep Panuke ²	Other Keltic Projects ³	M&NP Expansion ⁴	Factor in Cumulative Assessment Significance	Overall Cumulative Significance
Wildlife and Habitat	Large available habitat area	Minor	Minor to Medium (cleared area)	NAEE	Minor	Minimal	NAEE	Not Significant (On Shore VEC)	Medium (clearing)	Minimal to Minor	<ul style="list-style-type: none"> Available wildlife habitat in far exceeds cumulative habitat loss associated with the projects 	None
Migratory Birds	Alternate nesting habitat generally available	Minor	Minimal	Minimal	Minor	Minimal	Minimal	Not Significant	Included in Wildlife	Minimal to Minor	<ul style="list-style-type: none"> Mitigation measures for cumulative projects include avoiding nesting periods Adoption of EC recommendations for Interactions with Lights and Flares and Storm-petrel Stranding Protocol Roseate tern monitoring and integration with Recovery Plan and other project monitoring if available 	Not Significant
Wetlands	Requirement for No Loss of Wetland Function	Minor	Medium to Major (wetland loss but compensated to replace function)	NAEE	Minor	None	NAEE	Not Significant (On Shore VEC)	Minor	Minimal to Minor	<ul style="list-style-type: none"> Compensation required to meet No Loss of Wetland Function for any project with potential habitat losses 	None
Lighting Conditions	Existing environment typically rural with low levels of lighting	None	Minor	Minimal	Minor	Minor	Minimal	Not Significant (On Shore VEC)	Minor	Minimal to Minor	<ul style="list-style-type: none"> Projects in the area contributing low levels of localized 'skyglow' Adoptions of measures to protect birds as in Migratory Bird section 	Not Significant
Atmospheric and Acoustic Environment	Rural, sparsely populated	Minor	Minimal to Minor	NAEE	Minor	None	NAEE	Not Significant (On Shore VEC)	Minimal	Minimal to Minor	<ul style="list-style-type: none"> Noise impacts short term Deep Panuke construction expected to occur later than onshore works Predicted effects for all projects none to minor Noise modeling to be undertaken to confirm predictions 	None
Traditional Use	One of 10 larger hunting areas	Minor	Minor	NAEE	None	None	NAEE	Positive / No Significant Effect (On Shore VEC)	Not identified	Minimal to Minor	<ul style="list-style-type: none"> Alternate hunting/ fisheries areas available Predicted effects for all projects none to minor 	None
Heritage Sites	Heritage sites known for area	NAEE	NAEE	NAEE	NAEE	NAEE	NAEE	Positive / No Significant Effect (On Shore VEC)	Minimal to Minor	Minimal to Minor	<ul style="list-style-type: none"> Increased understanding of heritage in area due to research for this and other projects in area 	None
Archaeological Sites	High public sensitivity, burial sites and artefacts known for area	NAEE	Minor (un known)	NAEE	NAEE	Minor	NAEE	Positive / No Significant Effect (On Shore VEC)	Minimal to Minor	Minimal to Minor	<ul style="list-style-type: none"> Increased understanding of resources in area due to research for this and other projects in area 	None
Navigation	Harbour has minimal commercial traffic	NAEE	Minor	Medium (potential for collision)	NAEE	Minor	NAEE	Not Significant (Other Ocean VEC)	Not Assessed (see Health and Safety)	Minimal to Minor	<ul style="list-style-type: none"> TERMPOL process to resolve issues arising 	None
Marine Health and Safety	Limited fisheries/shipping	NAEE	Minor to Medium (increased traffic)	Medium (potential for collision)	NAEE	None	Medium (potential for collision)	Not Significant (Other Ocean VEC)	Minimal to Medium (potential for collision)	Minimal to Minor	<ul style="list-style-type: none"> TERMPOL process to facilitate decreased risk of potential accidents 	None

	Ecological / Social Cultural Context ¹	Keltic LNG (Construction) ¹	Keltic Marginal Wharf (Construction) ¹	Keltic Shipping 25 km from Country Island (Construction) ¹	Keltic LNG (Operation) ¹	Keltic Marginal Wharf (Operation) ¹	Keltic Shipping 25 km from Country Island (Operation) ¹	Deep Panuke ²	Other Keltic Projects ³	M&NP Expansion ⁴	Factor in Cumulative Assessment Significance	Overall Cumulative Significance
Human Health and Safety	Health and safety of employees and surrounding communities Existing dust and air, limited fisheries/shipping	Minimal	Minor to Medium (increased traffic)	Medium (potential for collision)	Minimal	None	Medium (potential for collision)	Not Significant (Other Ocean VEC)	Minimal to Minor; Medium (potential for collision)	Minimal to Minor	<ul style="list-style-type: none"> • TERMPOL process to facilitate decreased risk of potential accidents 	Not Significant
Fisheries	Wharf and shipping channel in Stormont Bay not a major fishing area	NAEE	Minimal	Minimal to Minor	Not Assessed	Minimal to Minor	Minimal to Minor	Not Significant	Minimal	Minimal to Minor	<ul style="list-style-type: none"> • Compensation for loss of fishing near construction sites 	None
Aquaculture	Aquaculture facilities in Country Harbour, not in vicinity of site	NAEE	Minimal	Minimal	Not Assessed	Minimal	Minimal	Not Significant	Minimal	Minimal to Minor	<ul style="list-style-type: none"> • Water quality impacts not expected to be significant • Aquaculture sites beyond Study Area 	None
Tourism	Eastern shore tourism sector renowned for natural beauty, coastal views, rural landscape Project Site is zoned for industrial use	Major (visual effects only), NA ⁶ for other tourism	Major (visual), other positive	NAEE	NA	Major (visual), other positive	NAEE	Positive (Economy)	Minor (negative) to Medium (positive)	Minimal to Minor	<ul style="list-style-type: none"> • Visual impact of cumulative projects major but local and not expected to affect regional tourism • Tourism in general expected to benefit by improved infrastructure to the region 	Not Significant

1) Section 5.0 of this document
2) Jacques Whitford Environmental Limited, 2006
3) AMEC, 2006
4) Preliminary assessment based on available information
5) NAEE – No Adverse Environmental Effect from routine works/activities
6) NA - Not Applicable