



ENVIRONMENTAL ASSESSMENT REPORT
(CLASS 2 UNDERTAKING)

Goldboro LNG Project
Natural Gas Liquefaction Plant & Marine Terminal
Pieridae Energy (Canada) Ltd.

SEPTEMBER 2013



**GOLDBORO
LNG**



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GOLDBORO LNG PROJECT

**NATURAL GAS LIQUEFACTION
PLANT AND MARINE TERMINAL**

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EXECUTIVE SUMMARY



GOLDBORO
LNG

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Proponent and Project

Pieridae Energy (Canada) Ltd. (Pieridae) is the Proponent of the proposed Goldboro LNG Project (the Project). The proposal entails the development and operation of a natural gas liquefaction plant, Liquefied Natural Gas (LNG) tanker terminal, and associated marine facilities in Goldboro, Guysborough County, Nova Scotia (NS). Pieridae is a Canadian energy infrastructure development company with extensive LNG experience and deep connections to the LNG industry worldwide. This Environmental Assessment (EA) report has been prepared to fulfil obligations pursuant to the NS Environmental Assessment Regulations for a Class II undertaking.

The Project is being designed to provide an LNG send-out capacity of 10 million tonnes per annum (Mtpa) and a gross LNG tank storage capacity of about 690,000 cubic metres (m³). The Project proposal also includes the development of a 180 megawatt (MW) on-site gas-fired power plant.

The Project location is identical to the site that was proposed for the LNG facility component of the Keltic Petrochemicals and LNG Project (the Keltic Project). The Keltic Project underwent provincial and federal environmental assessments and obtained EA approvals in 2007 (provincial) and 2008 (federal). The Keltic Project, however, was never executed and all approvals obtained have expired.

The Project Site

The Project will be located in the Goldboro Industrial Park, near the existing Sable Offshore Energy Inc. (SOEI) gas plant. The proposed site has been zoned with an I-3 designation permitting industrial and marine terminal developments. This designation encompasses an area of about 3,000 hectares (ha), of which approximately 150 ha have been allocated to Goldboro LNG. There are no permanent or seasonal residences on the Project site. The nearest residence is situated about 200 m north of the Project boundary on Route 316 near Webb's Cove. The nearest harbours are small fishing ports located in Isaac's Harbour to the west and Drum Head to the east, each approximately 2 kilometres (km) away from the Project site.

Currently, with the exception of the SOEI gas plant and an associated helicopter landing pad, there has been almost no development in and around the site and the industrial park, which provides for a largely vegetated location with coniferous forest of various ages, shrub land, old field, and wetland vegetation communities.

Numerous logging roads criss-cross the Project area. In addition, a number of mostly overgrown abandoned mine workings are spread across the site and adjacent lands, consisting of tailings, open shafts, and pits.

Located within the LNG Project footprint are one (unnamed) watercourse and several ponds. Part of the marine component of the Project is proposed to use a portion of Red Head, a coastal

peninsula. This location had been used in the past for farming as indicated by the presence of old-field vegetation, much of which is now colonized by White Spruce forest and ericaceous shrubs. The habitat on the promontory can be described as barren vegetation. The ocean shoreline is typical of marine shores with a narrow pebble beach. There are no dunes or sandy beaches in the footprint.

To provide the Project with freshwater, the proposal includes a water intake structure at Meadow Lake. This lake is located about 8 km north northeast of the Project site and is approximately 104 ha in size with an average depth of 2 metres (m). Approximately half of the Meadow Lake basin is wetland. The 7 km water supply pipeline that will connect Meadow Lake with the Project site will run immediately parallel to an existing Maritimes & Northeast Pipeline (M&NP) gas pipeline right-of-way (ROW) and will pass through an area with a mosaic of coniferous stands, clear cuts, shrub communities and wetlands. The route crosses two small watercourses, Branch Gold Brook and Betty's Cove Brook.

From a marine perspective, the Project site is situated in the coastal waters of Stormont Bay, at the opening of two natural harbour inlets, Country Harbour and Isaac's Harbour. The intertidal (littoral) and subtidal (sublittoral) habitat within Stormont Bay support a variety of marine organisms including estuarial, freshwater and pelagic fishes. The Black Ledges area, a shoal on the western entrance to Stormont Bay is considered good lobster and urchin habitat with shoals surrounded by large sandy mud areas.

Environmental Assessment (EA) and Terms of Reference (TOR)

The Nova Scotia Department of Environment (NSE) determined that, due to the proposed 180 MW power plant Project component, the Project is a Class II undertaking pursuant to the Nova Scotia Environmental Assessment Regulations. As such the Project requires approval under Part IV of the *Nova Scotia Environment Act* (NSEA). In accordance with the EA Regulations, NSE generated a Draft Terms of Reference (TOR) document for the EA planning process, obtained public and agency comments and issued the final TOR for the Project on the 7th of May, 2013. The final TOR specifies the regulators' information requirements for the EA approval and has been followed by Pieridae in the preparation of this EA Report.

Other Project Approvals and Permits

In addition to the approval of the Project under the NS Environmental Assessment Regulations, a number of federal and provincial environmental approvals and permits will be required. In particular, the marine terminal will require an approval under the *Navigable Waters Protection Act* (NWPA). The federal *Fisheries Act* is expected to require the proponent to obtain an authorization for works involving marine and freshwater fish habitat.

Additional provincial approval requirements entail a Permit to Construct and a License to Operate from the Nova Scotia Utilities and Review Board (NSUARB) pursuant to the Gas Plant Facility Regulations passed under the *Energy Resources Conservation Act*. Prior to site development, a series of approvals will be needed pursuant to Part V of the NSEA and its Activities Designation Regulations. These approvals will address such activities as watercourse alterations / diversions, wetland alterations, surface water withdrawal, and wharf construction

and maintenance. The Activities Designation Regulations also cover the Industrial Approval, which defines specific operational conditions and limitations. An Industrial Approval application will be filed by the proponent after receipt of EA approval.

Goldboro LNG - Project Description

Project Components

The Project comprises an onshore gas processing plant, a marine jetty for loading carriers with LNG product and a wharf for component delivery during construction, and for mooring of tug boats during operation. In addition, there will be a water supply pipeline to convey fresh water from a proposed intake structure at Meadow Lake to the site. The key components of the proposed Project are listed in Table ES-1.

Table ES-1 Key Components - Goldboro LNG Project

Components	Description
Natural Gas Liquefaction Plant	A facility for converting 10 Mtpa of natural gas into LNG for export to overseas markets.
LNG Storage Tanks	Full containment LNG cryogenic storage tanks each with a net storage capacity of 210,000 m ³ (gross capacity of around 230,000 m ³).
Marine Facilities	A jetty trestle for the LNG transfer lines and access road and two LNG ship loading berths. A marine wharf for the unloading of construction equipment and materials and for mooring of the tug and pilot vessels.
180 MW Power Plant	On-site power generation to support the LNG facility and support services. Emergency diesel generator sets provided for essential loads.
Feed Gas Pipeline and Inlet Facilities	Supply pipeline from the M&NP pipeline including pigging and metering.
Potable Water Pipeline and Intake Structure	Supply pipeline from a new intake structure at Meadow Lake to the Project site.
Buildings and Utilities	Various administrative, control and maintenance buildings. Utilities units to support the liquefaction and export facilities. On-site power generation suitable for 114 kiloVolt-amperes (kVA).
Temporary Work Camp	For the duration of the construction phase, the Project will include a work camp situated along the northern site boundary.
Information Centre	At the start of the construction activities an information centre is to be operated at the Project site.

Construction

Upon receipt of the applicable approvals, permits and authorizations, construction will commence with site clearing, grading and the preparation of lay down areas. Also, one of the first activities will involve the development of a temporary construction camp on lands immediately adjacent to the Project site. This camp will be designed to accommodate 1500 to 2000 workers. Power is to be provided by diesel generation sets and potable water will be

provided by local contractors until the Meadow Lake intake structure and the pipeline link are operational. Wastes generated from the construction camp will be treated at an onsite treatment facility, with domestic wastes disposed of at regional waste facilities. Upon completion of the construction activities, the camp site will be rehabilitated to pre-development conditions unless the municipality wishes to pursue other uses.

Another feature that will be developed early on in the construction phase is the Marginal Wharf. It will be used by barges for the delivery of large Project components to the Project site.

Characteristics of LNG and Natural Gas

Natural gas represents the cleanest burning of all fossil fuels. Natural gas that has been cooled to -160°C and attains liquid composition is considered to be LNG. The purpose of liquefying natural gas is to reduce transportation costs. Liquefaction of natural gas can reduce the volume by 600 times. This state is maintained by utilizing cryogenic cooling and not by pressurizing the gas. LNG is non-toxic and non-carcinogenic and is stored at just above atmospheric pressure. It is an odourless and colourless liquid, primarily comprised of CH_4 , ethane and propane with small fractions of butane and pentane.

Natural Gas Liquefaction Facility and LNG Storage

A key component of the proposed facility is the liquefaction plant. It will have a 10 Mtpa of LNG production capacity and will be installed in two “trains”. Each of the two trains will involve a series of refrigerant compressors cooling the feed gas to a temperature of around -162°C . All pressure relief (emissions) from the refrigerant/liquefaction process will be routed to the gas flare system. It consist of a number of flare stacks between 30 to 180 m in height and is provided for the reliable and safe disposal of hydrocarbon vapour and liquid streams that result from upsets and emergencies. Operation of the LNG facility will generate emissions to air, arising from natural gas combustion processes as well as venting from equipment. Combustion emission products will include Carbon Dioxide (CO_2), Carbon Monoxide (CO), Nitrogen and Sulphur compounds (NO_x / SO_x), unburnt Volatile Organic Compounds (VOCs) and Particulate Matter (PM). Vented emissions will include nitrogen and fugitive VOCs.

Three LNG storage tanks will be required, each able to store up to $210,000 \text{ m}^3$ of LNG. The LNG tanks will be approximately 90 to 110 m in diameter and 40 to 50 m in height. The “full-containment” tanks feature an inner and an outer tank. The outer tank, typically steel or concrete, is designed to retain natural gas in liquid and gaseous form in the unlikely event of a leak in the inner tank.

A number of supporting buildings and services will also be required such as a control building, a fire station, an air and nitrogen generation plant, security systems, and warehouses.

Water and Waste Management

The facility will be predominantly air cooled and as such will not require large volumes of raw, fresh water. Water will be sourced from the Meadow Lake via a 7 km pipeline. The total service water requirement will be approximately 500 cubic metres per day (m³/d). Prior to discharge to the environment, the on-site wastewater treatment facility will treat plant water to meet applicable effluent standards.

Marine Vessel Operations

During operation, LNG tankers will arrive every three to four days take on LNG at the jetty for 12 to 24 hours, and leave. The tankers will carry up to 266,000 m³. The marine jetty operations are expected to require four tugs, two line boats (to assist with the mooring), and one pilot boat; which will be permanently moored at the marginal wharf.

The marine terminal is located in a relatively wide and open bay. A water depth of over 20 m is sufficient for a LNG carrier with a draught of 12 m and the available width of the approach is more than adequate. During arrival the approach channel is used to reduce speed. About halfway up the channel, as the vessel becomes more difficult to control at reduced speed, the tug boats are required to assist the tankers manoeuvre. During loading of the LNG carriers, a 200 m exclusion zone is defined by code around the loading jetty.

Schedule

Subject to Goldboro LNG receiving all required regulatory approvals and permits it is anticipated that construction will begin in 2015 and that operation of the facility will commence by mid 2019.

Capital Expenditures, Workforce

Current estimations value the capital expenditure of the Project at approximately \$8.3 billion (Canadian (CDN) Dollars). This includes all works from the commencement of detailed design through to commissioning and completion of works.

For the construction of the facility, it is estimated that the initial mobilization, site preparation and early civil works require a workforce of about 550, followed by foundation, building and underground service works, which are likely to increase the required workforce to 2800. During subsequent module installation and associated mechanical and electrical / instrumentation works, the workforce is expected to reach a maximum of 3500 on-site workers. After this, workforce requirements will gradually diminish.

The current operations manpower assumption is based on two by 12 hours day and night shifts staffed by three crews. Each crew will work a six days on and three days off pattern. It is anticipated that a total of approximately 200 operations, maintenance and management personnel will be required to run the LNG facility all year round on a rotational basis.

Health, Safety and Environmental Management System

Pieridae is committed to the protection of the environment and ensuring the health, safety and security of all their employees, contractors, customers and neighbours. Pieridae's environmental policy includes:

- A commitment to a safe, healthy workplace which ensures all personnel are educated, trained and have the necessary safety equipment in place.
- A commitment to the communities in which they are engaged. Any incidents are reported to authorities immediately so corrective action takes place to ensure health, safety and protection of the environment.
- A commitment to recycling and reusing materials.
- A commitment to the conservation and stewardship of natural resources.

A Health, Safety and Environmental (HSE) Management System will be developed for the Project and followed throughout each of the Project phases (construction, operation and decommissioning) including the specific management plans and programs such as:

- Environmental Management Plan (EMP);
- Sulphide Bearing Materials Management Plan (SBMMP);
- Risk Management Plan (RMP);
- Monitoring and Follow-up Programs;
- Emergency Response Plan;
- Marine Terminal Manual;
- Workplace Health and Safety Plan (HASP);
- Environmental Awareness Training; and
- HSE Auditing Programs.

An EMP will be developed for the construction of the Project in accordance with applicable provincial environmental protection legislation and regulations. This plan will outline all environmental protection measures to be employed during both the construction and operation phases of the Project.

Some of the valued environmental components (VECs) described in this report require monitoring following completion of construction to determine if further mitigation is warranted and/or if there are any unanticipated environmental effects as a result of the development of the Project. Pieridae will undertake appropriate monitoring and follow-up activities as required to confirm effects predictions and to fulfil regulatory requirements.

A SBMMP will be developed for construction of the Project in accordance to protocols outlined in the Nova Scotia Guidelines for the Management of Contaminated Sites. This plan will outline all environmental protection measures to be employed during the construction phase of the Project when dealing with rock materials that are sulphide bearing. It will be submitted to the appropriate regulatory agencies for review.

A detailed RMP will also be developed for construction of the Project in accordance with protocols outlined in the Nova Scotia Guidelines for the Management of Contaminated Sites. This plan will outline all environmental protection measures to be employed during the construction phase of the Project when dealing with arsenic and mercury contamination from old tailings. It will be submitted to the appropriate regulatory agencies for review.

A detailed Emergency Response Plan for the Project will be developed and implemented as part of a regionally coordinated approach to emergency preparedness and response. Consultations will be conducted with the local fire department as well as other local and provincial authorities prior to the finalization of the Emergency Response Plan and start up of the facilities. This plan will be developed in accordance with all relevant provincial requirements for Emergency Response Plans.

A Marine Terminal Manual will be developed to address the specific requirements and operations of the LNG facilities, transfer from storage and loading in accordance with federal and provincial legislation and company policies. The outcomes of the Technical Review Process of Marine Terminal Systems in Trans-shipment Sites (TERMPOL) process will be incorporated, as appropriate in the Marine Terminal Manual.

A workers HASP will be developed to ensure the health, safety and security of all employees, contractors, and other personnel that may be on site during all phases of the Project. The plan will incorporate all company policies and will detail each individual's responsibilities. It will also include the methodology for conducting a job hazard analysis of each component of the Project by identifying the potential hazards and indicating what hazard controls must be in place. This plan will be reviewed by all employees, contractors, and other personnel that may be on site.

To support the implementation of the various HSE management plans and programs, environmental awareness training for employees will be provided. Public awareness of environmental issues (e.g., temporary noise levels, road closures, blasting activities) will be promoted via the Project's on-going public consultation program.

Consultation Program

Public Consultation

Pieridae has implemented a comprehensive public consultation program that effectively engages with stakeholders and the public at large. Responses and feedback obtained to date reflect significant support from the community. Specific components of Pieridae's consultation program included a comprehensive Project website (www.GoldboroLNG.com), several Public Information Sessions and a Newsletter. All four Information Sessions held since October 2012 had a high attendance level, ranging from 100 to 150 attendees, with public response being very supportive to the proposed Project. For the most part, participants appeared to see the Project as an excellent opportunity for long awaited economic development and job opportunities in the region, in particular since the Keltic Project was not implemented and the SOEI gas plant is expected to close in the near future.

Community Awareness and Views of the Project (Opinion Poll)

Pieridae commissioned an opinion poll during the EA phase to gauge public opinion regarding several different aspects of the Project. A randomly selected sample of three hundred residents was contacted by telephone. The vast majority of the populace had a high level of awareness of the Project. Most participants (86%) are in support of the Project with 77% of those identifying economic benefits as their main reason. Of the 11% of residents who were opposed, environmental impact/pollution and safety concerns were identified as the main rationale for opposition.

Stakeholder and Agency Consultation

As part of the consultation efforts, the study team also contacted a number of stakeholder groups and government agencies in order to provide information on the Project and obtain an understanding of stakeholder / agency issues and concerns. Where applicable, the feedback obtained was addressed in the EA Report or referred to subsequent planning and approval work.

Community Liaison Committee (CLC)

Pieridae established a Community Liaison Committee (CLC) and held a first meeting on 10 September 2013. The objective of this committee is to provide a formal forum for local communities to engage in the Project planning, learn about the proposal and provide feedback to the planning team regarding Project-related opportunities, issues, concerns and preferences. Future meetings will be held about every six months, in association with major Project milestones, or in response to specific community needs.

Information Centre

With the start of the construction activities Pieridae is planning on operating an information centre at the Project site. The centre will be expanded as the Project evolves and will be maintained throughout Project operation. Exhibits and information material are envisaged to inform about the Project and such topics as LNG, liquefaction technology, LNG tanker technology, and energy markets. Some cultural history may also be included, such as the Black Loyalist community and former Red Head Cemetery associated with the Project area.

Pieridae intends to continue its consultation program beyond the submission of the EA Report and is committed to an on-going consultation process during subsequent planning and design stages, construction, and operation. The CLC meetings, newsletter publications, and the Project website are expected to remain the program's main tools. They will be used to communicate Project updates and specific activities such as road closures or blasting schedules, and will also assist in heightening environmental awareness (e.g., on-site hazards). The specific format and extent of the future consultation activities will be developed in consultation with the CLC and in response to general public and stakeholder interest.

First Nation Engagement

Engagement Strategy

Since the early planning stages of the Project, Pieridae has been promoting First Nation involvement and cooperation with Aboriginal communities. As such, Pieridae developed an Aboriginal Community Engagement Strategy. The premise of the strategy is that, through engagement, the proponent can establish an effective relationship with Aboriginal communities and organizations. Pieridae's objectives have been to:

- inform Aboriginal communities about its proposal;
- solicit information on the Aboriginal issues and concerns with respect to the proposed Project; and
- identify ways and means for Aboriginal engagement in the planning process and approaches to a mutually beneficial Project implementation.

In implementing the strategy Pieridae arranged for meetings with representatives of the Mi'kmaq communities to identify their concerns about the Project and discuss Project-related opportunities.

Mi'kmaq Ecological Knowledge Study (MEKS)

A Mi'kmaq Ecological Knowledge Study (MEKS) was conducted as part of Pieridae's engagement with First Nations. The MEKS identifies the interests of Mi'kmaq communities in the lands and resources in and near the proposed Project. Pieridae is committed to applying information from the MEKS in the future planning and development of the Goldboro LNG Facility.

Memorandum of Understanding (MOU)

Pieridae will maintain ongoing dialogue with the Mi'kmaq communities during construction, operations, and decommissioning. The basis for this continued engagement has been established through a Memorandum of Understanding (MOU) between Pieridae and Mi'kmaq communities. The MOU was signed in early September 2013 and commits both sides to the signing of a Collaborative Benefits Agreement (CBA). The CBA will ensure a long-term cooperation and, most importantly, Project benefits for the Mi'kmaq communities including employment opportunities, training, and education.

Environmental Assessment (EA) Methodology

The EA methodology applied the EA follows the requirements formulated in the TOR. Accordingly, the assessment is focused on environmental components (VECs) of greatest concern expressed by regulators, technical specialists and the interested public.

The following VECs were selected and assessed for this Project:

- Geology, Soil/Sediment Quality
- Groundwater Resources
- Surface Water Resources
- Air Quality and Climate Change (Greenhouse gas (GHG))
- Acoustic Environment (Noise)
- Ambient Lighting
- Terrestrial Habitat and Vegetation
- Species at Risk (SAR)
- Employment and Local Economy
- Fisheries, Aquaculture and Marine Harvesting
- Human Health and Safety
- Visual Landscape
- Existing and Planned Land Use
- Agriculture
- Forestry

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- Wetlands
 - Terrestrial Fauna
 - Freshwater Aquatic Species and Habitat
 - Marine Species and Habitat
 - Tourism and Recreation
 - Aboriginal Use of Land and Resources
 - Transportation
 - Archaeological Resources

The EA methodology includes an evaluation of the potential effects on each of the VECs that may be caused during the construction, operation and decommissioning phase of the Project. Malfunctions and accidental events and their effects on VECs are also included in the approach. In addition, the EA examines the potential effects of the environment on the Project, for example as a result of severe storm or flood events.

Environmental Effects Assessment and Mitigation

The environmental effects assessment involved qualitative and quantitative analyses using existing knowledge, professional judgment, and computer modeling where appropriate and feasible. Project-VEC relations were investigated including direct and or indirect interactions via pathways to determine potential environmental effects. In accordance with the TOR the assessment was conducted in a step-wise fashion involving:

- prediction and evaluation of Project-related environmental effects;
- identification of necessary avoidance, mitigation, remediation, and/or compensation; and
- determination of residual effects and their significance.

As part of the Project, numerous design and operational features will be implemented in order to avoid and minimize adverse environmental effects (Table ES-2). Despite these measures, where an adverse environmental effect was identified and avoidance was not possible, additional mitigation measures were developed. In those instances where an adverse effect is unavoidable and cannot be mitigated to insignificant levels, options for remediation and/or compensation were investigated. For interactions where positive effects are anticipated, opportunities were determined for maximizing the positive effects.

Residual environmental effects were predicted for each VEC following application of mitigation measures, and were determined to either be “significant” or “not significant”. The evaluation was conducted on the basis of a set of criteria involving the magnitude of the effect, its geographic extent, duration/frequency, reversibility and the ecological/cultural context within which the effect is predicted to occur.

Table ES-2 Key Environmental Management Features

Environmental Management Feature	Description	Objective
Surface water management systems; site drainage infrastructure (construction, operation, decommissioning phases).	<ul style="list-style-type: none"> • On-site stormwater management system including retention pond, if necessary. • Oil/water separators. • If required, a controlled outlet structure with monitoring point. 	<ul style="list-style-type: none"> • To limit post development site-runoff to pre-development levels. • Monitoring of effluent quality. • To provide a shut down mechanism in case of emergency (spill containment).
On-site wastewater treatment facility (construction, operation, decommissioning phases).	<ul style="list-style-type: none"> • Wastewater collection system. • On-site treatment facility for wastewater stream. • Controlled outlet structures with compliance monitoring point. • Shut down mechanism (spill containment). 	<ul style="list-style-type: none"> • To prevent discharge of untreated wastewater to receiving water bodies. • To allow for monitoring of effluent quality and shut down. • To contain potential spills and mitigate impacts to the receiving environment.
Hazardous waste management system (construction, operation, decommissioning phases).	<ul style="list-style-type: none"> • Designated storage location(s) for hazardous materials. 	<ul style="list-style-type: none"> • Compliance with national policy. • Control of hazardous materials used in the operation of the LNG facility.
On-site emergency response unit and systems.	<ul style="list-style-type: none"> • On-site emergency response unit equipped and trained to address fires, explosions, spills, and hazardous material management. • Fire water supply system. • Process control and Emergency Shutdown (ESD) System protocols. • Field telephone, general alarm equipment. • Emergency escape lighting. • Regular drills to practice emergency team response time. 	<ul style="list-style-type: none"> • Immediate response in case of emergencies. • Provide multiple systems for emergency management. • Prevent potential injuries, loss of life and impacts to the environment. • Proactive management of emergency response teams.
Spill prevention and response system.	<ul style="list-style-type: none"> • Motion sensors in LNG loading arms. • Automated disconnection / shut off loading mechanism. • Emergency valve shutdown in case of loss of power or key input signals. • Sectionalised gas and liquid inventories to limit the quantity of material released on loss of containment. • LNG spill containment wall. • Secondary containment for all on-site fuel storage /filling areas. 	<ul style="list-style-type: none"> • Prevent exposure for workers, public and the receiving environment. • Provide backup systems and control systems for power loss. • Multiple systems for containment of LNG in the event of a site wide incident.
Uninterrupted power supply.	<ul style="list-style-type: none"> • Emergency power system. • Automatic power transfer of essential services. 	<ul style="list-style-type: none"> • Help protect against extreme weather events where loss of power could have a negative effect. • Prevent an automatic shut down of the LNG facility.

Environmental Management Feature	Description	Objective
Air quality/emission controls.	<ul style="list-style-type: none"> • Emergency pressure valves. • Flare systems to incinerate fugitive gaseous emissions. • Flares designed to produce minimal smoke. • High efficiency (98%), low noise flare tip. • Flare, vent, and drain systems are segregated in case of individual failure. • Flare gas metering. • Flare gas monitoring point. • Selective catalytic reduction post engine technology (to control NO_x emissions for marine diesel engines). 	<ul style="list-style-type: none"> • To minimize air emissions. • To prevent worker, public and environmental exposure to air emissions. • To minimize the contribution of the Project to acid gases. • To provide compliance reporting on emissions to regulators. • To provide chemical characterization and rates of the emissions from the LNG facility.
Energy efficiency (GHG management).	<ul style="list-style-type: none"> • High energy conversion efficiency technology (power plant). • Computerized combustion controls. • Waste heat recovery units for process or space heating. 	<ul style="list-style-type: none"> • Minimize the Project contribution to GHG. • High temperature combustion minimizes the by-products (benzene, CH₄, CO) and provides cleaner by-products. • Cogeneration (combined heat and electrical processes) minimizes the LNG carbon footprint.
Noise abatement.	<ul style="list-style-type: none"> • Mufflers at high noise machinery; • Housing of equipment in enclosures with insulation (combined with winterisation). 	<ul style="list-style-type: none"> • Limit the occupational exposure to noise for workers in the LNG facility. • Limit exposure of off-site receptors to noise.
Erosion control features (construction and decommissioning phases).	<ul style="list-style-type: none"> • Erosion and sediment control plans to prescribed soil stabilization requirements, silt fences, sediment traps etc. 	<ul style="list-style-type: none"> • Avoid soil erosion and increased sedimentation loadings in freshwater and marine environments and to prevent transfer of contaminated soils and sediments off-site.

Environmental Effects

The assessment concludes that under normal planned operations and following implementation of mitigation measures (including off-sets) and the HSE Management System, significant adverse residual effects are not likely to occur for any VEC. Key findings of the EA include:

- **Socio-economic effects** – The Project is predicted to provide very significant long lasting and beneficial effects to the local, regional, and provincial economies through employment, capital expenditures and tax revenues from property taxes and income tax. During the anticipated five–year construction period the maximum total workforce is expected to reach 3500 workers. Total direct capital expenditures are estimated to amount to CDN \$8.32 billion. Of this, CDN \$6.9 billion are expected to be spent in NS. During operation, the estimated total expenditures amount to CDN \$ 34.8 million annually (excluding property taxes). The Project meets the municipal Land Use Plan objectives and has received significant support by local and regional communities.

- Effects on terrestrial habitat and wildlife – Within the Project footprint, some loss of habitat for plants, terrestrial birds and animals is unavoidable and amounts to approximately 130 ha for the LNG facility and water supply pipeline, with 16.3 ha for the temporary work camp. Given the historic mining and recent commercial activities on and near the site, the habitat is not pristine and represents, for the most part, rather young regrowth and vegetation that is common in NS. None of the directly affected areas are considered critical habitat for Species at Risk (SAR). Mainland Moose and bats are present in the general area and could experience adverse effects should other future land developments be realized. In addition to mitigative measures Pieridae therefore also commits to contribute to recovery programs specific to these species. The Project's impacts are not expected to significantly influence long term populations locally or regionally.
- Effects on wetlands – The Project footprint has been arranged to minimize impact on wetland habitat as much as possible. The unavoidable loss involves a total of 3.3 ha of small on-site wetlands all of which are considered common in the region and do not provide critical habitat for SAR. A small additional area of wetland may be impacted along the proposed water supply pipeline route. This loss will be compensated through creation of comparable new habitat off-site so that wetland functions are re-established upon completion of construction.
- Effects on freshwater fish and fish habitat – Similar to wetland habitat, the Project footprint avoids as much as possible freshwater environments. As a result, only one small (unnamed) watercourse will be displaced to the site perimeter. Ecological functions that cannot be fully restored will be off-set by aquatic fish habitat improvements or new habitat creation within or adjacent to the watershed.
- Effects on air quality, climate change – The operation of the facility will result in air emissions typically associated with the combustion of natural gas, the cleanest burning of all fossil fuel. The computer modeled ground level concentrations are all well below the regulated maximum levels. GHG emissions in the form of CO₂ will be significant when compared with total GHG emissions in NS and provincial reduction targets. Although not regulated, Pieridae commits to minimizing and off-setting its GHG emissions in close cooperation with the Nova Scotia Climate Change Directorate.
- Effects on the marine environment – The loss of marine habitat will be minimized through the use of “mono-piles” to support the proposed jetty and a minimal footprint for the marginal wharf resulting in a total marine footprint of 3.7 ha (0.1ha and 3.6 ha respectively), representing approximately 0.38% of the total lobster habitat available in Stormont Bay. Residual adverse effects on marine fish and fish habitat will be off-set through improvements or creation of new marine habitat within Stormont Bay. Pieridae will participate in the voluntary TERMPOL planning process. It provides for the development of comprehensive design, operations, and safety plans for the marine components of the Project in cooperation with all relevant federal and provincial agencies. This will avoid and minimize potential interference with existing marine use of the Bay.
- Effects on road transportation – For the duration of the construction phase, the Project will bring up to 3500 workers to Goldboro. The majority will be accommodated in a temporary work camp at the site with the balance of the workforce staying in the local

and regional communities. Together with arrangements for shuttle bus services, car pooling, effects on the local road system are predicted to remain well within current road capacities and therefore are not considered significant.

Malfunctions and Accidents

Malfunctions and accident scenarios associated with LNG leaks are considered extremely rare events. The LNG industry is regarded to have the best safety record of any of the energy industries and, according to the US Department of Energy *“risks from accidental LNG spills, such as from collisions and groundings, are small and manageable with current safety policies and practices.”*

The Goldboro LNG plant and marine terminal will be designed, constructed and operated in accordance with rigid codes and standards specifically created for LNG facilities. This includes the requirements set out in the Code of Practice – Liquefied Natural Gas Facilities of the Nova Scotia Department of Energy (NSDE, 2005). The Code has been developed pursuant to the *Nova Scotia Energy Resources Conservation Act*, the *Pipeline Act* and the *Nova Scotia Gas Plant Facility Regulations*. In addition, the Project will fulfil the requirements of CSA Z276, the Canadian Standards Association’s (CSA) Liquefied Natural Gas standard.

As part of the Pre-Front End Engineering Design (FEED) a HSE protection philosophy was developed, including a Hazard Identification (HAZID) study and a Gas Dispersion Analysis, providing for the full integration of health, safety and environmental considerations into all aspects of the design, including materials, process and equipment selection, and site and layout choices.

The hazard assessment and consequence modeling demonstrated that the fire impacts from the accidents considered are within the confines of the plant boundary and ROWs and meet the requirements of CSA Z276.

Further HAZID studies as well as qualitative and quantitative risk assessments will be conducted as part of FEED to document compliance and to obtain regulatory approval. Safety requirements for the marine operations (e.g., vessel approach/departure, vessel mooring, loading, tug assist, navigational aids) have been included in the Pre-FEED Project design on the basis of a preliminary shipping study. This study will be detailed during FEED and as part of the voluntary TERMPOL planning process which will be completed in close cooperation with Transport Canada (TC), Canadian Coastguard, and the Canadian Pilotage Authorities.

Effects of the Environment on the Project

The proposed Project could be affected by extreme weather situations (high winds, heavy rain falls, fog, flooding), extreme marine conditions (extreme wind and wave conditions, sea level rise), the effects of global climate change and seismic events. During FEED, extreme weather conditions, extreme marine conditions and effects of climate change will be taken into consideration. In particular, dimensioning of the surface water management system will be based on frequency and severity of future storm events. Elevations and dimensioning of the marginal wharf and jetty will be based on extreme site-specific marine conditions that are

expected to result from climate change effects. No potential for adverse effects from seismic events have been identified due to the infrequent occurrence and limited magnitude of any such events in the region. In addition to Project features inherent to the design, the operation of Goldboro LNG will include routine inspection, monitoring, and maintenance. This will ensure that damage to any of the design features or operational aspects will be identified and corrected.

Cumulative Effects

The EA also assessed the potential for environmental effects from interactions of the Project with other existing, planned, and foreseeable future projects. In particular, the team investigated the Project's potential cumulative effects with the realignment of Route 316; the closure of the SOEI gas plant, other regional oil and gas developments; future industrial developments in the Goldboro Industrial Park; and provincial and national GHG emissions.

With the exception of GHG emissions, none of the potential residual cumulative effects are considered significant. Although currently not regulated in NS, GHG emissions have been identified as a concern in the context of provincial reduction targets. The EA therefore includes Pieridae's commitments to the development of strategies for GHG management and/or contributions to GHG offsets.

Monitoring and Follow Up

Pieridae has made monitoring and follow-up commitments related to the assessment of each identified VEC. The objectives of the monitoring and follow-up programs are to:

- supplement the existing environmental data base;
- assist in verifying effects predictions of the EA;
- confirm effectiveness of the mitigation measures proposed in the EA;
- determine the need for new mitigation strategies as required to address unanticipated adverse effects and/or ineffective mitigation; and
- ensure compliance with regulatory permits, approvals, and requirements.

The details of the monitoring programs (e.g., parameters, locations, frequency, reporting) will be determined in consultation with regulatory agencies and documented in the EMP/Environmental Protection Plan (EPP).

Assessment Summary and Conclusion

The construction, operation and decommissioning of the proposed Project will affect components of the bio-physical and the socio-economic environment. However, with the successful implementation of the identified mitigation measures (including off-sets) and follow-up activities it is expected that significant adverse effects are not likely to occur. The Project is predicted to have long-lasting and extensive beneficial effects on the local, regional and provincial economies and is strongly supported by the affected communities.