ENVIRONMENTAL ASSESSMENT (CLASS 2 UNDERTAKING)

Information Requests & Proponent Responses

Goldboro LNG Project

Natural Gas Liquefaction Plant & Marine Terminal

Pieridae Energy (Canada) Ltd.

JANUARY 2014

GOLDBORO LNG

ENVIRONMENTAL ASSESSMENT
(CLASS 2 UNDERTAKING)

INFORMATION REQUESTS AND PROPONENT RESPONSES

GOLDBORO LNG PROJECT
NATURAL GAS LIQUEFACTION PLANT AND
MARINE TERMINAL

Submitted to:
Nova Scotia Environment
Environmental Assessment Administrator
Environmental Assessment Branch
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ACRONYM AND UNIT LISTS

GOLDBORO LNG

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LIST OF ACRONYMS

ACCDC	Atlantic Canada Conservation Data Centre
AGRS	Acid Gas Removal System
AMO	abandoned mine opening
API	American Petroleum Institute
ARDA	Antigonish Regional Development Authority
ARIA	Archaeological Resources Impact Assessment
ARTM	Atlantic Road and Traffic Management
BFL	Boreal Felt Lichen
BLEVE	Boiling Liquid Expanding Vapour Explosion
BOG	Boil-off Gas
C-1	Commercial General (District 7 Land Use Bylaw)
C3MR	Propane (C3) pre-cooled mixed refrigerant (MR) process
CAC	Criteria Air Contaminants
CB&I	Chicago Bridge & Iron UK Ltd
CBA	Collaborative Benefits Agreement
CBC	Canadian Broadcasting Corporation
CC-1	Coastal Community (District 7 Land Use Bylaw)
CCME	Canadian Council of Ministers of the Environment
CD	Chart Datum
CDN	Canadian
CEA	Cumulative Effects Assessment
CEAA	*Canadian Environmental Assessment Act*
CEO	Chief Executive Officer
CEPA	*Canadian Environmental Protection Act*
CH_4	methane
CHB	Community Health Boards
CHS	Canadian Hydrographic Services
CLC	Community Liaison Committee
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COO	Chief Operating Officer
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	commercial, recreational, or Aboriginal
CSA	Canadian Standards Association
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
DHV	Design Hourly Volume
DWA	Deer Wintering Areas
EA	Environmental Assessment
EC	Environment Canada
ECM	Environmental Compliance Monitoring

EEM	Environmental Effects Monitoring
EHS	Emergency Health Service
ELC	Ecological Land Classification
EMP	Environmental Management Plan
EPP	Environmental Protection Plan
EPT	Ephemeroptera Plecoptera Trichoptera
ESD	Emergency Shutdown (ESD) System
FEED	Front End Engineering Design
FWAL	Freshwater Aquatic Life
GASHA	Guysborough Antigonish Strait Health Authority
GCHA	Guysborough County Heritage Association
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHGMP	Greenhouse Gas Management Plan
GPS	Global Positioning System
GSC	Geological Survey of Canada
H_2S	hydrogen sulphide
HADD	Harmful Alteration, Disruption or Destruction (of Fish / Fish Habitat)
HASP	Health and Safety Plan
HAZCON	Hazards in Construction
HAZID	Hazard Identification
HAZOP	Hazards and Operability Analysis (hazards analysis techniques for systems, hardware, and procedures)
HSE	Health, Safety and Environment
I-3	Industrial Resource (District 7 Land Use Bylaw)
ICSS	Integrated Control & Safety System
IMO	International Maritime Organization
ISO	International Standards Organization
Keltic Project	Keltic Petrochemicals and LNG Project
KMK	Kwilmu'kw Maw-klusuaqn
KO	Knock Out
LAN	Local Area Network
LNG	Liquefied Natural Gas
LOA	Length Overall (boat specification)
LP	Low Pressure
M&NP	Maritimes & Northeast Pipeline
MapleLNG	MapleLNG Limited
MBA	Maritimes Butterfly Atlas
MBBA	Maritime Breeding Bird Atlas
MBCA	*Migratory Birds Convention Act*
MCHE	Main Cryogenic Heat Exchange
MEKS	Mi'kmaq Ecological Knowledge Study
MODG	Municipality of the District of Guysborough

MOF	Marine Offloading Facility
MOU	Memorandum of Understanding
MR	mixed refrigerant
MSDS	Material Safety Data Sheet
N_2O	nitrous oxide
NAFO	Northwest Atlantic Fisheries Organization
NB	New Brunswick
NBCC	National Building Code of Canada
NFPA	National Fire Protection Association
NGL	Natural Gas Liquids
NGSWG	National General Status Working Group
NH_3	ammonia
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPRI	National Pollutant Release Inventory
NR-1	Natural Resources (District 7 Land Use Bylaw)
NS	Nova Scotia
NSDA	Nova Scotia Department of Agriculture
NSDAF	Nova Scotia Department of Aquaculture and Fisheries
NSDE	Nova Scotia Department of Energy
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Department of Environment
NSEA	*Nova Scotia Environment Act*
NSEL	Nova Scotia Department of Environment and Labour
NSESA	*Nova Scotia Endangered Species Act*
NSF	Nova Scotia Department of Finance
NSFA	Nova Scotia Federation of Agriculture
NSMNH	Nova Scotia Museum of Natural History
NSPI	Nova Scotia Power Inc.
NSTIR	Nova Scotia Department of Transportation and Infrastructure Renewal
NSUARB	Nova Scotia Utilities and Review Board
NSWA	*Nova Scotia Wildlife Act*
NWPA	*Navigable Waters Protection Act*
PDO	Property Damage Only
PEI	Prince Edward Island
PEL	Probable Effect Level
PIRI	Partners in RBCA (Risk-Based Corrective Action) Implementation (various countries; environmental program)
PM	Particulate Matter
PM_{10}	PM with aerodynamic diameter less than a nominal 10 micrometers
$PM_{2.5}$	PM with aerodynamic diameter less than a nominal 2.5 micrometers
POL	petroleum-oil-lubricant
RBCA	Atlantic Risk-based Corrective Action

RCMP	Royal Canadian Mounted Police
RMP	Risk Management Plan
ROW	Right-of-Way
SAR	Species at Risk
SARA	*Species at Risk Act*
SBMMP	Sulphide Bearing Materials Management Plan
SO_2	sulphur dioxide
SOCC	Species of Conservation Concern
SOEI	Sable Offshore Energy Inc.
SO_x	sulphur oxides
SQG	Sediment Quality Guidelines
TC	Transport Canada
TERMPOL	Technical Review Process of Marine Terminal Systems in Transhipment Sites
the Agency	Canadian Environmental Assessment Agency
the Project	Goldboro LNG Project
the Proponent	Pieridae Energy (Canada) Ltd.
TOR	Terms of Reference
TSP	total suspended particulates
TSS	total suspended sediments
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VEC	Valued Environmental Component
VHF	very high frequency
VOC	Volatile Organic Compound
WHMIS	Workplace Hazardous Materials Information System
WHO	World Health Organization
WL	wetland
WNS	White Nose Syndrome

LIST OF UNITS

%	percent
µg/kg	micrograms per kilogram
µg/L	micrograms per litre
µg/m^3	micrograms per cubic metre
µS/cm	microseimens per centimetre
µS/m	microseimens per metre
barg	bar gauge
cm	centimetre
dB	decibels
dB (LA_{max})	decibels (Maximum Sound Level)
dB (L_{eq})	decibels (Equivalent Sound Level)
dB re 1 µPa	decibel micropascals
dB(A)	decibels (A-Weighted)
dB(Lin)	decibels (Unweighted)
dbh	diameter breast height
g/s	grams per second
ha	hectare
kg	kilogram
km	kilometre
km/h	kilometres per hour
km^2	square kilometre
kVA	kiloVolts-amps
kW	kilowatt
kW/ m^2	kilowatt per square metre
L	litre
L/d	litres/day
Ldn	Day-night level
LPM	litres per minute
m	metre
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/d	cubic metres per day
m^3/h	cubic metres per hour
mbar (g)	millibars (gauge)
Mcf/d	million cubic feet per day
mg/kg	milligrams per kilogram
mg/L	milligram per litre
mg/m^3	milligrams per cubic metre
mg/m^3 (n)	milligrams per cubic metre (normal)
mg/Nm^3	milligrams per (normal) cubic metres
MJ/m^3 (s)	megajoules per cubic metre (standard)
mm	millimetre
MMscf	million standard cubic feet
mol%	mol percent
Mt	million tonnes
Mtpa	million tonnes per annum

MW	megawatt
NCU	Nephelometric Turbidity Units
ng/L	nanograms per litre
ºC	degrees Celsius
ppb	parts per billion
ppm	parts per million
ppmv	parts per million (volumetric)
ppt	parts per thousand
RPM	revolutions per minute
scf	standard cubic feet
t	tonne (metric ton)
t/d	tonnes per day
t/y	tonnes per year
V	volt
vol%	volume percent
vpd	vehicles per day

SECTION 1.0
INTRODUCTION

GOLDBORO LNG

1.0 INTRODUCTION

Project and Proponent

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.

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.

Pieridae prepared an Environmental Assessment (EA) report for the Goldboro LNG Project to fulfill obligations pursuant to the NS Environmental Assessment Regulations for a Class II undertaking. The EA report was submitted to Nova Scotia Environment (NSE) on September 23, 2013.

Environmental Assessment, Review Panel, Minister Decision

On October 20th, 2013, the Minister of the Environment referred the EA report to an EA Review Panel for review, in accordance with Part IV of the *Environment Act* and Section 24(2) of the EA Regulations. The EA Panel posted the EA report on the NSE website, made hard copies available in various locations, and invited the public to submit written comments up to December 16th, 2013.

On December 19th, 2013 the EA Review Panel notified the public that it had decided that a public hearing would not be required:

> *"The Panel has considered all of the information available to date. This includes all of the previous environmental assessment (EA) reports and data carried out at Goldboro, and associated public comments, public hearing record, and the EA Board panel report to the Minister in 2007. The previous proposal at Goldboro was very similar in nature and location to the current Goldboro proposal. The Panel has also examined the Goldboro EA report, and considered all public and government comments on the EA report received during the recent public*

> *comment period. The Panel finds that the information base from the previous review remains relevant to the Goldboro proposal. Few new issues have been raised, and the majority of the public have expressed support for the Goldboro proposal. The Panel has thus decided that no public hearings will be required for the Goldboro proposal." (NSE, Notice of 19th December 2013)*

The EA Review Panel requested that Pieridae addresses by January 10th, 2014, questions and comments raised by the public, government agencies, First Nations, and Panel members during the comment period that ended on December 16th, 2013. On January 8th, the Review Panel published another notice stating that a second period for written public comments has commenced and that comments would be accepted until January 24th, 2014. Following the second public comment period, the Panel will prepare its report and recommendations to the Minister of the Environment.

Pursuant to the Environmental Assessment Review Panel Regulations, the Minister of Environment is required to make a decision on the proposed project within 21 days following receipt of the Panel report and recommendations.

Information Requests and Proponent Responses

The EA Review Panel forwarded Pieridae all comments it received during the comment period that ended on December 16th, 2013. These comments, referred to as Information Requests (IRs), are presented in this IR Response Document together with Pieridae's responses. It is of note, all IRs have been re-formatted for the purpose of this report. The original text, however, has been reproduced verbatim to accurately reflect the initial submission.

The IRs were given a unique IR number and grouped into submissions from:

- The EA Review Panel;
- Government Organizations;
- Non-Government Organizations; and
- Concerned Citizens.

The IR Response Document has been organized in corresponding sections. In these sections the complete individual IRs are presented, each followed immediately by Pieridae's response. In some instances additional information is provided in an appendix. All appendices are presented at the end of the Document.

An electronic version of the IR Response Document is available for downloading on the Project website (www.GoldboroLNG.com). This site also provides access to Pieridae's Environmental Assessment Report including all of its appendices. Alternatively, the reader can access the EA Report and the IR Response Document via the website of Nova Scotia Environment: http://www.novascotia.ca/nse/ea/goldboro-lng.asp.

SECTION 2.0

ENVIRONMENTAL ASSESSMENT REVIEW PANEL (EARP)

GOLDBORO LNG

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 2
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 1

Preamble:

Natural Gas Supply

Request:

There are references to North American supplies of natural gas which will provide gas to this project. Can the Pieridae provide any details on these expected sources, and locations? The project evidently requires reversal of gas flow in the Maritimes & Northeast Pipeline (M&NP). Does Pieridae have an agreement with M&NP to do this? What would be the impact on present customers in Nova Scotia such as Heritage Gas or other distributors? Is the project likely to increase pressure or demand for hydrological fracturing activity within Nova Scotia or elsewhere to provide gas supplies to the project?

Response:

The Project plans to initially supply natural gas to the facility through a number of supply sources:

- Offshore Nova Scotia;
- Onshore New Brunswick; and
- North East United States through the M&NP system.

The final mix of supply volumes from the individual sources is not currently completed. Each of these sources requires commercial negotiations with counter parties that have ownership and control of the reserves and facilities. We would expect these commercial arrangements to be completed by the time the Project reaches its final investment decision in 2015. We currently forecast that about one-half of the gas would come from Atlantic Canada and one-half would come from the United States, but this is all subject to negotiations.

Pieridae has not yet entered into any transportation agreement with M&NP. These transportation agreements can only be finalized once the gas sources have been contracted for. M&NP's transportation agreements are subject to National Energy Board regulation in Canada and the Federal Energy Regulatory Commission in the US. The M&NP pipeline system was originally designed to be bidirectional, so reversing the pipeline flow does not pose any new circumstances.

Present natural gas customers in Nova Scotia pay the ongoing market price for natural gas. This situation would not change with the operation of this Project. Gas prices for Atlantic Canada are set by the large gas markets in the North East US. This will continue whether the Goldboro LNG Project proceeds or not.

Offshore Nova Scotia gas reserves are not shale or tight sand and as such do not require hydraulic fracturing. Goldboro LNG is unaware of any current plans for the development of natural gas for onshore Nova Scotia in sufficient quantities. The Project does not expect to use on shore gas from Nova Scotia in the near term. Onshore reserves in Atlantic Canada and the North East US are of the shale or tight sand type, which do require hydraulic fracturing. Gas reserves in the North East US would be developed with or without the Goldboro LNG Project. Gas reserves in New Brunswick are at a significant economic disadvantage when compared to gas reserves in the North East US and would probably have little development without an ability to move the gas offshore to higher priced markets.

Preamble:

Reference: p. iv, v, xi, 3-10, 3-20, 3-24, 3-39, etc. (Sewage and Wastewater Treatment Facility)

Request:

There are many references to the on-site sewage/wastewater treatment facility, but no details. What treatment process will be used, and what treatment level will be provided Please specify the discharge parameters and limits, and expected effluent characteristics. There is a commitment on p. xi to monitoring of effluent quality which does not appear to be reflected in Section 12.

Response:

Specific effluent discharge characteristics and limits will be generated during FEED. The proponent's commitment to monitoring of effluent quality during operation is stated in Table 10.3-4 (Monitoring of discharge quality). This should have also been included in the summary table provided in Section 12. The details of the monitoring programs (parameters, frequency, reporting etc.) will be established as part of Pieridae's permit application pursuant to Part V of the *NS Environment Act.* Similarly, the details of the sewage / wastewater treatment facility and treatment processes will also be subject to the NSE permitting and approval process. At this point, the following further information on the sewage/waste water treatment plant design can be provided:

<u>Wastewater Streams</u>

In a first step all wastewater streams will be identified and classified so that drainage design and appropriate treatment method(s) can be defined. Classifications and definitions of wastewater streams may include the following:

- Onsite Uncontaminated Runoff (OUR) - runoff from areas where surface rainwater cannot be contaminated by hydrocarbons or chemicals.
- Offsite Intercepted Runoff (OIR) - runoff from areas where surface rainwater run-off flows may be intercepted outside of the plant boundaries
- Potentially Contaminated Water (PCW) - surface water from areas not designated as continuously contaminated which normally meets the required specification but on occasions can be contaminated through non-routine activities, eg. maintenance.
- Considered Contaminated Water (CCW) - effluent that contains significant percentage of hydrocarbons that do not meet the required water effluent specifications – including certain drainage streams (washdown water, and

drainage from process areas subject to leaks and spills during normal operations).

- Domestic Sewage Effluent (DSE) – effluent derived from domestic sources, typically containing a significant BOD/COD load.
- Process Water (PW) – effluent derived from process sources.
- Chemical drains – spills and contaminated water shall be contained locally for off-site treatment.

Wastewater treatment facility components

Typical constituents of the wastewater treatment facilities would be:

- Drainage Collection System including collection of the different streams mentioned above. Contaminated water streams will be segregated from non-contaminated streams as far as possible. The potentially contaminated collection will be site wide with contaminated collection focused in areas surrounding specific equipment.
- Sediment Ponds. According to local conditions and regulations, sediment ponds may be established to capture silt and surface oil. These ponds may be installed during construction to control runoff from erosion following site clearance.
- Process Effluent Treatment Plant (ETP). Specific components will be defined during FEED. Potential treatment options/components include:
  - CCW Collection Tank for Oily Stormwater Buffering;
  - Produced Water Buffer Tank and Off Spec Tank;
  - Produced Water CPI Separator;
  - Produced Water Cooling and pH Correction;
  - BTEX Removal;
  - Oily Water Treatment by Dissolved Air Flotation;
  - Equalisation Tanks for Biotreatment Contaminant Buffering;
  - Conventional Activated Sludge Biological Treatment;
  - Biosludge Storage & Disposal;
  - Treated Effluent Inspection & Monitoring; and
  - Steam Condensate Blowdown Monitoring & Treatment.

- Sanitary Wastewater Treatment Plant (STP). Various potential treatment options/components exist for the STP and will be defined during FEED:
  - Sewage Balancing Tank for Diurnal Flow Buffering & 48hrs Storage;
  - Sequencing Batch Bioreactors;
  - Transfer Sumps & Pumps;
  - Enhanced Nutrient Removal;
  - Sand Filtration for Enhanced TSS & Phosphate Removal;
  - Sanitary Biosludge Storage Tank & Disposal; and
  - Treated Sanitary WW Tank for Water Reuse & Final Discharge.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 3

Preamble:

Reference: p. xii (Executive Summary)

Request:

Will the proposed project be expected to provide any gas royalties to the Nova Scotia Government, in addition to other economic benefits mentioned in the EA report?

Response:

The LNG project itself is not expected to add any additional revenues other than through the existing tax structure. Should the company develop resources in the Province, then we would expect to be in a position to pay royalties on resources that originated in Nova Scotia.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 4

Preamble:

Reference: p. xiii (Executive Summary)

Request:

How will offsite habitat creation ensure that "wetland functions are re-established" on the construction site? This seems contradictory.

Response:

The Nova Scotia Wetland Conservation Policy (Nova Scotia Department of the Environment, 2011) strives for “no net loss” of wetland function. This is accomplished primarily by replacing wetland habitat lost due to development with similar wetland habitat elsewhere (ideally in close proximity to the developed area such that compensation is achieved in the same watershed). In terms of the proposed undertaking, off – site wetland creation will serve to meet this policy goal by replacing the wetland functions lost due to Project activities. This statement was not meant to imply that the Pieridae will attempt to create new wetland habitat on the construction site. A wetland compensation plan will be developed in close consultation with Nova Scotia Department of Environment during the permitting phase of the Project. This will ensure target functions provided by existing wetlands are replaced by the new wetlands created off-site.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 5

Preamble:

Reference: p. 1-2 (Name, Address, and Identification of the Proponent)

Request:

If Pieridae sells some or all of the project to subsequent parties, will Pieridae remain legally responsible for all commitments and follow-up actions specified in this report throughout the life of the project? If not, what legal mechanisms will ensure responsibility and accountability?

Response:

If, as we hope, an approval is issued under Part IV of the *Environment Act* (Nova Scotia) in relation to the Goldboro LNG Project (the "Project"), that environmental approval will ultimately be issued to, and will be held by, Pieridae Energy (Canada) Ltd. in its capacity as the general partner of Goldboro LNG Limited Partnership and therefore Pieridae Energy (Canada) Ltd. will assume responsibility for all of the legally binding commitments and follow-up actions which are specified in the Environmental Assessment Report or which otherwise arise as a consequence of the environmental review process or the issuance of the environmental approval.

As the environmental approval is integral to the Project, no person would acquire the Project without also acquiring the environmental approval. However, Pieridae Energy (Canada) Ltd. is prohibited by subsection 59(1) of the *Environment Act* (Nova Scotia) from transferring the environmental approval to any person without the written consent of the Minister and the Minister is permitted by subsection 59(3) of the *Environment Act* (Nova Scotia) to impose any terms and conditions that the Minister considers appropriate in respect of such proposed transfer. Under these circumstances it can reasonably be assumed that the Minister would not exercise his (or her) discretion to consent to any proposed transfer by Pieridae Energy (Canada) Ltd. of the environmental approval to any person without satisfying himself (or herself) that the transferee will not only assume full responsibility and accountability for all of the related legally binding environmental commitments but also that the transferee has the financial means to fulfill all of those responsibilities to the Minister's full satisfaction.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 6

Preamble:

Reference: p. 1-4 (Project Schedule)

Request:

Can Pieridae specify gas sources to be used? Are any sources anticipated to be from onshore gas development in Nova Scotia?

Response:

The Project plans to initially supply natural gas to the facility through a number supply sources:

- Offshore Nova Scotia;
- Onshore New Brunswick; and
- North East United States through the M&NP system.

The final mix of supply volumes from the individual sources is not currently completed. Each of these sources requires commercial negotiations with counter parties that have ownership and control of the reserves and facilities. The Project expects that about one-half of the gas would come from Atlantic Canada and one-half would come from the United States, but this is all subject to negotiations.

The Project does not expect to receive any gas from onshore Nova Scotia gas production.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 7

Preamble:

Reference: p. 1-8; Figure 1.7-2 (LNG Facility Overview)

Request:

Will the proposed wharves, docks and/or jettys impact tidal circulation within Isaac's Harbour?

Response:

Not to an appreciable extent, because the marginal wharf structure is designed to minimize its footprint in the water and the jetty will be constructed with monopiles, which will permit tidal flows through the jetty pile structure.

During FEED a bathymetric survey will be conducted and currents will be monitored to provide detailed site-specific information for design and operational purposes. This monitoring will continue during operations to verify effect predictions.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 2
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 9

Preamble:

Reference: p. 3-23, 3-24 & 9-24 (Construction Water Supply)

Request:

What are the anticipated downstream effects of water withdrawal from Meadow Lake? The volumes are defined later in the report, but downstream impacts do not seem to be addressed in any detail. In addition, it is unclear why the most potential direct impacts to the Meadow Lake (eg. water withdrawal), is not included in Table 9.2-3.

Response:

The absence of Meadow Lake in Table 9.2-3 is an oversight. There is currently recreational fishing and perhaps other recreation by local residents in Meadow Lake. There are no current water use licenses issued by the province for Meadow Lake or Isaac's Harbour River, and no crown land leases for Meadow Lake; therefore, there are no identified users of surface water. Downstream concerns are entirely restricted to flow maintenance for fish habitat and fish passage. The potential impacts on maintenance flow and water levels in Meadow Lake are described in Section 10.3.2 (Surface Water). The major conclusion is that proposed water withdrawal volumes are so small relative to natural flow and flow variation, that the potential impacts are negligible. Following is a brief summary of the assessment.

Flow characteristics for the Isaac's Harbour River watershed were developed for the Keltic project in a detailed hydrological model and field measurement program (a report copy is appended – see appendices to this response document). This was used as the starting point for the Goldboro LNG assessment (Section 9.2.2). In general, the proposed withdrawal is a tiny fraction of low flow conditions in the river, at only 1.2% of the lowest monthly average, and only 0.23% of the mean annual flow. The lowest average monthly base flow is about equal to one lake volume, so in theory the maximum lake draw down would be 2.4 cm (1.2% of average depth – 2 m). In reality, this will be much smaller, since the rate at which the lake continues to fill up will likely increase slightly in response to the draw down. In other months the flow-through is 4 to 10 times the volume of the lake, and will recharge far faster than the intake system can withdraw water. Therefore, the water withdrawal will have a negligible effect on lake water levels annually. Overall, the effect on water level in the lake will not be large enough or long enough to cause changes in shoreline habitat including wetlands (ie., the change in water level will be much smaller than natural fluctuations).

A provincial water withdrawal permit will be required, as the Project demand (600 m^3/d) is well over the 23 m^3/d specified in the *Activities Designation Regulations* (Division I). Since no other water users were identified at Meadow Lake or downstream, water allocation is not an issue. The water withdrawal permit application will require

calculation of sustainable yield using flow-duration curves, in order to demonstrate that the proposed Project withdrawal is acceptable. Fisheries maintenance flow requirements would then be coordinated with DFO, when precise FEED level water demands are known. The predicted 1.2% reduction in lowest average monthly base flow will likely be far below the total withdrawal allowance based on the sustainability curve.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 10

Preamble:

Reference: p. 3-23 (Construction Wastewater Management)

Request:
There is reference to trucking of wastewater to an "approved facility" during site preparation. What facility is that, and is there an agreement in place with this facility to accept the wastewater?

Response:

The facility (or several facilities) will be identified and agreements established during the next phase of the Project when quantities and schedules for any such requirements are better understood. There are several municipal wastewater treatment systems operating in the general area including those in Guysborough, Mulgrave, Sherbrook, Canso and Little Dover. No private sector treatment facilities have been identified yet. Criteria in the decision making process as to which facility will be used depends on a number of factors such as the operator's acceptance, facility operation licence, facility capability and capacity, and haul distance.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tony Blouin – EA Review Panel Chair Nova Scotia Environment	IR # EARP 11

Preamble:

Reference: p. 3-29, 3-30, 3-33 & 3-39 (Hazardous Waste Disposal)

Request:

Can the proponent provide more detail on methods and locations for mercury, benzene, wet flare and hazardous wastes disposal?

Response:

Mercury – the source of mercury for disposal will be the mercury removal filters. These will typically be replaced by the vendor who will take the contaminated filters offsite for safe mercury disposal.

Benzene – Any VOCs from the condensate systems will be dealt with through the condensate venting system. Depending on the BTEX levels this may either be via flare or vent. Should BTEX levels be sufficiently high, an incinerator may be considered.

Wet flare – The wet flare package will be located according to studies into radiation and dispersal from an unignited release. The package, including stack, tip and ignition system will be designed by a vendor.

Hazardous waste – a contractor will be found to remove the hazardous wastes from site and safely dispose of them.

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Preamble:

Reference: p. 3-45 (Maneuvering Basin)

Request:

It is stated that no wave or current data is available for the project location. Is a study required to provide baseline data? It also seems that a bathymetric survey is required.

Response:

Pieridae is in the process of finalizing work plans for a series of studies for the marine environment and intends to commence with the work in early 2014. Key study topics include bathymetry and met-ocean conditions (including currents, wave climate, and wind). The studies are required for the detailing of design and operation plans (including vessel navigation/manoeuvring). Some aspects of the work are also prepared as input to the TERMPOL review process with Transport Canada for which a first meeting is scheduled for mid January 2014.

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Preamble:

Reference: p. 3-56 (Emissions, Discharges and Waste)

Request:

Can Pieridae provide more clarity on the on-site wastewater treatment facility? There is a reference to "partial" treatment and off-site disposal. This would seem to conflict with prior descriptions of on-site wastewater treatment (pgs. 3-10, and 3-39)

Response:

This reference is an error in the EA Report. In Table 3.5-1, the descriptions of wastewater treatment during construction and operation are reversed.

As stated in the other sections of the report, domestic wastewater produced during the early stages of construction, prior to the completion of the on-site wastewater treatment facility, will be partially treated by mobile units and removed off-site for disposal at an approved facility. When the on-site wastewater treatment facility becomes operational, all wastewater will be treated to comply with regulatory requirements and released into the harbour.

Preamble:

Reference: p. 3-74 (Local Spending)

Request:

There is mention of local spending and community services which might be provided, but no commitments. What commitments are being made if any?

Response:

Pieridae is committed to maximizing the Project's benefits to the local community. As such, Pieridae is making the following commitments:

- Procurement policy for goods and services that prefers local suppliers;
- Coordination and early communication with business communities, labour unions, Chambers of Commerce and regional development agencies to enable local businesses to prepare for and bid on tenders for Project components;
- Continuation of regular Community Liaison Committee (CLC) meetings to ensure local benefits are being realized. The CLC is meant to address not only environmental issues but also those related to economic development, local business and employment opportunities, and how to maximize the Project's benefits for the local community. If considered beneficial, one or more public meetings will also be organized, tailored to the needs and interests of local / regional contractors.
- Development and implementation of a Collaborative Benefits Agreement with Aboriginal communities to ensure provision of training and employment opportunities (this commitment has already been firmly established in a signed MOU between Pieridae and the Assembly of NS Chiefs (through KMK)).

It is of note that Pieridae is already making a concerted effort to identify local suppliers for the procurement of required goods and services. Pieridae is currently using the Goldboro LNG Project website to communicate Project schedules and to generate a roster of potential suppliers. The site also allows contractors to enter their contact information and specific business interests. As part of the Project's procurement policy, all bids will be judged on their economic merit first but otherwise local bidders will be given preference.

With respect to employment of the local workforce, Pieridae is now in the process of identifying the skill sets required and will coordinate and consult with local and regional educational institutions to ensure that the employment opportunities presented by the Project will be known and brought to the attention of students for consideration in the

development of curricula and career choices. Similar to the procurement of goods and services, job applications will be evaluated based on skills and experience and a preference for local applicants.

Pieridae Energy will seek to maximize the impact of community investment, not only for contractors and employees, but for the community as a whole. Support through monetary donations have already been provided to groups including the Isaac's Harbour Community Centre, St. Mary's Minor Hockey, Sherbrook Village, and the Erinville Fishing Derby. Regular business also takes place with both the Guysborough Journal in the form of advertising and the rental of the Isaac's Harbour Community Centre for Open Houses and meetings.

Once the final investment decision is made, a community relations plan will be developed in partnership with the Community Liaison Committee. All donations, sponsorship and partnership decisions will be made to benefit the greatest number of citizens and the communities.

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Preamble:

Reference: p. 4-7; Table 4.1-2 (Guidelines, Policies and Codes)

Request:

The federal Wastewater Systems Effluent Regulations (2013) may apply to wastewater treatment for the project, but are not mentioned.

There is no mention of the Canadian Council of Ministers of the Environment (CCME) Canada-wide Strategy for Municipal Wastewater Effluent. While this project is not municipal in nature, it does serve a large residential camp, and the Strategy may apply.

Response:

Ultimately, NSE will establish the effluent standards applicable to the Project's wastewater treatment system during the application process for approval under Part V of the *Environment Act* and the *Nova Scotia Activities Designation Regulations.* It is expected that both standards will need to be met, i.e., the *Wastewater Systems Effluent Regulations* and the CCME *Canada-wide Strategy for the Management of Municipal Wastewater Effluent.* It is of note that another federal regulation is anticipated to apply, the *Wastewater System Effluent Regulations* (WSER) which were recently established under the *Fisheries Act*.

Preamble:

Reference: p. 5-1 (Need for and Purpose of the Project)

Request:

What will be the balance of off-shore vs on-shore gas supply for the project? The project clearly requires reversal of gas flow in the M&NP. What will be the impact on gas consumers in Nova Scotia?

Response:

Balance of offshore vs onshore gas supply

The Project plans to initially supply natural gas to the facility through a number supply sources:

- Offshore Nova Scotia;
- Onshore New Brunswick; and
- North East United States through the M&NP system.

The final mix of supply volumes from the individual sources has not yet been determined. Each of these sources requires commercial negotiations with counter parties that have ownership and control of the reserves and facilities. We would expect these commercial arrangements to be completed by the time the Project reaches its final investment decision in 2015. We currently forecast that about one-half of the gas would come from Atlantic Canada and one-half would come from the United States, but this is all subject to negotiations.

Reversal of gas flow in the M&NP system and its impact on gas consumers in Nova Scotia

The report entitled *"The Future of Natural Gas Supply for Nova Scotia"* produced by ICF Consulting Canada, for the Government of Nova Scotia in March 2013 provides the best direct assessment on the natural gas supply-demand situation in Nova Scotia and Atlantic Canada generally. The conclusions of the report include:

- The technological developments that made possible large volumes of shale gas extraction in North America have created both benefits and challenges for Maritimes Canada.

- The shale gas supplies have lowered prevailing natural gas prices relative to recent history. ICF believes gas prices will remain in the $4 to $6 per MMBtu range and that this means economic gas supplies for Maritimes Canada for the foreseeable future.
- "*Much of the reason for the limited development of Maritimes Canada gas resources has been the growth in U.S. shale gas production, and more specifically the growth in the Marcellus Shale, which have lower exploration and production costs than the offshore resource. The rapid growth of shale gas production helped to reduce gas prices throughout North America and have resulted in lower prevailing prices in the Northeast and Maritimes Canada. While gas prices are already showing signs of firming, they are not expected to return to pre-recession levels which were much higher. The relatively low cost of developing Lower-48 shale gas makes additional development of Maritimes Canada's gas resources less likely, as is presented in ICF's Base Case. New England, which is currently the largest market into which Maritimes Canada gas is sold, is increasingly looking to the Marcellus Shale to fill its needs for natural gas*."
- In almost all scenarios examined, Maritimes Canada is dependent on some amount of imported US supplies to meet regional demand.
- A north-bound flow on M&NP, acquiring incremental supplies from the US offers the lowest cost option for serving Maritimes Canada.
- Reversing M&NP to deliver gas into Maritimes Canada is feasible and except for the high demand cases, probably lowest cost. But reversing M&NP is not the issue; securing additional supplies into US Northeast that can reach M&NP [through pipeline inter connections] is the challenge.
- Given the need for external supply, ICF believes there is a strong argument for Maritimes Canada consumers to contract for firm pipeline capacity on one of the proposed pipeline expansions into US Northeast that would allow shippers to buy gas at one of the Marcellus basin market hubs to an interconnection with M&NP.
- Maritimes Canada shippers themselves are unlikely to be able support an entire pipeline expansion (in the US to connect to M&NP) and would have to partner with other counterparties (such as the Goldboro LNG project).

In summary, consumers in Nova Scotia are currently linked to the North American gas market through the M&NP system. The price of the natural gas supplied to Nova Scotia is determined by the functioning of the North American natural gas market as reflected at the relevant local gas market hubs. In the case of Nova Scotia, these gas prices are linked to the North East United States gas hubs in and around Boston/New York. This price link will remain unchanged with the operation of the Goldboro LNG project. Nova Scotia does see significant price volatility in winter related to its price link to the North East United States. Some of this volatility will be reduced over the coming years as new

pipeline projects in the North East United States reduce pipeline restrictions to the M&NP system.

One advantage that the Goldboro LNG project will bring to the overall cost of natural gas in Nova Scotia and New Brunswick is that by increasing the amount of gas moved on the M&NP system, the average unit cost of transportation will be reduced.

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Preamble:

Reference: p. 6-1 (A Description of Alternatives to the Project)

Request:

Conservation of gas for future use is not mentioned as a benefit of the "do nothing" option. Should a sustainable approach to resource management not require consideration of conservation for future use?

Response:

Resource management is a societal/political decision of the provinces. Goldboro LNG cannot provide an opinion on what constitutes a “sustainable approach to resource management”. Goldboro will operate within the parameters set by government agencies for the development or non-development of natural gas reserves in Nova Scotia and the rest of Atlantic Canada.

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Preamble:

Reference: p. 10-101 & 10-116 (Fishery and Marine Habitat Compensation)

Request:

There is mention of possible enhancements in aquatic habitat for Crusher Brook and Betty's Cove Brook, but no commitment. What commitment is being made, if any? In addition, there is mention of support for native fisheries. What commitment is being made, if any? Furthermore, there is mention of marine habitat compensation. What commitment is being made, if any?

Response:

The requirement to offset impacts to both freshwater and marine habitats is federally regulated under the *Fisheries Act*. A comprehensive Habitat Compensation Plan (HCP) will be developed as a component of a *Fisheries Act* authorization required for the Project to proceed. The development of the HCP will include input from stakeholders, First Nations and regulatory bodies.

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Preamble:

Reference: p. 10-150 (Maximizing Project Benefits)

Request:

There is mention of local benefits, but no commitment. What commitment is being made, if any?

Response:

Commitments to ensure and maximize local economic benefits are listed in Table 10.13-5 and include:

- procurement policy for goods and services that prefers local suppliers;
- coordination and early communication with business communities, labour unions, Chambers of Commerce and regional development agencies to enable local businesses to prepare for and bid on tenders for Project components; and
- development and implementation of a Collaborative Benefits Agreement with Aboriginal communities to ensure provision of training and employment opportunities (this commitment has already been firmly established in a signed MOU between Pieridae and the Assembly of NS Chiefs (through KMK)).

Pieridae also considers its commitment to the continuation of regular Community Liaison Committee (CLC) meetings as directly relevant to ensuring local benefits are being realized. The CLC is meant to address not only environmental issue but also those related to economic local business and employment opportunities, and how to maximize the Project's benefits for the local community. If considered beneficial, one or more public meetings will also be organized, tailored to the needs and interests of local / regional contractors.

Beyond that Pieridae is committed to environmental stewardship and active support for local communities. As a testimony to that commitment, to date Pieridae has provided financial support to numerous groups and organizations from various communities in the region. This includes contributions to such organizations and events as the Isaac's Harbour Community Centre, St. Mary's Minor Hockey, Sherbrook Village, and the Erinville Fishing Derby. Regular business also takes place with both the Guysborough Journal in the form of advertising and the rental of the Isaac's Harbour Community Centre for Open Houses and meetings.

Once the final investment decision is made, a community relations plan will be developed in partnership with the Community Liaison Committee. All donations, sponsorship and partnership decisions will be made to benefit the greatest number of citizens and communities.

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Preamble:

Reference: p. 10-186; Table 10.15-3 (Residual Environmental Effects Summary for Transportation)

Request:

There is mention of road upgrades by the municipality. Has the municipality made this commitment in writing, and if so could that be made available to the public?

Response:

MODG has not yet provided a written commitment pertaining to road upgrades.

Pieridae will determine the Project's road transportation requirements during FEED. This will include a specification of the type, number, and weight of trucks and loads to be hauled. This will also determine the requirements for oversize/overweight loads should such loads not all be shipped to the site by barge. Once the specific information has been established Pieridae will consult with NSTIR and local and regional municipalities on the required upgrades and the implementation of these upgrades to the existing transportation infrastructure.

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Preamble:

Reference: p. 13-5 (Open House Sessions)

Request:

Could the proponent confirm that in fact there was no negative feedback from the public received at all at Pieridae's open house sessions, regarding the proposed project?

Response:

Pieridae's representatives indeed received no negative feedback from any of the participants at the three public meetings held in Goldboro, i.e., none of the participants verbalized an explicit opposition to the Project. Participants did express an interest in the proposed management of potential effects and specifics of the construction phase and the operation. However, the majority of questions received related to the Project schedule (approval time, start of construction, start of operation) and business opportunities associated with the proposal (i.e., How can I / my business become involved?). Numerous participants simply expressed their support for the Project and the hope that the Project will be implemented as Guysborough County has seen several large development proposals come and go.

Preamble:

Reference: p. 13-8 (Community Liaison Committee)

Request:

What is the membership of the Community Liaison Committee (CLC)? Who are the invited interested parties mentioned on p. 13-8?

Response:

Public announcements for the Goldboro LNG CLC committee were made in the Guysborough Journal, and through the Goldboro LNG Newsletter. Anyone interested could submit their name to be part of the committee.

Sixteen nominations were received and eight people were chosen to represent surrounding communities and special interest organizations. If there were multiple nominations for an identified community or special interest group, the CLC member was selected through a random draw. Those who were not chosen will be informed if a position becomes available.

An invitation was extended to First Nations Communities, and discussions were held with First Nations leaders. Unfortunately, no First Nations individuals put their name forward to be a member of the CLC.

Together with representatives from Pieridae Energy and NATIONAL Public Relations, the Goldboro LNG CLC committee held its first meeting on September 10, 2013 at the Goldboro Interpretive Centre.

Community Liaison Committee Members

Donna Hochman	Antigonish Guysborough Black Development Association Employment Resource Center
Frank Fougere	Isaac's Harbour
Janice Langille	Seal Harbour/Drumhead
John Peitzsche	Goldboro
Rickey MacLaren	Municipality of the District of Guysborough - Councilor District #7
Robert Walsh	Country Harbour
Jason Langley	Community Fisheries
Gordon MacDonald	Municipality of the District of Guysborough – Director of Economic Development
Mark Brown	Pieridae Energy
Bonnie Sheppard	Pieridae Energy
Sean Lewis/Sarah Simpson	NATIONAL Public Relations

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Preamble:

Reference: Nova Scotia Transportation and Infrastructure Renewal (NSTIR) comment letter dated Dec. 16, 2013

Request:

NSTIR indicated in their Dec. 16, 2013 letter regarding the Goldboro EA report that "Presently, the proposed Rte 316 realignment is only at its very early pre-planning stages. As part of this process, this will require extensive collection of data, an extensive consultation process with stakeholders and selection of a proposed alignment. Depending on what alignment is chosen, there is a good possibility that the proposed road may require another EA. Once the alignment has been finalized, the highway would still need to undergo detailed design. This entire process typically takes 18 months to 2 years with construction another 24 months."

Given route 316 realignment is crucial to the Goldboro project, will the route realignment timeline (of approximately four years) affect viability of the Goldboro project?

Response:

The road realignment is a critical aspect of the Project. If the road realignment schedule interferes with the Project's construction schedule, it may result in a postponement or cancellation of the Project. This would be determined as part of the Final Investment Decision expected in 2015 and largely depend on the willingness of Pieridae's customers to wait beyond the 2020 proposed drop dead date for delivery of the LNG.

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Preamble:

Reference: p. 1-5 & 1-6 (Site Overview)

Request:

The Archaeological Resource Impact Study does not appear to have considered First Nations archaeology. Are First Nation archaeological issues being treated in a separate program?

Response:

The preliminary desktop review for the Project area was conducted in 2004. It was reported at that time that there were three locations in the vicinity of the Project area where "Mi'kmaq encampments" may have been situated: Schoolhouse Brook, the head of the harbour on Isaac's Harbour River, and possibly at Webb's Cove (DAC 2004:1). It is unclear why a potential encampment at Schoolhouse Brook was mentioned in the 2004 studies as there does not appear to be a "Schoolhouse Brook" in the vicinity of the Project area. However, both the head of the harbour on Isaac's Harbour River and Webb's Cove are located outside of the Project area. The head of the harbour on Isaac's Harbour River is located approximately five kilometres northwest of the principal Project area (where Isaac's Harbour River empties into Isaac's Harbour) and Webb's Cove is located approximately 150 metres northwest of the Project impact area.

Visual surveys were also conducted in 2004 and 2007 (DAC 2004, DAC 2007a, DAC 2007b) of the entire Project area including areas with elevated potential for Native archaeological resources, such as shorelines. In addition, subsurface testing programs were conducted in areas deemed to have high potential for archaeological resources within the study area. No Native archaeological resources were identified during the course of these field studies.

The Mi'kmaq Ecological Knowledge (MEK) Study updated for the Goldboro LNG Project (EA Report, Appendix L) found several references to burial sites within Guysborough County, but no archival reference or archaeological evidence of Aboriginal burials or occupation was identified for the Project footprint.

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Preamble:

Reference: p. 3-6 & 3-7 (Marginal Wharf and Causeway)

Request:

Should combi-wall technology also be used on the south side of the Pond 6 sand bar to restrict possible extrusion (remobilization) of contaminated pond sediments that might underlie the sand bar (or will revetments be satisfactory)?

Should borings of the Pond 6 sand bar be carried out during the preconstruction phase to confirm the nature of underlying sediments (refers to: “further studies will be carried out based on geotechnical information to determine the optimum location and layout”)?

Response:

Consideration will be made during FEED for the potential remobilisation of sediments from Pond 6 and the restriction of extrusion; this may include the use of combi-wall technology.

The area will be surveyed prior to construction. This will include borings and soil analyses.

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Preamble:

Reference: p. 3-8 & 3-9

Request:

How will the waste removed from the raw water screens be disposed of?

Response:

This has not been determined yet. As there will also be solids screened from the wastewater at the LNG facility, it is likely that the two sources of screened materials will be combined and transported for disposal at a licensed landfill site.

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Preamble:

Reference: p. 3-10 On Site Wastewater Treatment System

Request:

What will be the degree of treatment of waste water designated for discharge into the sea (i.e., what kinds of treatment in addition to the proposed sedimentation ponds)?

Response:

Refer to Pieridae's response to IR - EARP2.

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Preamble:

Reference: p. 3-34 & 3-35 (Utilities, Infrastructure and Support Systems)

Request:

Are there plans for any security systems aimed specifically at detecting terrorist activities?

Response:

A risk assessment will be undertaken during the FEED. As part of that terrorist activity risks will be assessed. If the risk is considered significant, then systems will be designed into the plant to mitigate the risk.

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Preamble:

Reference: p. 3-52 & 3-53 (Decommissioning Phase)

Request:

Will a funding element be part of the final Decommissioning Plan? Should decommissioning costs be accrued in a trust account over the life of the project?

Response:

There will not be a funding element per se as part of the final Decommissioning Plan. While there is no legal requirement to provide same, either directly, or as part of a trust account accruing over the life of the project, it is an issue that is always top of mind. As the project nears the end of its economic life, the costs associated with decommissioning will be dealt with at that time.

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Preamble:

Reference: p. 3-54 to 3-57 (Waste Management, Emissions)

Request:

How will soluble contaminants in the otherwise "uncontaminated" site runoff stream be treated before discharge of the runoff into the environment?

Response:

During design any areas of potential soluble contamination will be bunded and any releases from the bunded areas in to the site runoff will be checked for potential contamination, caused by spills etc. If the stream is found to contain contamination it will be collected and treated. This may be onsite if the contaminants are suitable for treatment in the available packages (e.g. sewage treatment package) or offsite through a specialist contractor.

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Preamble:

Reference: p. 3-58 to 3-65 (Malfunctions and Accidents)

Request:

Does the Emergency Response Plan rely only on the local fire department for a first response?

Response:

Pieridae is prepared to develop and implement an Emergency Response Plan without reliance on existing local services. However, the preferred approach is to develop and implement the plan in close consultation and cooperation with the local fire department. The department has already approached Pieridae and expressed an interest in such cooperation and has followed a similar approach for the emergency response planning as was done for the SOEI gas plant.

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Preamble:

Reference: p. 3-67 to 3-69 (Environmental Management Plan)

Request:

What is the "routine" interval for review/updating of the EMP? As well, will the Safety, Health and Environmental Coordinator position be filled before the start of construction?

Response:

It is envisaged that the EMP will be annually reviewed and updated. Outside of these routine reviews, the EMP will be updated, if applicable, in response to such issues as changing legislation or unsatisfactory monitoring results.

Pieridae is currently developing a key staff list for the development, construction and operation of the facility. The Safety, Health and Environmental Coordinator position will be part of that list and will be in place before the start of construction.

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Preamble:

Reference: p. 3-73 to 3-74 (Workforce and capital Expenditure)

Request:

Is the "environmental manager" position in addition to the Safety, Health and Environmental Coordinator position noted in 3.7.2?

What sorts of training programs might be offered by the proponent (has the proponent assessed currently available local work force expertise)?

Response:

Pieridae is currently developing a key staff list for the development, construction and operation of the facility. The process will determine the general job descriptions and scope of responsibilities for specific positions. No decisions have been made yet whether or not the Environmental Manager position will be separate from the Safety, Health and Environmental Coordinator position.

As part of the list that is being prepared, the actual skill sets required will also be defined. Given the long period of time that both Imperial Oil and Encana have been operating in the area, Pieridae believes there already exists a significant pool of talent to draw from.

Pieridae also plans to have consultations with educational institutions to ensure that the opportunities presented by the facility will be made aware to the student body to ensure students have the opportunity to develop the skills necessary to obtain employment at the facility.

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Preamble:

Reference: p. 7-1 to 7-2 (Other Methods for Carrying Out the Project)

Request:

Will the marginal wharf and LNG jetty be constructed simultaneously?

Response:

Yes – there will be periods of simultaneous work.

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Preamble:

Reference: p. 9-8 to 9-10 (Marine Sediment)

Request:

Will there be further pre-construction marine sediment sampling along the intertidal and subtidal areas of Red Head peninsula (i.e., north of the sample DC-2 location) to detect mercury-contaminated deposits that may be remobilized during the construction of the wharf access road (causeway)?

Will the section of the road that passes over the Pond 6 sand bar be designed with culverts to facilitate water exchanges between Dung Cove and Stormont Bay?

Response:

Yes - marine sediment sampling will be undertaken including a chemical analysis to determine potential contamination. And yes, culverts will be included in the section of the road that passes over Pond 6 (referred to by Pieridae as the haul road) as required.

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Preamble:

Reference: p. 9-37 to 9-44 (Climate)

Request:

Pieridae appears to presume "a predicted minor increase in average temperature and rainfall over the life of the project" that is likely based on current anthropogenic global warming theories and model output scenarios. However, the possible impacts of global cooling on the proposed project are not addressed.

Response:

Global cooling encompasses a number of natural and man-made mechanisms that act upon the earth's climate system to produce long and short term cooling trends. These include major influences such as variation in the earth's orbit, solar intensity, global oceanic flow ("La Nina"), and accumulation of natural and man-made particulates and aerosols in the atmosphere. These and other cooling mechanisms work in combination with global warming mechanisms to produce the global climate trends that we experience. The question in climate science is which of these mechanisms are dominant and how are they changing over time. While there is (and should be) some critical debate over the current trend of climate change and the causes of it, the prevailing opinion in the science community is that global warming is dominant.

In the Final Terms of Reference for the Preparation of an Environmental Assessment Report (dated May 7, 2013), Pieridae was directed to consult with the NSE Climate Change Directorate (CCD) regarding requirements to satisfy provincial and federal commitments to addressing climate change (Section 10.3, page 18). In Pieridae's communication with the CCD, global cooling was not identified as an issue that should be considered in the assessment. Currently, it is the declared policy of the Province of Nova Scotia that global warming is happening and that the causes and potential effects should be addressed in project development (Guide to Considering Climate Change in Project Development in NS (NSE, 2011)) and in environmental assessments (Guide to Considering Climate Change in Environmental Assessments (NSE, 2011)). Therefore, this is the approach Pieridae has taken for the Goldboro LNG Project.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Charles Schafer – EA Review Panel Member Nova Scotia Environment	IR # EARP 37

Preamble:

Reference: p. 9-106 to 9-107 (Substrate)

Request:

Pieridae states that "Sediment samples taken from the proposed wharf site do not show elevated mercury or arsenic levels…(AMEC, 2006)". Yet AMEC Figure 9.1.4 shows only one (DC-2) sediment sample and no sediment sample position data are shown on the Marine Fish Habitat Map (Figure 9.6.3). Are the other "sediment samples" for this location shown on some other figure in the EA report or is the statement based on only one sample?

Response:

In fact, there was no sediment sample recovered at DC-2 as the bottom environment was predominantly rocky. The nearest sample to the Goldboro LNG jetty and wharf is DC-3; which showed very low mercury (non-detectible) and relatively low arsenic (9 mg/Kg). According to sediment sampling conducted by Encana for the Deep Panuke project (Encana, 2006), similarly low levels of arsenic and mercury were identified along the nearshore M&NP pipeline route (approximately parallel to the southeast edge of the Goldboro LNG project footprint). No other sediment samples are located near the proposed wharf.

Pieridae recognizes that this represents a preliminary investigation based on a small number of samples, and is in the process of initiating additional marine baseline studies following EA approval to further identify the presence and extent of tailings contaminated sediments within or near the Project footprint. The proposed additional studies will be designed to comply with EA conditions of approval, regulatory guidelines and industry standards for treatment of potentially contaminated sites in NS. The study results would be subject to review by NSE. Special mitigation for Project activities and/or remediation (if any) would be designed in consultation with NSE.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Charles Schafer – EA Review Panel Member Nova Scotia Environment	IR # EARP 38

Preamble:

Reference: p. 10-14 to 10-17 (Effects of Construction)

Request:

Can Pieridae provide a preliminary plan showing the diversion route for the unnamed tributary to Dung Cove? Where along the tributary channel will the diversion begin?

Response:

The preliminary design is to follow the storm water ditches along the western site boundary. Specific routes and details will be prepared during FEED when the finalised plot plan is being developed.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Charles Schafer – EA Review Panel Member Nova Scotia Environment	IR # EARP 39

Preamble:

Reference: p. 10-57, 10-58 & 10-63 (Effects of Operation)

Request:

Do noise data indicate that, in addition to berms and plantings, sound barriers (e.g., the type used along some multi-lane highways) will be needed to buffer the effect of continuous noise with respect to nearby residential receptors?

Why is it not possible to develop a Project Lighting Plan as part of the FEED exercise as opposed to the proposed "post FEED" development of the plan?

Response:

Further noise modelling will be undertaken in FEED using the finalised plot plan. Based on the preliminary noise model three receptors have been identified as having noise levels above Nova Scotia guidelines for night hours. Mitigation will be undertaken, if required after detailed noise modelling, which may include additional on-site measures as well as off-site receptor mitigation and possibly relocation of receptors.

A Project Lighting Plan can and will be developed during FEED. The sentence on page 10-63 of the EA Report is incorrect and should read:

> "Similar lighting needs will be required for this Project, consequently it is recommended that a lighting plan be developed during FEED".

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Charles Schafer – EA Review Panel Member Nova Scotia Environment	IR # EARP 40

Preamble:

Reference: p. 11-1 to 11-9 (Evaluation of Advantages and Disadvantages to the Environment)

Request:

Is there any expectation by Pieridae that jetty infrastructure might create new habitat for attached invertebrate marine species that could attract foraging commercial species?

Response:

Hard substrates in the marine subtidal zone commonly become habitat for attached marine invertebrate species. The material used to construct the jetty piles will have an effect on the level of settlement but it would be expected there will be a level of settlement regardless of the material. The level to which those marine invertebrates will attract foraging species, including those of commercial interest, is difficult to predict.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Charles Schafer – EA Review Panel Member Nova Scotia Environment	IR # EARP 41

Preamble:

Reference: p. 12-1 to 12-6 (Proposed Compliance Effects Monitoring Programs)

Request:

Among the suite of monitoring programs, which ones will be used to monitor potential environmental impacts arising from ongoing operations associated with the jetty and wharf?

Response:

For the operation of the jetty and the marginal wharf Pieridae is committed to conduct the following key monitoring programs:

- **Oceanographic conditions:** monitoring of bathymetry, currents, sedimentation at/near the wharf and jetty.
- **Marine habitat and wildlife:** monitoring of marine habitat conditions at/near wharf and jetty (to include bottom conditions before and after implementation of compensation measures if implemented at/near wharf and jetty).
- **Fisheries:** monitoring of issues and concerns expressed by fishermen; additional specific monitoring to be established in response to concerns/issues identified and in consultation with Community Liaison Committee; this could involve monitoring of fish/fish habitat conditions, gear entanglement, and vessel navigation issues.
- **Marine Traffic:** monitoring of Project-related vessel movement at and near wharf and jetty plus the approach channel (LNG tanker schedules, type and number of vessels; other marine activities).
- **Safety:** monitoring of accidents associated with the immediate operation of the wharf and jetty.
- **Heritage Resources/Archaeology:** monitoring of erosion and possible exposure of shoreline areas of archaeological interest at/near the wharf and jetty (Sculpin Cove 1-5, Hurricane Island Mine, Dung Cove, Giffin's Mill, and McMillan Mine).

It is expected that the specifics of the monitoring (parameters, frequency, duration, reporting, etc.) will be established in consultation with the regulators and the Community Liaison Committee.

Preamble:

Reference: p. 13-1 to 13-23 (Consultation and Engagement Programs)

Request:

Of the total number of community engagement pathways described in this section of the report, what key pathways will Pieridae likely rely on to "continually engage with all stakeholders during the operation of the facility"?

Response:

Pieridae intends to establish, through a professional communications consultant, a Community Communication Plan for the construction and operation phases of the Project. It will formulate the objectives, specific communication tools, and responsibilities for the plan implementation. At this point it is envisaged that during the operation phase Pieridae will engage the local community and stakeholders primarily through:

- CLC;
- Goldboro LNG website;
- newsletter; and
- on-site visitor/information centre.

The success and effectiveness of these communication tools will be assessed as the Project operation unfolds. Program adjustments will be made in response to feedback that Pieridae obtains from participants and the community at large.

The long-term continuation of the CLC will depend on the interest, dedication, and cooperation of participating community representatives. Pieridae considers this committee essential for staying in close communication with the communities and is committed to working with the committee as long as the participants consider it a useful forum.

Pieridae sees the Goldboro LNG website as another key element for ongoing and future communication with the community and stakeholders. It is envisaged that the site will always be in place as an information source and an interactive tool for feedback and discussions.

The publication of the Goldboro LNG newsletter will likely continue at least during the initial operating phase. Its distribution via e-mail may eventually become limited to a posting on the website.

The on-site visitor/information centre is considered primarily an information source for the traveling public and a learning opportunity for school classes and other visiting groups. It will also provide an on-going opportunity for the local community to get in direct contact with Goldboro LNG representatives, obtain information, and provide feedback.

As far as First Nations communities are concerned, Pieridae maintains its standing invitation to First Nations for participation in the CLC. Pieridae also continues to encourage First Nations communities to utilize all of the Project's general communication opportunities mentioned above.

Based on the signed MOU between Pieridae and the Assembly of Nova Scotia Chiefs (through the KMKNO), Pieridae is committed to a continuous engagement of First Nations communities through a CBA. It is expected that this agreement will include mechanisms for on-going communication, and review and discussions of the implementation of the CBA for the construction and operation phases.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 43

Preamble:

Reference: xii (Executive Summary)

Request:

Could the waste heat recovery system be sufficient to provide heat / steam to the greater Goldboro industrial park area should a market become available in the future?

If so, could the capacity to connect to a distribution system (steam, hot water, etc.) be engineered into the final design?

Response:

External users for utilities generated for the Goldboro LNG Project have not been considered in the design.

If approached by external users, Pieridae is open to exploring opportunities for utilizing the facility's waste heat for providing heat or steam to other future industrial park users

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 44

Preamble:

Reference: p. 1-4 (Project Schedule)

Request:

What is the expected lifespan on the project (independent of changing economic landscapes)?

Response:

The physical life of the assets is at least 40 years. The contractual demand for the project will be at least 20 years with a renewal option of up to 10 additional years.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 45

Preamble:

Reference: p. 3-7 (Power Plant)

Request:

Would the LNG facility's power plant be grid connected? If so would a power purchase agreement with Nova Scotia Power Inc. be sought?

Response:

The current design is onsite power generation with no connection to the grid.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 46

Preamble:

Reference: p. 3-7 (Power Plant)

Request:

Would there be capacity to sell / provide power to the greater Goldboro industrial park area?

If so could the capacity to connect to a local power distribution be engineered into the final design?

Response:

The current basis is only to provide power for the Goldboro LNG Project needs. No others users are considered in the power generation design.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 47

Preamble:

Reference: p. 3-8 (Meadow Lake Water Intake Structure and Pipeline)

Request:

Based on the current design, could the Meadow Lake water supply be used to provide a potable water supply to the greater Goldboro industrial park area?

If so, could the capacity to connect to a potable water distribution system be engineered into the final design?

Response:

The current basis is only to supply water for the Goldboro LNG Project needs, no other users have been accommodated in the design.

As stated in the EA Report (Section 10.19.3.4; page 10-127) Pieridae is open for discussions with other (future) industrial park users and the municipality to contribute to a coordinated approach to the use of fresh water resources. At this point however, no other such interests have been identified.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 48

Preamble:

Reference: p. 9-41 (Thermal Inversions)

Request:

More information is required on the effects of thermal inversions trapping fugitive emissions from the LNG plant during operation, specifically:

- Modeling on the frequency and duration that thermal inversions occur in the area of the Project site, and how inversions may affect air quality by trapping fugitive emissions from the LNG plant during operation;
- Information on the effects of trapped emissions on human health;
- More robust monitoring plans on how to assess the impacts of fugitive emissions trapped by thermal inversions on the air quality in the Project site area may need to be developed: The one month air quality monitoring commitment may be insufficient to assess the effects of thermal inversions trapping fugitive emissions through a sufficient variety of atmospheric conditions;
- A Mitigation strategy on how to reduce the impacts (if any) of emissions trapped by thermal inversions may need to be developed.

Response:

It is not thought that dispersion of fugitive emissions will be impacted by thermal inversions. Fugitive emissions, at a realistic release rate, would be considered to disperse to harmless levels before any thermal inversion can lead to trapping of the release.

Dispersion modeling was performed using the USEPA preferred regulatory model AERMOD. In order to assess all types of weather conditions such as thermal inversions, USEPA recommends a minimum of 5 years of meteorological data be used in the model (refer to website link below). As part of the modeling process, AMEC included 5 years of hourly meteorological data from the closest Environment Canada weather stations (Shearwater and Halifax).

USEPA Website: http://epa.gov/scram001/7thconf/aermod/degrade.pdf

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 49

Preamble:

Reference: 9-81 (Birds)

Request:

The EA does not provide a sufficient baseline assessment of bird behavior during the spring and fall migration periods. The potential for bird mortality from the flair tip was dismissed due to past incidences being rare and poorly documented. The incident in September, 2013 at the Canport Liquified Natural Gas (Saint John NB) in which approximately 7500 song birds were killed in one night, shows that these incidences, albeit rare, can be extremely devastating and very much possible in Atlantic Canada. A robust assessment of avian behavior during spring and fall migration, especially at night, needs to be completed and used to inform a mitigation strategy to reduce the risk of the flare tip to migrating birds.

Response:

Pieridae acknowledges the potential for gas flaring to impact migrating birds in the EA Report (Section 10.9.3.2). Based on information available, bird mortality associated with flaring is however considered a rare event. It is expected to be particularly rare at the Goldboro LNG facility, since there will be no flaring under normal operating conditions (> 90% of the time; note: flaring will only occur during start-up and shut down events, and emergency situations). This means that flaring will be considerably less frequent than at the existing SOEI plant located just north of the Project site. At the SOEI plant flaring occurs almost on a weekly basis and during the approximate 13 years of operation no major incidents of birds flying into the SOEI flare have been published.

Nevertheless, in recognition of the potential for adverse effects, Pieridae is committed to developing an Avian Management Plan and conducting environmental effects monitoring that includes mortality monitoring for birds and bats to assess the impacts and better understand this seemingly rare and little-studied phenomenon.

The Avian Management Plan will include a method for tracking/forecasting avian migration with the intent of minimizing or eliminating large-scale mortality events such as the incident at the CANAPORT facility in September 2013. Migration tracking/forecasting will be based on monitoring of the regional migration forecast website provided the Cornell Laboratory of Ornithology. Based on the forecasts, facility start-ups and shut-downs can be avoided during high-risk times (e.g. nighttime during the spring and fall migration periods) and low visibility weather conditions, in order to reduce the potential for avian mortality. The success of this approach will be reviewed annually and, if necessary, other techniques will be implemented which may include the use of radar based monitoring.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 50

Preamble:

Reference: p. 9-182 (Emergency Response)

Request:

Are there sufficient medical services in the area (Guysborough County) to provide medical services during all phases of the Project?

Would temporary medical services be brought in to accommodate increased medical demands during any of the Project phases (i.e. during construction)?

Response:

Yes, temporary medical services would be available on site and in the camp during construction, however regional services and facilities would be used for any serious injuries.

Details of the required level of on-site medical services will be established during FEED in consultation with local service providers and facilities (e.g., Guysborough Antigonish Strait Health Authority, Emergency Management Office, Emergency Health Services, Emergency Medical Care Inc.).

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 51

Preamble:

Reference: p. 9-184 (Community Response Planning)

Request:

Are there sufficient medical services in the area available to handle disasters (i.e. explosions, gas leaks, etc.) during all phases of the Project? A disaster plan may need to be developed.

Response:

Pieridae will develop as part of the Project's health, safety and environmental management a comprehensive Contingency and Emergency Response Plan (see EA Report Section 3.7). That plan will establish specific requirements for emergency related on-site medical services, equipment, procedures, training, drills, responsibilities, and protocols.

The plan will be developed and coordinated in close consultation with relevant local and regional service providers (e.g., Guysborough and Antigonish fire departments, Guysborough Antigonish Strait Health Authority, Emergency Management Office, Emergency Health Services, Emergency Medical Care Inc.).

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 52

Preamble:

Reference: p. 10-5 (Tailings)

Request:

Can the proponent provide more information on how potential effects of disturbing the tailings from historic mining activities will be mitigated?

- Is there a plan to remediate contamination from the tailings in areas of the Project footprint that will be unavoidably disturbed by construction activities?

- Have all potentially contaminated sites been identified within the development footprint or will this be an on-going process throughout development?

Response:

During FEED, Pieridae will develop a comprehensive Risk Management Plan (RMP), which will evaluate the potential environmental and health risks associated with the tailings areas. The RMP will also determine the necessary environmental safeguards and health protection.

As part of FEED, when the finalised plot plan is developed and the extent of site clearance is determined, a Site Remediation Plan will be established to address the findings of the RMP. The Remediation Plan will establish remediation objectives, as well as techniques and measures to be applied in the remediation process. The plan development will follow the Nova Scotia *Contaminated Sites Regulations* (NSE, 2013).

In a first step and prior to any site development, comprehensive site investigations will be conducted including soil sampling and testing in order to identify and delineate potentially contaminated areas. Sampling and testing will also be conducted during construction for any areas where contamination is suspected.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 53

Preamble:

Reference: p. 10-20 (Mitigation Measures for Surface Water Effects)

Request:

The EA commits to Harmful Alteration, Disruption or Destruction of fish/fish habitat (HADD) compensation. Will this still be undertaken despite the changes to the Fisheries Act that have reduced the need for HADD compensation?

The EA commits to maintaining a maintenance flow down Isaac's River.

- What work (if any) has been done to assess what kind of maintenance flow is necessary (in cubic feet per second)?
- Has a baseline flow been established? For different portions around the year?
- Would the flow requirements change throughout the year to accommodate fish migration needs in different portions of the year?
- Will the proposed cofferdam provide upstream fish passage?

How will the proposed cofferdam effect water levels within Meadow Lake?

Has any work been done to establish baseline water levels within Meadow Lake and / or static water levels of the lentic wetlands associated with the lake?

Will a mitigation plan be developed to address potential effects to the water levels of Meadow Lake and associated wetlands as a result of the installation of the cofferdam and water intake.

Response:

In accordance with the recent changes (November 26, 2013) to the Fisheries Act, fish habitat protection provisions have been replaced and Fisheries and Oceans Canada (DFO) now determines whether a project is a work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery. Ultimately this will be determined by DFO and Pieridae will submit detailed Project design plans (FEED level) to facilitate that determination. At this point, Pieridae assumes that the Project will require an authorization pursuant to the changed *Fisheries Act* and will need to implement fisheries offset plans. The EA Report establishes Pieridae's commitment to such offsets and outlines approach and options in Sections 10.110.3.1 and 10.11.3.2 respectively). The specifics of the offsets will be determined in consultation with DFO and in the context of the application for authorization.

The discussion of existing (baseline) hydrology in Isaac's Harbour River and in Meadow Lake is presented in Section 9.2.2. Flow characteristics were developed for the Keltic project in a detailed hydrological model and field measurement program. This was used as the starting point for the Goldboro LNG assessment.

In Section 9.2.2.5, the water supply potential was assessed based on a 10% withdrawal limitation (at lowest annual monthly flow), assuming that would be more conservative than the actual maintenance flow. In Section 10.3.2, the potential impacts of the project on flow maintenance and water levels in Meadow Lake are discussed, with qualifying remarks. In general, the proposed withdrawal is a tiny fraction of low flow conditions in the river, at only 1.2 % of the lowest monthly average, and only 0.23 % of the mean annual flow. The lowest average monthly baseflow is about equal to one lake volume, so in theory the maximum lake draw down would be 2.4 cm (1.2% of average depth – 2 m). In reality, this will be much smaller, since the rate at which the lake continues to fill up will likely increase slightly in response to the draw down. In other months, the lake will recharge far faster than the intake system can withdraw water, and will have a negligible effect on lake water levels annually. Overall, the effect on water level in the lake will not be large enough or long enough to cause changes in shoreline habitat (i.e., the change in water level will be much smaller than natural fluctuations).

The proposed coffer dam will be only temporary during construction of the water intake piping and pump house. The coffer dam will isolate the portion of the shore and lake bottom, so that fish may be safely removed and the water drained. The coffer dam would be removed following construction, and would never interrupt fish passage or lake water levels, except temporarily, within the "submerged" intake footprint.

A provincial water withdrawal permit will be required, as the Project demand (600 m^3/d) is well over the 23 m^3/d specified in the *Activities Designation Regulations* (Division I). Since no other water users were identified at Meadow Lake or downstream, water allocation is not an issue. The water withdrawal permit application will require calculation of sustainable yield using flow-duration curves, in order to demonstrate that the proposed Project withdrawal is acceptable. Fisheries maintenance flow requirements would then be coordinated with DFO, when precise FEED level water demands are known. It is likely that the limit of 10% of baseflow used in the EA will be more conservative than the total withdrawal allowance based on the sustainability curve.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 54

Preamble:

Reference: p. 10-42 (GHG Emission Off-sets)

Request:

Can the proponent provide any information on intended contributions to carbon-offset programs?

Response:

The EA report provides a discussion of GHG Off-sets in Section 10.4.5.4 including a specific list of potential off-set schemes under the subheading “GHG Emissions Off-sets” (p.10-42). As stated in the text, all options for off-sets that are currently discussed for the oil and gas industry will be considered. Further details will need to be developed in close consultation with NSE and the Climate Change Directorate.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 55

Preamble:

Reference: p.10-62 (Ambient Lighting)

Request:

Was the light generated by the flair tip given much consideration?

Could the proponent develop and implement a mitigation strategy to address the light generated by the flair tip should it prove bothersome to local residents.

Response:

During normal operation of the plant flaring is not required. Therefore, significant light from the flare, when in use, would only be in unplanned emergency situations, start up and shut down. These periods would be limited relative to normal operation.

Apart from the pilot flame and aircraft warning lights the flare will emit limited light. It is also of note that the SOEI gas plant located adjacent to the Goldboro LNG site has been operating a flare stack since its commissioning about 13 years ago and flaring events have been rather frequent (about once per week). During public meetings no complaints of the SOEI flaring activities have been received and no concerns have been raised related to the proposed Goldboro LNG flare stacks.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 56

Preamble:

Reference: p. 10-87 (Terrestrial Fauna)

Request:

Has any consideration been giving to impacts of the water supply pipeline from Meadow Lake acting as a barrier to habitat connectivity for wildlife?

It may be necessary to develop a mitigation strategy to reduce the impacts of the water supply pipeline to habitat connectivity.

Response:

The existing habitat along the proposed water supply pipeline is currently in various stages of forest management, including clear-cut, regenerating, immature, and mature growth (EA Report Figure 9.4-4). This mosaic of open and closed habitat is transected by the existing, M&NP pipeline easement, within which the vegetation is maintained as a grass/small shrub community. The water supply pipeline corridor would add an additional 6 -10 m to the existing 35 m wide M&NP corridor and would also be subject to similar vegetation management to prevent pipe damage by tree roots. Given the existing variability in the vegetation cover, the existing MN&P corridor, and the vegetated state of the completed water supply line, the proposed new easement is not expected to represent a barrier to wildlife and to not adversely affect habitat connectivity.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Scott Dickey – EA Review Panel Member Nova Scotia Environment	IR # EARP 57

Preamble:

Reference: p. 10-146 (Effects on Employment and Local Economy)

Request:

How will procurement opportunities be advertised?

Will local (Guysborough County or Nova Scotia based) service providers be given special consideration during procurement?

Response:

Pieridae is currently using the Goldboro LNG Project website to communicate Project schedules and to aggregate a roster of potential suppliers. The site also allows contractors to enter their contact information and specific interest in supplying goods and services to the facility development and operation.

It is envisaged that the Project website will remain a key source of information that the business community can access to obtain updates on construction activities and schedules, tender information, and job opportunities. Tenders will also be advertised in various print media. Further, Pieridae is considering the organisation of one or more public meetings specifically tailored to the needs and interests of the local/regional contractors.

Pieridae is making this concerted effort to identify local suppliers for the procurement of required goods and services to ensure they are given an opportunity to bid on the work being tendered. As part of the Project's procurement policy, all bids will be judged on their economic merit first but otherwise local bidders will be given preference.

It is of note that Pieridae has also signed a Memorandum of Understanding with the Assembly of Chiefs. It commits both sides to develop and implement a Collaborative Benefits Agreement, which will ensure local First Nations communities are provided with employment and training opportunities.

SECTION 3.0

GOVERNMENT AGENCIES

GOLDBORO LNG

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 05, 2013	Page 1 of 2
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Dr. Robert Strang Concerned Citizen	IR # NSHW 1

Preamble:

Based on the material provided by Pieridae Energy (Canada) Ltd. in the Goldboro LNG Environmental Assessment Document, the Environmental Health Responsibility Centre of the Department of Health and Wellness offers the following comments regarding this project:

Request:

1. Wells within 800 meters to 1km of blasting should be surveyed and monitored prior to blasting/construction and after, during operation to ensure no adverse effects on the public's drinking water supplies. The survey on the wells in the area that was done in 2008 for Keltic should happen again as wells/residences may have changed. All drinking water (wells that are being monitored off site, as well as potable water on-site) should meet the Canadian Drinking Water Quality Guidelines. This is of great concern due to the inactive tailing disposal sites that remain from mining in the area.

2. The closest resident to the property is 200 m north of the project boundary. It was unclear exactly where this residence was as no map was shown with the residence marked on it.

3. Emissions should be monitored so as to show the environmental effects of the plant. Monitoring stations could include a station in the community to monitor where emissions land, the effect on the environment and the effect on human health. Of particular concern would be PM 2.5 which would be small enough to be inhaled and may cause potential health effects.

4. There was no mention of pedestrians in the EA. With 3500 people coming into the area for work, it is possible that the roads will be used more for walking, biking to work. Are the sidewalks sufficient for this type of traffic, and what about bike lanes?

5. How will recreational users be made aware of how their environment will change? Will there be signage up in the wooded area surrounding the plant? Will there be fences erected in order to keep people out of the property?

6. Consultation with the Department of Agriculture is recommended in case the project site meets the requirements for a food establishment permit (if there is to be a cafeteria on-site).

This is sent on behalf of Dr. Robert Strang, Medical Officer of Health for Guysborough Antigonish Strait Health Authority.

Nita MacLean
Environmental Health Consultant
Nova Scotia Health and Wellness

Response:

1. A well water survey will be implemented prior to blasting. The sampling program will be designed in consultation with NSE, including identification of sampling area (i.e., distance from proposed blasting activity) and the parameters to be tested. It is expected that the well water analysis will address Canadian Drinking Water Quality Guidelines.

2. The three nearest residences were marked on Figure 9.3-1 "Nearest Sensitive Receptors and Baseline Noise Monitoring Locations" (page 9-54 of the EA Report). For your convenience, the figure is attached to this response (Appendix 1). The distance from the Project's property boundary to the two residences located to the west and northwest of the site is about 250 to 300m; the distance to the property located east of the Project site is about 1000m.

3. Preliminary modelling of predicted air emissions indicates that all parameters linked to direct human health risk will be well below guidelines in the local communities. This includes cumulative effects with the SOEI Gas Plant emissions. Pieridae will comply with any air quality monitoring requirements that are identified by NSE as a condition of the EA approval or subsequent operating permits. It is expected that the parameters to be monitored will include PM 2.5.

4. The temporary work camp accommodation is located immediately adjacent to the construction site and all workers will be bussed or may walk to their respective work areas without accessing public roads. Workers living in the region or local community are expected to be bussed from established muster areas, or will have personal vehicles.

   In general, there are no sidewalks in Goldboro and the adjacent communities as the area is rural. Pedestrian or bicycle travel to work would be discouraged.

5. To ensure public safety (including recreational users), access into the construction site will be controlled using barricades, fencing, security and warning signs. To ensure safety of personnel entering the site, correct personal protective equipment (PPE) must be worn and all personnel must have undertaken site induction. Visitors will be escorted around site.

6. Comment noted. Pieridae will contact the Dept. of Agriculture, prior to construction of the temporary work camp, to obtain necessary permits.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC1**

Preamble:

General Comment

Section 3.0 (Project Description) - The report indicates that the project description is based on a preliminary and conceptual design that will be further developed through a Front-End Engineering and Design (FEED) process which will commence immediately upon receipt of environmental assessment (EA) approval. It is unclear how the environmental effects of the project can be adequately evaluated and that there can be any confidence in the predictions given that the project description is preliminary and subject to modification during the FEED process.

Request:

The proponent should provide a discussion about how any changes/modifications to the project will be evaluated from an environmental perspective and whether the results of the EA will be revisited upon finalization of the project design.

Response:

Impacts to the airshed were assessed by developing an air dispersion model that was based on Pre-FEED information. Changes/modifications to the Project will be assessed by comparing the Pre-FEED air dispersion model inputs with updated FEED information. If the model inputs change significantly (including types of equipment, emission rates, types of emissions generated and location of sources), then further assessment will be performed. The Pre-FEED air dispersion model will be updated to include significant changes/modifications to the Project, and the model will be rerun to assess potential impacts to the airshed from these changes/modifications. Given the conservative nature of the Pre-FEED dispersion model and its assumptions used for the EA Report, the re-run of the model with updated FEED information is not expected to change the conclusions of the assessment. However, should any potential for exceedances of ground level concentrations be identified, additional mitigation measures will be developed to ensure the facility meets all regulatory requirements. It is of note that during plant operation an air quality monitoring program will be implemented and results reported to NSE to document regulatory compliance.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning Regional EA Coordinator Health Canada, Atlantic Region**	**IR #** **HC2**

Preamble:

Air Quality

Section 9.3.2 (Regional Air Quality Baseline) - The background/baseline air concentrations of nitrogen dioxide (NO_2), sulphur dioxide (SO_2), total suspended particulate (TSP) and particulate matter 2.5 microns or less in diameter ($PM_{2.5}$) that were used in the predictive modelling of project-related emissions (in the context of overall regional air quality) were from data collected in 2004 in Seal Harbour, NS. The rationale provided was that no other longer-term background air quality data is available that is representative of the area. Given that the data is almost ten years old, it is unclear how representative it is of current conditions.

Request:

The proponent should provide additional justification that the baseline data from 2004 is representative of current conditions

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Response:

Air monitoring was performed at Seal Harbour which is located within 3 km of the proposed Pieridae Project site. The location is considered rural and has a secondary highway that follows the shoreline and with a few residences in the immediate area of Seal Harbour and the proposed Pieridae Project site. Two communities, Goldboro (population approximately 450) and Isaac's Harbour (population approximately 50) are located approximately 5 km to the northwest of the proposed Pieridae Project site. The population of these communities and the area around Seal Harbour has not changed significantly since 2004. The largest industrial source, the SOEI gas plant, started producing gas in 1999 from the Thebaud, North Triumph and Venture natural gas fields; Phase II of the Project resulted in production of the Alma gas field in 2003 and the South Venture gas field in 2004. Since the 2004 air quality monitoring was performed in 2004 with the natural gas plant operating along with there being no appreciable increase in population or other industry in the area, the information from the 2004 air monitoring program is still considered representative of baseline conditions for the proposed Pieridae Project site. This will nevertheless be re-evaluated during FEED when the dispersion model is re-run.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC3**

Preamble:

Section 10.4.1 (Air Quality and Climate Change (GHG), Threshold for Determination of Significance) and Section 10.13.1.3 (Human Health) - A significant adverse air quality effect has been determined to "represent a condition where regulatory objectives are regularly exceeded". "Regularly" is not defined. Given that some of the contaminants of concern (COCs) can have adverse effects on people from acute or short-term exposure (eg. NO_x and SO_2 are respiratory irritants), individual exceedences of regulatory objectives may result in adverse health effects. As such, the toxic effects of the individual COCs should be taken into consideration when defining "regularly".

Request:

The proponent should define how many times regulatory objectives can be exceeded in order for the effect to be considered significant, with consideration of the individual toxicity of each COC.

Response:

There were no predicted air quality exceedances for the Project. A regular exceedance would have been considered one that is associated with regular plant operation as opposed to emissions associated with specific situations such as start up, shut down and malfunctions.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 9, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC4**

Preamble:

Section 10.4.1 (Threshold for Determination of Significance) - The report discusses $PM_{2.5}$ in then in the fourth paragraph of this section states "Health Canada provides a reference value of inhalation of 3 µg/m^3 for an annual period; Quebec has an objective of 10 µg/m^3 for a 24 hour period; and Alberta has an objective of 30 µg/m^3 for a one hour period." None of these inhalation values are referenced, thus it is not possible to determine which substance(s) they refer to. In Section 10.4.3.5 (Air Dispersion Modeling Methodology), page 10-37, these same values are presented in relation to benzene.

Request:

The proponent should clarify in **Section 10.4.1** whether or not the values presented are for benzene and literature references for all values should be provided.

Response:

Section 10.4.1 does present values for benzene; however, the text referencing Health is not accurate and should have read as follows:

"*A value of 3 µg/m^3 was calculated based on the Health Canada Turmorigenic Concentration 05 (TC05) and this value will be compared to predicted results for longer averaging periods (annual). Quebec has an objective for benzene of 10 µg/m^3 for a 24 hour period and Alberta has an objective of 30 µg/m^3 for a one hour period*."

Website Reference: http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/hbct-jact/index-eng.php

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Allison Denning Regional EA Coordinator Health Canada, Atlantic Region	IR # HC5

Preamble:

10.4.3.5 Air Dispersion Modeling Methodology - Since a literature reference was not provided for the Health Canada inhalation reference value of 3 µg/m^3, it is unclear whether this is an appropriate value. Health Canada's published inhalation unit risk for benzene (benzene is considered a carcinogen via the inhalation route of exposure) is 0.0033 $(mg/m^3)^{-1}$ (Health Canada, 2012)1. An inhalation unit risk is not directly comparable to an environmental concentration. Instead, the unit risk value represents the incremental lifetime cancer risk (ILCR) that would be estimated if a person were exposed to an air concentration of 1 mg/m^3 of that contaminant on a 24-hour continuous basis for every day of their life. For benzene, the unit risk value is 0.0033 (mg/m^3)-1, which means that a person exposed to a benzene air concentration of 1 mg/m3 on a continuous lifetime basis would have an ILCR of 3.3 x 10-3 (or 3.3 in 1,000) due to this exposure. The calculation of an ILCR using a unit risk value is as follows:

ILCR = Time-Adjusted Lifetime Air Concentration (µg/m^3) x Unit Risk $(µg/m^3)^{-1}$

Request:

The proponent should provide a literature reference for the reference value of 3 µg/m^3 cited as being from Health Canada. In addition, if the 3 µg/m^3 is actually a unit risk value (which should be 0.0033 $(mg/m^3)^{-1}$ or 3.3 $(µg/m^3)^{-1}$), the ILCR should be calculated and compared to Health Canada's acceptable value of 1 x 10^{-5} (or 1 in 100,000 increased lifetime cancer risk).

Response:

Website Reference: http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/hbct-jact/index-eng.php

[1] Health Canada. 2012. Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values, Version 2.0. http://www.hc-sc.gc.ca/ewh-semt/contamsite/docs/index-eng.php

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Allison Denning Regional EA Coordinator Health Canada, Atlantic Region	IR # HC6

Preamble:

Section 10.4.3.5 (Air Dispersion Modeling Methodology) (page 10-37) - With respect to total VOCs, benzene was selected as the surrogate parameter to model (representing all VOCs), and modelling was conducted for gas leakage from valves, fittings, storage tanks, vents, etc. which would occur during natural gas liquefaction processing. There is no discussion about background concentrations of benzene or evaluation of cumulative effects of releases of benzene from the project and the nearby SOEI plant. According to Environment Canada's National Pollutant Release Inventory[1], the SOEI plant reported releasing 21.9 tonnes of VOCs to the atmosphere through stack/point and fugitive releases in 2012. Benzene emissions for the SOEI plant, which were reported until 2005, were 0.01 tonnes in 2005. Given that background benzene concentrations and current emissions from the SOEI plant were not used in the emissions calculations, predicted future benzene concentrations may be underestimated.

Request:

The proponent should evaluate all benzene sources, including the existing SOEI plant in calculating future benzene concentrations at the site boundary and at the nearest residences.

Response:

It is agreed that background levels of benzene were not accounted for in the assessment document. During FEED the air dispersion model will be updated to include the SOEI plant as a source of benzene emissions, and the model will be re-run to include both the proposed Goldboro LNG plant and the SOEI plant as benzene sources.

[1] Environment Canada. 2012. National Pollutant Release Inventory. Facility and Substance Information. http://www.ec.gc.ca/inrp-npri/donneesdata/index.cfm?do=facility_substance_summary&lang=en&opt_npri_id=0000005012&opt_report_year=2012

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC7**

Preamble:

Table 10.4-8 (Dispersion Modeling Results - Maximum Ground Level Concentrations (GLCs)) – According to the table, under both normal and upset conditions, NO_2 is at 80% of its 1-hour provincial guideline, and SO_2 is at 75% of its 1-hour provincial guideline, 61% of its 24 hour provincial guideline, 46% of its annual provincial guideline. Based on the figures presented in Appendix N (Air Dispersion Modelling Results), all maximum ground level concentrations are located in Stormont Bay, southwest of the project area (and closer to Residences 1 and 2 near Webb's Cove than to the project site itself). Although the predicted levels are lower than the criteria, NO_2 and SO_2 both act as respiratory irritants, and circumstances via which airborne concentrations of these two contaminants are simultaneously increased would substantially increase the risk for greater numbers of receptors to experience pronounced respiratory effects (Health Canada, 2004)[1]. As such, HC advises that all technologically and economically feasible technologies be employed to reduce emissions to the extent possible.

Request:

Given that NO_2 and SO_2 are both respiratory irritants as a result of acute exposure, and that two residences are in close proximity to the maximum ground level concentrations, the proponent should consider all technologically and economically feasible technologies to reduce these emissions to the greatest extent possible.

Response:

Agreed. During FEED the plot layout, building and stack heights, equipment and control systems, and facility operations will be further detailed. This will include considerations to minimize air emissions.

[1] Health Canada. 2004. Canadian Handbook on Health Impact Assessment, Volume 4.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC8**

Preamble:

Noise
Construction Noise
Section 10.5.2.1 (Acoustic Environment, Effects of Construction) - The report describes three types of construction noise: 1) equipment powered by internal combustion engines; 2) impact equipment; and 3) other equipment. Section 3.2.3 (Site Preparation, On-shore Cut and Fill, Blasting) indicates that blasting will be required during construction. There is no discussion in Section 10.5.2.1 about blasting as a potential noise source during construction. As such, it is unclear whether all potential noise sources were evaluated for the construction phase of the project.

Request:

The proponent should ensure that all relevant noises are included in the evaluation of potential construction noise at the nearest receptors.

Response:

Comment noted. Blasting will be required, the extent of which will be defined during the FEED stage. The review of construction noise sources will be undertaken in FEED as the design is developed and the execution strategies are defined in detail. The construction execution plans will consider noise impacts including those from blasting activities on local receptors. Specific mitigation measures, including scheduling and public notifications will be incorporated with the Project's Environmental Management Plan for the construction phase.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC9**

Preamble:

Noise
Construction Noise
Section 10.5.2.1 (Acoustic Environment, Effects of Construction) - In quiet rural areas, Health Canada suggests that during construction, the long-term average day-night sound level (Ldn) be below 57 adjusted A-weighted decibels (dBA) at residences. An Ldn of 57 dBA is expected to be the threshold for widespread complaints for construction noise (USEPA, 1974). If noise levels at residences are expected to exceed the acceptable level, it is suggested that the report include a discussion about proposed mitigative measures. It is suggested that priority be given to the use of quieter technology rather than extending the construction duration to reduce the daily Ldn. Attached is a document outlining potential construction noise mitigation measures (adapted from the New South Wales Construction Noise Guideline, New South Wales, Australia).

If a Ldn of 57 dBA at receptors cannot be obtained with the use of quieter technology, Health Canada suggests that community consultation be undertaken to determine work schedules and to inform the public of the times and durations of noisy activities (including blasting). In general, Health Canada suggests that impulsive sources (e.g. hammering, pile driving) be avoided at night and in the early morning. Further, Health Canada suggests that noise management and noise monitoring plans, including complaint resolution, as appropriate, be included as part of an Environmental Management Plan.

Request:

Please consider additional mitigative measures in order to minimize construction noise levels at potentially sensitive receptors (such as those presented in the New South Wales Construction Noise Guideline).

Response:

The information provided is duly noted and gratefully received. It will be considered during the next phase of the Project. Measures to mitigate construction noise, similar to those outlined in the example *Construction Noise Guideline* provided by Health Canada, will be implemented where practical. Community consultation and notification will be integral part of the Project during construction. Pieridae has established a Community Liaison Committee and will work closely with the Community Liaison Committee to address potential noise issues and develop construction schedules that are sensitive to the needs of the local community.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC10**

Preamble:

Noise
Operational Noise
Section 10.5.2.2 (Effects of Operation) - references a noise dispersion modelling study performed by CB&I to model off-site noise impacts. This noise dispersion modelling study was not provided with the EA report. In order for Health Canada to evaluate the accuracy of the predicted noise model results, the noise dispersion modelling study, including model inputs and output sheets containing the assumptions used in the predictions, should be provided.

Request:

The proponent should provide the noise dispersion modelling study, including a discussion of all of the model input parameters utilized in predicting future operational noise levels and software output sheets in order for Health Canada to evaluate their appropriateness and assess the validity of the noise model results.

Response:

The preliminary Noise Study (CB&I 2013, Rev.C, Doc# 185 352 – 000 – ME – RP – 00001) has been provided (Appendix 2). It includes details of model inputs and software output.

Please note that the results are indicative only. A full noise study based on final plant layout, contours and specific equipment data will be carried out during the FEED.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC11**

Preamble:

Noise
Operational Noise
Section 10.5.2.2 (Effects of Operation) - The report states that the main anthropogenic noise source in the area is the ExxonMobil Sable (SOEI) natural gas plant, and there are additional noise sources including a nearby wind farm and vehicle traffic. Since the noise dispersion modeling study was not provided, it is unclear whether the noise modelling included these noise sources and evaluated the increase in ambient noise levels as a result of the existing noise sources and this proposed project. In reviewing Section 10.19 (Cumulative Effects), it does not appear that noise from these multiple sources was evaluated in terms of cumulative effects.

Request:

The proponent should evaluate the potential cumulative noise impacts associated with the proposed project and existing noise sources.

Response:

As explained in the Noise Study provided (Appendix 2, CB&I 2013, Rev.C, Doc# 185 352 - 000 - ME - RP - 00001), cumulative noise effects were not considered in the preliminary noise model. Ambient noise will be considered along with the detailed noise modelling to be undertaken during the FEED stage of the Project and the predicted cumulative noise effects at off-site receptor locations established. The design of mitigation and noise abatement measures will take the results of the cumulative effects assessment into account and ensure that, during normal operations, Nova Scotia Noise Guidelines are being met.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC12**

Preamble:

Noise
Operational Noise
10.5.1 (Acoustic Environment, Threshold for Determination of Significance) - A significant adverse noise effect is defined as representing "*a condition where the recommended guidelines are regularly exceeded*". Regularly is not defined. The report then states that a continuous operational noise level of 60 dBA (24 hours/day) is predicted at the three residential receptors located closest to the site. The Nova Scotia guideline for acceptable noise levels for the evening is 60 dBA and for the night-time is 55 dBA. Thus, on a daily basis noise levels will exceed the provincial guideline during the night-time.

Request:

a) The proponent should define "regularly".
b) Given that noise levels are expected to exceed provincial noise guideline on a daily basis, it would appear that this should constitute a significant effect. The proponent should justify why they do not consider the predicted noise levels to constitute a significant adverse effect.

Response:

a) In the definition of significant adverse noise, the word regularly means "during normal operation". This would not include occurrences of noise that may be caused by start up, malfunctions, or accidental events.
b) The plot plan, site topography, and equipment specifications will be advanced during FEED considering noise emissions. As part of that effort, the noise model will be detailed and re-run to predict the effectiveness of the refined design and associated noise abatement measures. If at that stage (after design refinement and noise modelling) noise levels at receptors are still predicted to be above the Nova Scotia guidelines, further noise mitigation measures will be developed. This would include the consideration of mitigation at the receptor site(s) and possibly relocation of affected receptor(s).

   Ultimately, Pieridae commits to design and operate the facility in such a way that no off-site receptors will experience, during normal operations, noise levels that exceed Nova Scotia guidelines. Pieridae therefore considers the predicted noise levels to represent an adverse effect that is not significant. It is of note that the predictions of the noise model and the effectiveness of all mitigation measures will be subject to a noise monitoring program for the operation phase of the facility. Details of the program will be developed in consultation with NSE.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC13**

Preamble:

Noise
Operational Noise

Section 10.5.3.2 (Operation Phase) and Section 10.5.4 (Summary and Residual Effects) - These sections indicate that treed buffers and/or berms are potential mitigative measures being considered to reduce noise levels. Based on ISO 9613:2 (1996)1, vegetative shields, such as trees and hedges, do not absorb much sound. In addition, in order for physical barriers such as berms, walls or fences to be effective at reducing noise levels, the barrier must break the line of sight at the source (ISO 9613-2:1996).

Request:

The proponent should provide sufficient detail about any proposed mitigation measures in order for Health Canada to evaluate their effectiveness at reducing noise levels at the nearest receptors.

Response:

The preliminary and conservative noise model (Appendix 2, CB&I 2013, Rev.C, Doc# 185 352 - 000 - ME - RP - 00001) identifies only three residential properties that may experience noise levels that are above Nova Scotia (night time) guidelines. During FEED, the finalized plot plan, finalized equipment specifications, and the new site topography will be modeled to refine the predicted noise levels at the identified receptors.

If required, noise abatement and mitigation measures will be implemented. This may include on-site as well as off-site measures or possibly relocation of receptors.

Where applicable, the effectiveness of these measures would be assessed based on ISO standards (ISO 9613-2:1996). The specifics of the noise abatement measures and the inputs and outputs of the refined noise model would be determined as part of FEED and will be made available to Health Canada and NSE.

[1] International Standards Organization (ISO) 9613-2. 1996. Acoustics – Attenuation of sound during propagation outdoors –Part 2: General method of calculation. First edition.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allison Denning** **Regional EA Coordinator** **Health Canada, Atlantic Region**	**IR #** **HC14**

Preamble:

Drinking Water

Section 3.3.12.2 (Potable Water) - indicates that potable water will meet the World Health Organization standards for domestic usage at the facility. *Section 10.2.1 (Groundwater Resources* - Threshold for Determination of Significance) references the *Guidelines for Canadian Drinking Water Quality* (GCDWQ)[1] from Health Canada (Health Canada, 2012). *Section 10.13.1.3 (Human Health)* - indicates that drinking water will meet the CCME guidelines for drinking water quality. Nova Scotia has adopted the GCDWQ, and thus, the correct guidelines to evaluate potable water supplies in Nova Scotia are the GCDWQ.

Request:

The proponent should utilize the most recent version of the GCDWQ when evaluating potable water quality for the project.

Response:

Comment noted. Future potable water evaluation for the Goldboro LNG Project will utilize the latest version of the GCDWQ.

[1] Health Canada. 2012. Guidelines for Canadian Drinking Water Quality—Summary Table. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/2012-sum_guide-res_recom/2012-sum_guide-res_recom-eng.pdf

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Allison Denning Regional EA Coordinator Health Canada, Atlantic Region	IR # HC15

Preamble:

Typographical Error
Table 8.3-2 (Basis for Selection of VECs) - Under the VEC of "Human health and safety" the third bullet in the Rationale Column states "potential effects on human consuming marine organisms". There appears to be a typo, which should read "humans" rather than "human". If you have any comments/questions, please contact the undersigned at your convenience.

Request:

Check and amend as appropriate

Response:

This is a typo. The bullet is intended to reflect potential effects on multiple humans.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 11, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Billy Joe MacLean, Mayor Town of Port Hawkesbury	IR # TOPH 1

Preamble:

Support for the Project

Request:

On behalf of Port Hawkesbury Town Council, we are pleased to provide a letter of support to the Municipality of the District of Guysborough for the proposed Goldboro LNG natural gas liquefaction plant and marine terminal.

We want to extend our assistance to you during Nova Scotia Environment's final phase of the environmental assessment for this project – a project which in its construction phase could generate over 4,000 jobs with the potential for 250 permanent jobs. In addition to creating new investment and employment opportunities for Guysborough County, the project would have a far reaching positive impact for the entire region.

On behalf of Port Hawkesbury Town Council, we look forward to offering our assistance and support to the Municipality of the District of Guysborough in moving the Goldboro LNG project forward.

Sincerely,

Billy Joe MacLean
Mayor, Town of Port Hawkesbury

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 12, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Krista Hilchey, Nova Scotia Environment Halifax Office	IR # NSE1

Preamble:

I have reviewed the environmental assessment (EA) document, dated September, 2013, for the above referenced project. My review focused on the potential for the proposed project to negatively affect wetlands. My comments are as follows:

Request:

1. I do have concerns regarding the proposed wetland alterations. Of the wetlands involved in the proposed wetland alterations, a high number have "red-highlighted" functions based on their Functional Assessments. As stated on the Nova Scotia Wetland Evaluation Technique Field Data Sheet (September 2011): "SF (significant function) ratings highlighted in red indicate critical wetland functions or watershed conditions that are highly degraded. Whenever a wetland is found to have red-highlighted SFs the proponent is encouraged to contact NSE for advice about the approval because NSE is unlikely to approve alterations to wetlands that would affect these red-rated functions". Although the EA states 7 of 13 potentially altered wetlands have red-rated functions, this is an error, as 9 of 13 have red-rated functions (the additional wetlands have fringing properties that are red-rated functions).
2. If wetland alterations are approved, given the number of high functioning wetlands on this property, compensation for wetland alteration at this site will require either a) additional requirements for compensation (i.e. wetland restoration to take place within a certain number of kms of the alteration) or b) a higher compensation ratio.

Response:

1. The proponent acknowledges that 9 of the 13 wetlands provide red rated functions; however, the seven wetlands referred to in the EA provide red rated "significant functions" (SF) according to the Nova Scotia Wetland Evaluation Technique Field Data Sheet (September 2011). The two wetlands that provide fringing functions (and no red rated SF) were not included in the summary, however functions provided by these wetlands (and all other wetlands proposed to be impacted) will be considered during the development of the wetland mitigation/compensation plan.
2. The proponent commits to developing a wetland compensation plan upon EA approval. The compensation plan will be established in close consultation with NSE as part of in the wetland alteration approval process pursuant to Part V of the *Nova Scotia Environment Act.*

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 13, 2013	Page 1 of 2
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Sharon Vervaet, P.Eng Industrial Management Unit, Nova Scotia Environment Halifax Office**	**IR #** **NSE2**

Preamble:

As requested, I have reviewed the air quality sections (excluding greenhouse gas emissions) of the Environmental Assessment submission for the above mentioned project, prepared by AMEC Environment & Infrastructure, dated September, 2013. I offer the following comments and concerns for your consideration:

Request:

1. When the engineering design is finalized for the project, a detailed air dispersion modelling report will be required. A full inventory of emissions should be included which would identify and model, amongst other air contaminants, the speciated volatile organic compounds (VOCs) anticipated for the facility
2. The engineering design may need to be modified to comply with the impending Base Level Industrial Emissions Requirements (BLIERS) under the Air Quality Management System.
3. Table 10.4-6 assumes that LNG carrier ships burn fuel comprised of 1% sulphur. This sulphur limit assumption seems low. What is the basis for this assumption?
4. Additional information is necessary prior to the Department determining whether an incinerator is required for acid gas removal. An emission inventory for this source is required.
5. The noise modelling predicted exceedences of the Departmental noise guidelines. These guideline levels will be limits in any Operating Approval issued for the project. Section 10.5.4 indicates that with proper noise mitigation design, the noise levels should be reduced to below the guideline values. How do they propose to reduce noise if the measures do not mitigate it within guideline limits?
6. Although the Air Quality Regulations do not include ambient objectives for VOCs, point of impingement limits for speciated VOCs should be applied to any Operating Approval issued for the project.

Response:

1. Agreed - The Project will be assessed for speciated VOCs once engineering design is finalized.
2. During the design phase, the Project will continue to be assessed if the proposed Federal Base Level Industrial Emissions Requirements (BLIERS) for the oil and gas industry become available.
3. On July 1, 2010, Marpol Annex VI established a the SOx Emission Control Area (SECA) which currently comprises the Baltic Sea, the North Sea, the English Channel and the area outside North America (200 nautical miles). The sulphur

content of fuel oil used onboard a ship is not to exceed 1% in weight. Based on this information, sulphur content in fuel oil of 1% by weight was used to calculate emission rates for use in the assessment.

Source: Wartsila. Wartsila Environmental Product Guide. Wartsila.com, January 1, 2013.

4. The FEED Project design includes two incinerators for acid gas removal. This requirement may change once final design is complete. As part of the EIA, the assessment included the emissions from the two acid gas removal incinerators. Refer to Table 3.3-4 Summary of Expected Emissions During Operation, Section 3.0 Project Description (Environmental Assessment Report) for an inventory of projected emissions from the operation of the two acid gas removal incinerators.
5. The plot plan, site topography, and equipment specifications will be advanced during FEED considering noise emissions. As part of that effort, the noise model will be detailed and re-run to predict the effectiveness of the refined design and associated noise abatement measures. If at that stage (after design refinement and noise modelling) noise levels at receptors are still predicted to be above the Nova Scotia guidelines, further noise mitigation measures will be developed. This would include the consideration of mitigation at the receptor site(s) and possibly relocation of affected receptor(s). Ultimately, Pieridae commits to design and operate the facility in such a way that no off-site receptors will experience, during normal operations, noise levels that exceed Nova Scotia guidelines.
6. As per the response to Item #1, above, the Project will be assessed for speciated VOCs when the engineering design is complete. Project related air emissions would be controlled to comply with Operating Approval conditions/limits.

Preamble:

Pieridae Energy submitted an environmental assessment report to develop and operate a natural gas liquefaction plant, liquefied natural gas (LNG) tanker terminal, and associated marine facilities in Goldboro, Guysborough County.

The project will have a capacity of 10 million tonnes per annum (Mtpa) and a gross LNG storage capacity of about 690,000 cubic metres in three tanks. The project proposal includes the construction of a 180 MW on-site gas-fired power plant.

The proponents expect the marine terminal and liquefaction plan to emit 3,778,290 tonnes CO2e/year. The proponent estimates GHG emissions from their operations will be:

- Incinerator for AGFS 566,386 tonnes/year
- Refrigerant compressor gas turbines 1,812,564
- Power generation gas turbine: 1,196,291
- Pilot/purge gas for flares 60,785
- Emergency diesel generator set 13,950
- LNG carriers (idling at berth) 47,694
- Leakage from nat gas processing plant 80,620

Request:

<u>General comments and recommendations:</u>

The proposed project would cause a significant 18% increase in Nova Scotia's GHG emissions, compared to the most recent 2011 total of 20.4 MT. With approximately 3.8 MT of annual GHG emissions, the Goldboro LNG Plant would be the largest emitter in the province when built. Nova Scotia's climate target, in the *Environmental Goals and Sustainable Prosperity Act* is to reduce GHG emissions to 10% below 1990 levels by 2020. In 2020, Nova Scotia's emissions must be at or below 17.1 MT.

Nova Scotia's existing Greenhouse Gas Emissions Regulations applies to the electricity sector only, which is currently the largest contributor of GHGs in the province. Electricity sector GHGs must decline gradually over time, to 7.5 MT or below by 2020 and 4.5 MT or below by 2030. Nova Scotia is currently in negotiations with the federal government towards an agreement that the new federal GHG regulations on coal-fired electricity would stand down in this province, in favour of the Nova Scotia regulation. Nova Scotia does not currently have any GHG regulations that would apply to LNG facilities. However, the federal government has indicated that they will be developing GHG regulations for the oil and gas sector. Other provinces with LNG potential, such as British Columbia, are also in the process of developing policy and regulations to address GHG emissions from LNG. The proponent

The Goldboro LNG Plant would be expected to comply with any future federal and/or provincial GHG policy, which may include requirements for GHG reductions, and/or place a financial penalty on GHG emissions. The Goldboro LNG Plant should be strongly encouraged to implement best available technology to minimize GHG emissions, as well as rigorous GHG measurement and reporting and continuous improvement in GHG performance in both absolute GHG emissions and GHG intensity.

The Climate Change Unit supports the proponent's willingness to develop a GHG Management Plan in concert with the NSE, and expects the plan to pursue progressive reduction of total net GHG emissions and/or GHG emissions per unit of product, with annual reporting, and provide a detailed implementation plan, including "low regrets" and "beyond no regrets" measures.

Response:

A GHG Management Plan will be developed in concert with NSE and will support the information provided in this IR.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 4
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Gordon Check, Hydrogeologist, Science Division, NS Environment	IR # NSE4

Preamble:

I have reviewed the September 2013 Environmental Assessment (EA) Registration document for the Goldboro LNG Project submitted by Pieridae Energy (Canada) Ltd. as prepared by AMEC Environment & Infrastructure, a Division of AMEC Americas Limited.

My review focussed on the potential for the proposed undertaking/project to adversely affect groundwater resources, including general groundwater quality and local water wells. Comments and recommendations are provided at the end.

Request:

Review Summary

The Goldboro LNG Project proposal entails the construction and operation of an onshore natural gas liquefaction processing plant, a marine terminal for loading carriers with LNG product and a wharf for mooring associated support vessels and unloading materials at the site location in Goldboro, Guysborough County, Nova Scotia (NS).

In addition to the marine facilities, more specifically, operations at the site include the Natural Gas Liquefaction Plant, large LNG storage tanks, a number of administrative, control and maintenance buildings; on-site gas electrical power generation; a natural gas feed pipeline from the M&NE pipeline; and a water supply pipeline accessing the nearby freshwater source of Meadow Lake. An on-site wastewater treatment plant is proposed to treat up to 600 m3 per day for discharge into the ocean.

There are no direct groundwater components to this project – i.e. no groundwater withdrawal requests or water well installations and no excavations planned below the water table. The potential for chemical quality impacts is mainly related to secondary site uses or activities (vehicles, maintenance) and not from LNG (a flammable gas but unlikely to affect groundwater). There is the potential for some indirect effects of site operation to groundwater and local water wells that will be examined here.

Sections 9 and 10 of the registration document (the “report”) deal specifically with the Existing Environment and the Environmental Effects Assessment. The majority of the proponent’s information related to groundwater and water wells are found in these sections.

Section 9.2.1 deals specifically with groundwater. The proponent provides a comprehensive review of groundwater in the area including groundwater flow directions. They also conducted a local water well survey of wells within 1 km of the site. The majority of water wells are cross-gradient from the main site operational area.

Approximately 15 of these wells were sampled for baseline water quality. Well information was presented from the NSE well logs database. It was noted that the majority of wells in the area are dug wells (27 out of 40) likely due to the low yields that bedrock wells have in this area.

Section 10.2 deals with Environmental Effects on Groundwater Resources. Groundwater is identified as a VEC (Value Environmental Component) and potential effects to groundwater from the proposed operations are addressed in this section.
Main potential areas covered, among others, include:

- Blasting effects on water wells for yield and quality, particularly in shallow wells
- Excavations and trench effects on water table lowering
- Baseflow reductions to streams resulting in dry streams
- Groundwater quality degradation from chemical spills
- Acidic rock drainage affecting water wells and streams
- Siltation affecting groundwater quality

Table 10.2.1 in the report describes a number of mitigation measures to address these potential effects.

Although groundwater was examined for the potential to provide water supply, low yields led the proponent to propose a surface water source (Meadow Lake). Due to the proposed withdrawal volumes of 600 m3 day a water withdrawal approval is required under the **Activities Designations Regulations**. The proponent's analysis suggests that the lake has approximately 25 % of it's baseflow coming from groundwater. The lake is about 7 km from the proposed operations site.

Section 10.17 of the report describes in more detail the proposed mitigation responses to Malfunctions and Accidental Events.

Section 12 provides Proposed Compliance and Effects Monitoring Programs. Table 12.0-1 provides a table of Monitoring Programs which includes groundwater resources and wells. It is noted that the proponent focusses on the pre-construction and construction time frames.

Section 14 provides the proponents Assessment Summary and Conclusions. Table 14.1-1 gives a Summary: Effects, Mitigations and Significance of Residual Effects.
For groundwater these effects are summarized by the proponent as:

- Potential effects for dug or drill wells on water quality (including siltation) and yield
- Potential water level reductions in dug wells

- Potential contamination of wells and/or on-site streams from remobilized mine tailings/contaminated soils.

The proponent provides mitigation measures for all these effects and concludes that all potential groundwater effects would have no "significance of adverse residual effect".

Surface water potential effects are similarly examined and the proponent reaches the same conclusions.

Comments and Recommendations

The proponent has provided a thorough evaluation of groundwater resources, local water wells information, the potential for effects on groundwater and wells from a wide range of construction scenarios, mitigation measures to address potential adverse effects and compliance monitoring proposed to properly assess for such effects.

No significant concerns respecting groundwater resources are raised in this review of the proponent's evaluation.

In several sections of the report dealing with compliance regarding contaminants and chemical spills, the proponent makes reference to out-of-date Departmental guidelines – the Guidelines for the Management of Contaminated Sites in Nova Scotia. However, new **Contaminated Sites Regulations** became effective in the province in July 2013, and all related contaminated sites work (should it be necessary) should be conducted following these regulations.

It was noted on page 3-37 that the proponent states "Drinking (potable) water will be produced to meet World Health Organization (WHO) standards". This should make reference instead to meeting provincial drinking water standards as provided by the **Water and Wastewater Facilities and Public Drinking Water Supplies Regulations**.

- While much of the potential monitoring actions around groundwater and wells will be dependent on site activities during the proposed construction phase, it should be noted that post-construction groundwater monitoring is also recommended. Groundwater quality effects may be slow to become evident due to groundwater flow times, so a minimum period for 1-2 years monitoring post-construction is recommended for those groundwater areas most likely to show impacts (i.e. for example existing water wells adjacent to the site, within 500 metres or so).

  There may be additional reasons for the proponents to provide long-term monitoring of some local residential water wells in areas potentially affected, and these should be considered.

Response:

Pieridae acknowledges that the Management of Contaminated Sites in Nova Scotia is out-of-date. In future, we shall refer to the new *Contaminated Sites Regulations* (under the *Environment Act*) for contaminated sites requirements and guidance (if applicable).

Pieridae acknowledges that the standards for acceptable drinking (potable) water should be those provided in the *Water and Wastewater Facilities and Public Drinking Water Supplies Regulations* (under the *Environment Act*).

A groundwater monitoring plan will be developed for both the construction and post – construction (operation) phases of the Project, as part of the Environmental Management Plan. The details of the monitoring program (test parameters, well number, location, duration) will be established in consultation with NSE. If required, this will involve the monitoring recommendations of the Science Division.

Preamble:

As requested, I've briefly reviewed aspects of the environmental assessment for the proposed Pieridae liquefied natural gas (LNG) facility at Goldboro, Guysborough County. My focus was on the Project Description document (section 3 of the overall environmental assessment package) and particularly those aspects that related to my current duties with industrial approvals and petroleum management.

Request:

In general, the report seems comprehensive but lacked many of the engineering and technical details that would permit an exhaustive review and development of proposed conditions for an industrial approval. As this report often noted, this level of detail would be generated at a later date if the proposed project passes through the EA process and the owners decide to proceed to the design and approval stage. It is possible that many of these issues could be adequately handled at the industrial approval level and would not be seen by me as barriers on this aspect of the EA process (recognizing that there are many other site-specific, ecological and economic or social factors that the EA process also considers). That being said, there are still several aspects that could be improved or clarified and would improve the response at the approval level. These are listed with respect to where they appeared in the document and are as follows:

1. s.3.3.9 notes that there will be space for a LNG truck loading facility for local usage. There is little detail provided on this and it is unclear if this would be part of this initial project or a later edition.
2. s.3.3.13 lists "cleaner" and "solvents" as materials stored onsite. This should be more precise to indicate potential issues.
3. s.3.3.13 combines "glycol/methanol". It is unclear if this references a specific mixture of these compounds or simply combines potential anti-freeze compounds. Clarity is needed since these have different management requirements.
4. s.3.3.13 notes fuel storage will be inside containment areas with 125% of the total volume of liquid stored. This should be expanded to require secondary containment and monitoring for individual tanks. It should also be clarified to require that incompatible materials not be stored within the same containment area.
5. s.3.6.3.1 (p.3.61) notes that the operator will compare CSA Z276-01 and NFPA 59A and, where differences occur, will generally use the more conservative requirement or, if not, will justify the decision to use the less stringent. This is a fairly weak statement for an important aspect and may potentially affect the design of the facility.
6. s.3.3.14 discussion of wastewater does not appear to differentiate well between process water, storm water and sewage (listed as "domestic water"). Will these

systems be separate or combined? This will have a significant effect on design and operation of the collection and treatment systems. This also notes that the treatment system will operate at near design capacity which would appear to leave minimal allowance for increased usage, upset conditions or incidents and should be addressed.

Response:

1. LNG Truck Loading will not form part of the Project.
2. The primary use of solvent on the facility is amine solution used in the acid gas removal unit (AGRU). Apart from this there may be some small scale use of chemical solvents in the site laboratory.

   Cleaners (apart from the use of domestic cleaning products around the facility) will include degreasing agent used in the commissioning of the AGRU and a proprietary detergent used in the online washing of the gas turbine blades (refrigerant compressor drive and power generation).

   A more precise list of materials, use and restrictions will be developed during FEED.
3. Glycol will be used as anti-freeze in various closed water systems (cooling loops or barrier fluid systems). The only other potential envisaged use is for hydrate inhibition during start-up activities where either glycol or methanol may be required but not a mixture of both.
4. Containment areas are considered as the secondary containment; which are bunded (i.e., tanks and storage areas are surrounded by a berm that provides secondary containment in the event of spills). Individual tanks will have monitoring, and appropriate segregation of materials will be undertaken where required.
5. Comment noted. Pieridae will also seek input on these issues from the regulator during approval applications under Part V of the *Nova Scotia Environment Act* and the Activities Designation Regulations.
6. Please find below a more detailed description of potential waste water system design. The plant wastewater treatment design will include capacity for upset conditions.

Wastewater Streams

Wastewater streams will be classified so that drainage design and appropriate treatment method(s) can be defined. Classifications and definitions of wastewater streams may include the following:

- Onsite Uncontaminated Runoff (OUR) - runoff from areas where surface rainwater cannot be contaminated by hydrocarbons or chemicals.
- Offsite Intercepted Runoff (OIR) - runoff from areas where surface rainwater run-off flows may be intercepted outside of the plant boundaries.
- Potentially Contaminated Water (PCW) - surface water from areas not designated as continuously contaminated which normally meets the required specification but on occasions can be contaminated through non-routine activities e.g. maintenance.
- Considered Contaminated Water (CCW) - effluent which contains significant percentage of hydrocarbons that do not meet the required water effluent specifications - including certain drainage steams (wash down water, and drainage from process areas subject to leaks and spills during normal operations).
- Domestic Sewage Effluent (DSE) - effluent derived from domestic sources, typically containing a significant BOD/COD load.
- Process Water (PW) - effluent derived from process sources.
- Chemical drains – spills and contaminated water shall be contained locally for off-site treatment

Wastewater treatment facility components

Typical constituents of the wastewater treatment facilities would be:

- Drainage Collection System including collection of the different streams mentioned above. Contaminated water streams will be segregated from non-contaminated streams as far as possible. The potentially contaminated collection will be site wide with contaminated collection focused in areas surrounding specific equipment.
- According to local conditions and regulations, sediment ponds may be established to capture silt and surface oil. These ponds may be installed during construction to control runoff from erosion following site clearance.
- Process Effluent Treatment Plant with potential treatment options:
  - CCW Collection Tank for Oily Stormwater Buffering;
  - Produced Water Buffer Tank;
  - Produced Water Oil Separator;

- Produced Water Cooling and pH Correction;
- BTEX Removal;
- Oily Water Treatment by Dissolved Air Flotation;
- Equalisation Tanks for Biotreatment Contaminant Buffering;
- Conventional Activated Sludge Biological Treatment;
- Biosludge Storage & Disposal;
- Treated Effluent Inspection & Monitoring; and
- Steam Condensate Blowdown Monitoring & Treatment.

- Sanitary Wastewater Treatment Plant with the following potential treatment options:
  - Sewage Balancing Tank for Diurnal Flow Buffering & 48hrs Storage;
  - Sequencing Batch Bioreactors;
  - Transfer Sumps & Pumps;
  - Enhanced Nutrient Removal;
  - Sand Filtration for Enhanced TSS & Phosphate Removal;
  - Sanitary Biosludge Storage Tank & Disposal; and
  - Treated Sanitary WW Tank for Water Reuse & Final Discharge.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Darrell Taylor, Water Quality Specialist, Science division, NS Environment	IR # NSE6

Preamble:

I have reviewed the EA report dated September 2013 for the above referenced project. My comments are provided for your consideration related to the management of surface water resources with a focus on freshwater. Note that while general comments on wetlands and groundwater may be included, applicable technical specialists should be consulted for specific guidance.

This proposed project involves the development and operation of a natural gas liquefaction plant, liquefied natural gas (LNG) tanker terminal, and associated marine facilities in Goldboro, Guysborough County. It also involves the development of a gas-fired power generation plant. The project location is identical to the site that was proposed for the LNG facility component of the Keltic Petrochemicals and LNG Facility Project assessed in 2006-08 that was approved but never executed.

Request:

1. Most of the comments from my previous review of the Keltic LNG project in October 2006 are still pertinent to the current project review. Those comments of October 30, 2006 are attached for reference and should be consulted. Several of the points mentioned in those comments are reiterated below.

2. In the current registration report surface waters are identified as a VEC, with protection of aquatic life and associated habitat an important management goal. No surface water related registered public or municipal drinking water supplies were identified which could be potentially affected by this project.

3. Important fish species such as Atlantic salmon and brook trout were found in watercourses on and near the project site and should be protected. Consultation with fisheries management agencies including DFO will be important to assess fish habitat, maintenance flows / water levels, and appropriate protection measures.

4. As indicated in the report, the project has potential to impact surface waters from many activities including those mentioned in previous comments. Such activities include the development of gravel pits, road construction, stream crossings, blasting, concrete use and disposal, and petroleum products from facility operations and heavy ground-moving equipment. Hazardous materials will also be used and stored on–site. The disturbance of acid bearing slates and /or old (gold) mines and tailing disposal areas in the area is particularly problematic and can cause acid drainage and mercury and arsenic release. Construction and operation of a heavy industrial water supply (including a dam if still proposed)

and a 7 km pipeline to the facility can also impact watercourses, wetlands, and associated surface water resource use.

5. Mitigation measures are outlined in general terms in the report, with a number of appropriate guidance documents referenced - including NSE's Erosion & Sedimentation Control Handbook and Guidelines for Developing on Slates in Nova Scotia, as well as federal guidelines for blasting near fish-bearing waters.

6. It is understood that the intent is to provide detailed Environmental Protection Plans, Environmental Compliance and Effects Monitoring Plans, and Contingency plans after final project design has been determined. In order to manage risks to surface waters, it is important that appropriate detailed surface water protection, mitigation and monitoring plans be included, and subsequently employed.

7. Water supply needs for the construction and operation of this facility is substantial and a significant concern which was flagged in the previous Keltic project proposal. Although the rationale for selecting Meadow Lake know has been clarified, as being avoidance of previous mining areas and a more reliable water supply, other concerns identified in previous comments remain. It appears that water supply requirements in the current project proposal has been significantly reduced (from 1200 m3 / hour to a peak of 30 m3 / hour – Appendix C, page 1) and that a dam is no longer part of the proposal. If that is the case, then concerns surrounding watershed flooding, associated release of contaminants, and dam safety may no longer exist. Concerns related to estimated monthly stream flows remain. Since these estimates influence subsequent projections of available water supply, and possible need for a dam, confirmation of monthly stream flows would seem prudent.

8. Proposed mitigative measures in the report include maintaining 20 meter riparian vegetated buffer distances around watercourses. Riparian vegetated buffer distances of 30 meters are generally proposed to protect surface waters, which would provide a higher level of protection. Inclusion of these larger distances should be considered. Additionally, a 50 meter setback from watercourses is proposed for fuel and chemical storage on-site. This could be extended to 100 meters as has been generally proposed for similar development proposals.

9. The report in section 10.3.1.1 cites the CCME CWQG for Protection of Aquatic Life for Total Suspended solids for 'clear flows' as being; a maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). And a maximum average increase of 25 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d). It should be noted

that the CCME advises the maximum average increase for longer term exposures to not exceed 5 mg/l from background levels as opposed to 25 mg/l. Although erroneous this does not affect the conclusions of the report.

10. It would be advised to better characterize surface water quality when undertaking further baseline or follow-up studies. This should include field measurements for pH, conductivity, dissolved oxygen, and turbidity. And where surface water samples are taken, lab analysis of parameters should be performed to the lowest detection limit possible – for example nutrients such as Phosphorus should be analyzed at a detection limit of 1 ug/l for Total Phosphorus and ortho Phosphorus. Surface Water Monitoring Results (Appendix J) currently show water quality results for Phosphorus with wastewater level detection limits which do not allow trends to be assessed since all results are less than detection limits.

Response:

1. We have reviewed the comments provided for the previous Keltic project to ensure that relevant observations are incorporated into the Goldboro LNG Project implementation going forward. We conclude that most of those issues have been addressed in the current EA report.

   It is particularly important to understand that the proposed water withdrawal volume is only 1.2 % of the lowest average monthly flow in Isaac's Harbour River (compared to 61% for the Keltic project), and there will be no permanent dam associated with the Goldboro LNG Project. Therefore, the several potential issues related to flooding of Meadow Lake and impacts on water quality and flow management are not applicable. A temporary coffer dam is currently proposed for construction of the water intake structure and pump house, in order to do the work "in the dry". This will not affect water levels or connectivity.

   Wetland impacts at Meadow Lake are likewise not applicable, although it should be noted that the current EA report does make clear commitments to provide wetland compensation for other Project impacts on wetland functions.

   The information provided on flow volumes in Isaac's Harbour River and Meadow Lake was developed for the Keltic project and was used as the starting point for the Goldboro LNG assessment. The hydrological study conducted by Keltic was based on considerable field measurements and modelling, and we considered this adequate for the current assessment. The Keltic EA included the hydrological study as an appendix; which we have attached for your convenience (see Appendix 3 at the end of this response document). We reviewed the study

again, with reference to your comments on confidence in the monthly flow data and seasonality. We believe the predictions can be relied on.

We take note of the reference to the NSEL "Guide to Surface Water Withdrawal Approvals"; which will be applicable to the Project. As part of the application, the sustainable yield curve will be generated in order to demonstrate that the proposed withdrawal can be done while maintaining minimum flows for downstream water use.

We take note of comments on water quality sampling and analytical procedures and will consider these recommendations when developing future monitoring programs for the Project. Monitoring protocols will be detailed as part of the EMP that will be developed following EA approval. The EMP will be subject to regulatory review, including consultation with NSE.

2. Comment noted. Pieridae recognizes the importance of potential impacts on surface water quantity and quality relative to aquatic habitat and water use. While no current water users have been identified in the Isaac's Harbour River watershed, we consider that future opportunities are also a resource, and that the Project will not prevent additional water withdrawal for typical residential or moderate industrial purposes.

3. Comment noted. As stated above, a Surface Water Withdrawal Approval will be required; which includes an assessment of sustainable yield relative to maintenance of downstream fish habitat and fish passage. DFO has been contacted with respect to potential fish habitat compensation requirements and the implications of recent changes in federal legislation.

4. Pieridae acknowledges the potential impacts identified as being relevant to the Project, with the exception of the dam related issues. There will be no permanent dam or flow control structure in the design, since the proposed water withdrawal volume is so small.

   Specific mitigation for the identified risks to surface water quality, including contingency planning, will be detailed in the EMP following EA Approval.

5. Comment noted. Pieridae will review and update the list of guidance documents during development of the EMP.

6. Comment noted. As above, the detailed mitigation, including environmental protection plans, contingency plans, and monitoring plans (both compliance and effects) will be clearly identified in the EMP.

7. There will be no permanent dam associated with the Goldboro LNG Project. Therefore, the several potential issues related to flooding of Meadow Lake and impacts on water quality and flow management are not applicable. A temporary coffer dam is currently proposed for construction of the water intake structure and pump house, in order to do the work "in the dry". This will not affect water levels or connectivity.

   The hydrological study conducted by Keltic was based on considerable field measurements and modelling (attached - see Appendix 3 at the end of this response document), and we considered this adequate for the current assessment.

   The proposed water withdrawal volume is only 1.2% of the lowest monthly average flow and 0.23% of the mean annual flow. Considering that the natural variation in monthly average flows is nearly 1000% and that every other month of the year averages between 3 and 10 times the lowest average flow, the likely impact of the Project on downstream flow and water level in Meadow Lake will be extremely small. The Project will nevertheless also provide some on-site water storage capacity to buffer a short-term supply shortage. Typical on-site storage would include 8 days potable water, 3 days service water, and 2 hours fire-fighting capacity (with seawater backup). However, within these periods alternative water sources could be established and operation/maintenance could be adjusted to reduce water consumption hence plant operation should not be significantly affected on a temporary basis.

8. The details of environmental protection measures will be provided in the EMP. Pieridae will incorporate the recommended buffer/setback distances to the extent practical, and in compliance with regulatory permit requirements.

9. Pieridae acknowledges that CCME guidelines for longer term exposures to TSS (e.g., from 24 hours to 30 days) indicates the maximum average increase should not exceed 5 mg/l from background levels. The monitoring protocols, including parameters and allowable concentrations, will be specified in the EMP, subject to regulatory review.

10. Pieridae will consider the recommendations for surface water sampling procedures when developing future monitoring programs, as part of the EMP. Monitoring locations, frequency, test parameters lab methods, and reporting will comply with regulatory permit requirements and conditions of approval.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 13, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Vernon Pitts, Warden Municipality of the District of Guysborough (MODG)**	**IR #** **MODG1**

Preamble:

Support for the Project

Request:

On behalf of the Municipality of the District of Guysborough (MODG) we would like to convey our support for the construction of a natural gas liquefaction plant and marine terminal in Goldboro, Guysborough County, Nova Scotia.

The MODG has worked closely with the developer, Pieridae Energy, and have been impressed with the attention to detail and the level of ongoing communications with both Council and the community.

The MODG has invested significantly in acquiring lands for future industrial development and identifying specific zones for a variety of uses within our Municipality. We have completed land use planning, through broad consultation with local residents. In fact, we are one of the very few select municipalities in rural Nova Scotia with current land use plans for all districts within our jurisdiction.

Like many rural communities in Nova Scotia, the MODG has also experienced significant population decline. In fact, these declines are among the highest percentage-wise in Canada. The Goldboro LNG project will profoundly impact the MODG, our region, and the Province of Nova Scotia. We have had a very positive experience with both the Sable Offshore Energy Project and also with Deep Panuke.

We have well established processes in place to interface effectively with large-scale industrial developments. These processes provide an avenue for open, ongoing communications with developments located within our Municipality. Pieridae have been very responsive, open and supportive in responding to and addressing any concerns or issues arising in the early development phase of the project and we look forward to continuing to build on this relationship as we move to construction and operation.

In closing, we appreciate the important role that you play in reviewing these projects and wish to, once again convey our strong support for this development.

Respectfully submitted

Vernon Pitts, Warden
Municipality of the District of Guysborough

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 13, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Mihai Balaban, Manager Compliance and Enforcement, Transport Canada, Marine Safety - Atlantic**	**IR #** **TCMSS1**

Preamble:

I would like to provide the following comment:

"Pieridae Energy Canada Ltd, the proponent for the Goldboro LNG Terminal, formally requested TC to initiate a TERMPOL Review Process in order to evaluate this submission with respect to dedicated vessel design, the selected route for the vessels in waters under Canadian jurisdiction, vessel navigation and approaches to the terminal, cargo handling equipment and procedures, terminal operations procedures and port information.

Request:

As the majority of the items covered by the TERMPOL review don't appear to be covered in the environmental assessment posted on the Nova Scotia Environment internet site, TCMSS is recommending that the conclusions, recommendations and any limitations which may be revealed, as a result of the TERMPOL Review, be taken into consideration by the NS Government for the purpose of issuing any permits or authorizations.

Please keep us posted with any new developments.

Response:

Pieridae is looking forward to working with TCMSS through the TERMPOL review process. Pieridae initiated the voluntary process in order to detail the design and operational aspects of the Project's marine components in close cooperation with and input from all participating government agencies.

The environmental assessment has been conducted based on a Pre-FEED level of information. As discussed with TCMSS, the detailed engineering and design (FEED) is scheduled to commence immediately upon receipt of the EA approval. Pieridae is committed to integrate and implement the outcomes of the TERMPOL review process with the marine designs and operational plans to be established during FEED.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 3
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Angela Swaine, Environmental Analyst, NS Transportation and Infrastructure Renewal	IR # NSTIR1

Preamble:

NSTIR staff have reviewed the EA for the proposed Goldboro LNG project and offer the following comments:

Request:

Traffic Engineering and Road Safety

1. The information provided in the EA is a Traffic Impact Analysis. TIR would require more detail in the form of a Traffic Impact Study outlining the types, weights and volumes of trucks and other materials that will be used throughout the course of the project, including during construction, so that the proposed route can be analyzed. Any impacts due to the classes of road and spring weight restrictions would be able to be analyzed at this time as well. The TIS would be able to identify any pavement strengthening, road modifications or structure reinforcements that may be required on the proposed route. While for a different project, attaching the 2007 study as an appendix is also recommended.

2. A Working Within the Highway Right of Way Permit would be required as there are several references to access roads being required. Any accesses off of any provincially owned roads would need to meet Departmental guidelines and be approved by Department staff. This would be done in conjunction with this permit.

3. Any work areas on any provincially owned roads would need to be in compliance with the appropriate sections of the Nova Scotia Temporary Workplace Traffic Control Manual.

4. There may be a requirement for a Special Moves Permit, as there are references to oversize/overweight loads. These are available from Service Nova Scotia and Municipal Relations. Our Departmental contact for these is Mike Balsom and the proponent is encouraged to contact him as soon as possible to get this process started. He can be reached at balsommg@gov.ns.ca

Highway Planning and Design

5. Presently, the proposed Rte 316 realignment is only at its very early pre-planning stages. As part of this process, this will require extensive collection of data, an extensive consultation process with stakeholders and selection of a proposed alignment. Depending on what alignment is chosen, there is a good possibility that the proposed road may require another EA. Once the alignment has been finalized, the highway would still need to undergo detailed design. This entire

process typically takes 18 months to 2 years with construction another 24 months.

Structures

6. There have been no evaluations of any of the structures on the proposed route to determine if they can withstand the weights of the types of vehicles and equipment that are to be used in the construction and operation of this project. There has not been any information provided in the EA to indicate the types of trucks that would be used. Should any structural strengthening be required and identified as a result of these analyses, they would need to get completed prior to the project being started. This may require revised structural designs, which would need to get developed, tendered and constructed. This would take up to 18 to 24 months.

Response:

Traffic Engineering and Road Safety

1. Pieridae will determine the specific transportation requirements for the construction phase during FEED. This will include types, weights and volumes of trucks, as well as loads and materials to be hauled to the site. An assessment of the road infrastructure was conducted as part of the Keltic EA (AMEC 2006) and through a follow up study in 2007 (Atlantic Road & Traffic Management - ARTM 2007), which provided suggestions for road improvements (e.g., horizontal alignment improvements). As suggested, that study has been attached to this response document (Appendix 4). Once the construction requirements have been established Pieridae will update the study's analysis and recommendations in order to determine, in consultation with TIR and local /regional municipalities, requirements for improvements (e.g., pavement strengthening, road modifications or structure reinforcements) and their implementation.
2. Pieridae will consult with NSTIR during FEED to ensure all of its access roads are designed in accordance with the Department's guidelines and to obtain the necessary "Working Within the Highway Right of Way Permit".
3. Pieridae will consult with NSTIR during FEED to ensure all of its work areas on provincially owned roads will be in compliance with the appropriate sections of the Nova Scotia Temporary Workplace Traffic Control Manual
4. As stated in the EA, in a project of this scale, it is possible for the construction traffic to include oversized/overweight loads. This traffic may require temporary special markings, traffic control measures, and/or traffic interruptions. Pieridae

will determine the specific requirements for oversize/overweight loads during FEED. This will also include an investigation of avoidance of the road infrastructure through shipments of any such loads via barge. As soon as the Project's road transport needs have been refined, Pieridae will be in contact with Mr. Mike Balsom to initiate the Special Moves Permit application process.

5. Comment noted. Pieridae will stay in close contact with NSTIR for coordinating its own schedule with NSTIR's project development efforts. Pieridae offers to make environmental baseline data from its EA report and subsequent technical studies available to NSTIR for use in the development and/or assessment of road alignments.

Structures

6. As stated above, Pieridae will determine the road transportation requirements during FEED. This will include a specification of the type, the number, and the weight of trucks and loads to be hauled. This will also determine the requirements for oversize/overweight loads should these loads not all be shipped to the site by barge. Once the specific information has been established Pieridae will consult with NSTIR, local and regional municipalities on the requirements for and implementation of upgrades to the existing transportation infrastructure.

Preamble:

Staff of the Department of Communities, Culture and Heritage have reviewed the registration document for the Goldboro LNG Project and have provided the following comments:

Request:

1) Archaeological and Historical Sites

Staff is unable to sign off on the archaeology at this time because the EA document lists archaeology yet to be completed. Overall, there has been a thorough approach to the archaeology however, there is clearly more work that needs to be carried out. There are 2 main sections on archaeological resources and mitigation. See Sections 9.12 and 10.16.

The EA document contains a comprehensive list of archaeologically sensitive areas noted in the Archaeological Resource Impact Assessments completed by Davis, Macintyre and Associates (2004, 2007, 2007a), that may be impacted by the development and associated projects. To help address these areas the EA includes reference to an overall archaeological monitoring contingency plan that will be in affect during the phases of construction. It will be important to specify what this plan includes. No details are provided.

Items noted and not yet completed under the heritage research permit for assessment work include the underwater investigation/review for heritage and/or archaeological resources, the investigation of the east portion of the project impact area, and the 2 additional areas yet to be archaeologically assessed at Meadow Lake. The EA notes the overall potential for First Nation archaeological resources and early in Section 9.12, 3 areas, Schoolhouse Brook, Webb Cove and the head of harbour at Isaac's River, are identified as having potential for pre-Contact archaeological resources. Staff were unable to find specific follow up information for these areas in the document.

The plan that is included shows the development footprint and identified archaeological resources however it does not show where the noted pre-Contact areas are in relationship to the developmental footprint. Webb Cove is on the map but not Schoolhouse Brook or the head of harbour at Isaac's River. It will be important to see if these three areas are going to be impacted or if they are outside the developmental area.

Section 10.16 Archaeological Resources (p. 10-187) covers details on basic mitigation plans. Again, the monitoring contingency plan should be detailed as well as a human remains protocol given Red Head Cemetery. In Section 10.16.2.1, when the sensitivity of Redhead Cemetery is discussed, there is this additional statement: "The precise Project footprint for the various construction activities has not been identified with respect to the

other known archaeological sites/resources and therefore the potential for disturbance is poorly defined." Noted after this statement is, as the project progresses through FEED stages: further studies may be necessary; mitigation will be required.

For a proposed project area with many archaeological resources identified, Staff has concerns with things being poorly defined. Staff recommends that as the footprints are defined, qualified archaeologists should be brought in, prior to disturbances, to ensure the archaeological assessments for the footprints are complete. More clarity is needed around the mitigation plans for underwater/coastal heritage/archaeological resources. It is mentioned that periodic monitoring along the shoreline will take place during operation (Table 10.16.2). It is important to define and clearly schedule monitoring plans. Finally, archaeological awareness and sensitivity training for construction crews is mentioned in the document. It is important to better define plans for what this will specifically include.

2) Botany

Staff has reviewed the records for plant species-at-risk in our files and report that the following species-at-risk may be found within the footprint as outlined in the request.

Betula michauxii Yellow
Eriophorum gracile Yellow

The presence/absence of these species should be determined during field assessment and reported in any submission. Our recommendation is that field assessment be conducted during the growing season or when the identity can be determined to species or variety. The ranks are the national status ranks for Nova Scotia.

3) Zoology

Staff has reviewed the report. The found it appears to be a reasonable representation of our understanding of the site, and have nothing to add to it at this time.

Sincerely,

Sean Weseloh McKeane
Coordinator, Special Places

Response:

1. ***Archaeological Monitoring Contingency Plan (AMCP):*** The AMCP for this Project will include two principal elements, construction monitoring and post-construction (operation) monitoring.

   Construction Monitoring – For the areas where archaeological construction monitoring has been recommended, a permitted archaeologist will be required to be

on site to observe all subsurface disturbances within 30 metres of the identified location of archaeological interest. This will include grubbing activities as well as excavations. Project specific monitoring protocols will be developed for both the discovery of archaeological resources and the discovery of human remains. These protocols will outline the steps that will be taken by the monitoring archaeologist should either of these discoveries be made during construction. These steps will include: halting excavations, initial analysis of the find, contacting and consultation with the provincial regulator, contacting the proponent, consultation with a faunal expert (osteologist), and contacting the appropriate police agency (should human remains be discovered that may be associated with a criminal act).

Post-Construction Monitoring – As was recommended from the initial survey of the Project area conducted in 2004 and reiterated in the EA, the shoreline areas of archaeological interest (Sculpin Cove 1-5, Hurricane Island Mine, Dun Cove, Giffin's Mill, and McMillan Mine) will be visually surveyed prior to construction. The proposed post-construction monitoring program will include an annual survey of these locations for five years following construction and twice more (every two years) over the next four years. This will allow the monitoring of the effects of erosion on, and possible exposure of, the identified archaeological areas of interest located along the shorelines.

The AMCP, which will include detailed monitoring protocols, will be included in the Heritage Research Permit Application, which will be submitted to the provincial regulator, to conduct the archaeological monitoring activities for this Project.

Investigation/review of underwater heritage/archaeological resources: A desktop review has been conducted of the potential for underwater marine archaeological resources in the vicinity of the Project development area. This research included searches of online shipwreck databases (Shipwrecks of Nova Scotia 2013, Maritime Museum of the Atlantic 2013, Wreck Site 2013), and a review of relevant texts concerning shipwrecks in the area (Cooke 1976, Hart 1975, Zinck 1975, Zinck 1977). In addition, a review was completed of previous marine investigations conducted in Stormont Bay area, which included sonar, seismic, video, geophysical, and marine monitoring of pipeline construction investigations. The result of the desktop review is included in the forthcoming permit report for the present studies (A2013NS014). It is not anticipated that any underwater marine archaeological resources will be negatively impacted by the construction of the Project's marine components or the potential increase of shipping traffic in this area.

Areas Requiring Field Assessments: As stated in the EA, there are three locations that require field assessments prior to the initiation of construction activities in those areas. In the southeast of the Project area, desktop research indicated that there is potential for the remnants of Buckley Farm, which were not identified during the original visual survey (DAC 2004). As was recommended in 2004, it is proposed that

"this area be resurveyed by an archaeologist once the brush is cleared from the impact area" (DAC 2004). This activity will be conducted following the pre-construction clearing of this area. Should archaeological resources be identified as a result of this resurvey, further mitigation measures will be recommended prior to construction. The other two areas that have not yet been archaeologically surveyed are the two ends of the proposed Meadow Lake water supply pipeline route. These sections of the proposed linear corridor route, along with a yet to be more accurately delineated location for a pump house, will be visually surveyed by a permitted archaeologist prior to construction activities in those areas. If subsurface testing is deemed warranted for either of these areas, an appropriate testing program will be developed in consultation with the provincial regulator, and will be conducted prior to construction.

Previously reported areas with potential for First Nations archaeological resources: The preliminary desktop review for the Project area was conducted in 2004. It was reported at that time that there were three locations in the vicinity of the Project area where "Mi'kmaq encampments" may have been situated: Schoolhouse Brook, the head of the harbour on Isaac's Harbour River, and possibly at Webb's Cove (DAC 2004). It is unclear why a potential encampment at Schoolhouse Brook was mentioned in the 2004 studies as there does not appear to be a "Schoolhouse Brook" in the vicinity of the Project area. However, both the head of the harbour on Isaac's Harbour River and Webb's Cove are located outside of the Project area. The head of the harbour on Isaac's Harbour River is located approximately five kilometres northwest of the principal Project area (where Isaac's Harbour River empties into Isaac's Harbour) and Webb's Cove is located approximately 150 metres northwest of the Project impact area. These locations will be mentioned and depicted in the forthcoming permit report for the present studies (A2013NS014).

When precise Project impact areas (footprints) are defined: Once the precise Project footprints have been defined, a qualified archaeologist will review the previous investigations conducted in these areas to ensure that the archaeological assessments for the footprints are complete. Should it be determined that additional investigations are warranted, the provincial regulator will be informed and consulted.

Heritage/archaeological awareness and sensitivity training for construction crew: The proposed archaeological awareness and sensitivity training for construction crews will be developed and delivered prior to the commencement of the construction of this Project. This training will likely be conducted concurrently with the Project safety training. The following is a draft outline of what will be included in the archaeological awareness and sensitivity training:

- Aboriginal cultural sensitivity.
- What is an archaeological resource?
    - pre-contact; and

  - historical.
- Indicators of archaeological resources (features and artifacts):
  - pre-contact; and
  - historical.
- Specific to the Goldboro Project:
  - research;
  - elevated potential areas; and
  - identification of archaeological resources.
- Potential for the recovery of human remains.
- Discovery of human remains protocol.
- Discovery of potential archaeological resources protocol.

The Project proponent will make an active effort to involve KMKNO in both the development and delivery of the pre-contact archaeological resources and the Mi'kmaw cultural information sections of this training.

References:

Cooke, Findlay. 1976. History and Stories of Isaac's Harbour and Goldboro. Formac Limited: Antigonish, Nova Scotia.

Davis Archaeological Consultants Limited (DAC). 2004. Archaeological Resource Impact Assessment: Goldboro Industrial Park. Heritage Research Permit A2004NS76. Manuscript on file, Nova Scotia Nova Scotia Museum.

Hart, H.C. 1975. History of the County of Guysborough Nova Scotia. Mika Publishing: Bellville Ontario.

Zinck, J. 1977. Shipwrecks of Nova Scotia: Volume II. Lancelot Press: Windsor, Nova Scotia.

Zinck, J. 1975. Shipwrecks of Nova Scotia: Volume I. Lancelot Press: Windsor, Nova Scotia.

2. ***Botany***: Rare vascular plant field surveys were carried out in 2012 and 2013 at the Project site, and neither species was found in the survey footprint. In preparation for field surveys, data on known occurrences of fauna and flora rare species at and near the Project site were requested from DCCH as well as ACCDC. Both sources listed *Betula michauxii* and *Eriophorum gracile* as having known occurrences near the Project site (see Appendix K of the EA Report). AMEC personnel were therefore aware of the potential presence of these and many other species-at-risk at the Project site and did look for them. None were found. Field surveys were carried out in the appropriate phenology windows (September 2012 and June, 2013; see Appendix D-1 and D-3 of the EA, respectively). *Eriophorum gracile* flowers in early summer, and *Betula michauxii* can be easily identified whenever it has leaves.

In addition to confirming the absence of both species in the Project footprint, the field surveys showed that there is a very limited amount of habitat present at the site that would be suitable for these two species: *B. michauxii* grows in bogs, and *E. gracile* in bogs, fens and on peat. There are few bogs in the Project footprint, but there are several fens, most of them small (see Section 10.8 of the EA).

3. ***Zoology:*** Comment noted.

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GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Edward Parker, Fisheries Protection Biologist Fisheries and Oceans Canada**	**IR #** **DFO 1**

Preamble:

DFO comments on the Environmental Assessment Report for the Goldboro LNG Project

Request:

Fisheries and Oceans Canada (DFO) has reviewed the Environmental Assessment Report (the Report) for the Goldboro LNG Project whereby Pieridae Energy (Canada) Ltd. is proposing 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.

On November 26, 2013, changes to the *Fisheries Act* replaced the habitat protection provisions with the fisheries protection provisions. In accordance with these changes, the Goldboro LNG Project is being reviewed to determine whether it is a work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery which is prohibited under subsection 35(1) of the *Fisheries Act,* or by sections 32, 33 and 58 of the *Species at Risk Act* that apply to aquatic species. Information on these changes and how projects are assessed, including regulatory timelines and information requirements, can be found on DFO's website at http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html.

Based on the information provided thus far, DFO is of the view that the Goldboro LNG Project could potentially result in serious harm to fish. However, the design plans of the various project components interacting with the freshwater and marine environments have not yet been finalized. In order to complete our review, final design details must be reviewed to determine the specific regulatory requirements pursuant to the *Fisheries Act.* In addition to the assessment of whether serious harm is likely to occur, the completeness of information will be assessed, final mitigations set in place, and offsetting identified to offset any potential serious harm.

DFO notes that the Report does not contain detailed or localized information on marine commercial, recreational or Aboriginal fisheries in relation to the project. More detailed information on marine fishery activities in the vicinity of the project is required in order to assess the potential impacts on patterns of access and use by local fishers. DFO acknowledges that the proponent intends mitigation through a marine fisheries offset plan and consultation with local fishers, and recommends that the proponent establish effective consultation and information sharing with affected fishing interests to minimize potential impacts on access and use. This includes the incorporation of fishery-related interactions in environmental effects monitoring programs.

DFO also notes that additional information on ecologically and biologically significant areas in the vicinity of the project is available in the following publication:

Gromack, A.G., Allard, K., Fenton, D., Johnston, S., and Ford, J. 2010. Ecological and Human Use Information for Twenty Areas on the Atlantic Coast of Nova Scotia in Support of Conservation Planning. Can. Tech. Rep. Fish. Aqua. Sci. 2880: xiv + 226 pp.

An updated DFO report covering ecologically and biologically significant areas in the project area will soon be completed and will be made available to the proponent in early 2014.

DFO will continue participating in the ongoing Aboriginal consultations in fulfillment of the Government of Canada's duty to consult with First Nations, prior to issuance of an authorization for serious harm.

Yours sincerely,

Edward Parker
Fisheries Protection Biologist
Fisheries Protection Program
Fisheries and Oceans Canada
Dartmouth, NS

Response:

AMEC will provide DFO with all final Project designs for review once they have been approved for distribution.

Most of the information on marine commercial, recreational or Aboriginal fisheries was supplied to AMEC by DFO. The existing environment presented in the Environmental Assessment Report represents the up to date commercial fishery information available from the Department, augmented by public and stakeholder consultations.

Pieridae has been in contact with the GCIFA and individual local fishers since the early stages of the Project to discuss the proposed undertaking, fisheries related concerns, and resource management issues. Pieridae will continue this consultation to further develop its approach to mitigation and marine fisheries offset plans. Pieridae has also established a CLC. The CLC is meant to provide a public forum to address environmental and economic issues including fisheries as one of the economic backstays of the local communities. Pieridae will ensure adequate representation of inshore and offshore fisheries interests among the CLC members.

The Gromack *et. al*, 2010 report has been reviewed. The St. Mary's River has been noted as an Ecologically and Biologically Significant Area. It is greater than 15 km from the Project site; therefore, no direct interaction with the Project is anticipated. The St. Mary's River will be considered in future shipping related risk assessment.

Preamble:

DNR has been requested to review the Environmental Assessment document and provides the following comments.

General Comments & Recommendations:

Wildlife:

Comments submitted by: Mark Elderkin

Overview:
The proposed Goldboro LNG plant is located within a 3,000 hectare land area designated (zoned) for marine terminal and other types of industrial development on the Eastern Shore of Nova Scotia. The Goldboro LNG proposes to utilize 150 hectares of the total area within the industrial park which is mostly undeveloped at this point.

Notwithstanding the existing land zoning of the industrial park, the proposed development area and that surrounding it, supports a diverse array of wildlife habitats and wild species therein, with rich biodiversity in freshwater, marine and terrestrial environments. While the consultants and authors of the EA have made commendable efforts and investment in building on the foundation of earlier environmental assessment work done within the general area it is the department's view that further work will be required to effectively assay risks of certain project components in the pre-development, development and operational phases.
The authors are commended for undertaking additional inventories for lichens, vascular plants and new inventory for dragonflies and butterflies included in this new EA registration.

Request:

Primary Issues Identified with the EA Registration:

1. Lack of effective address to assay impacts of flaring gas in a foggy coastal environment, known as a corridor for many coastal and migratory birds (Leach's Petrels, songbirds etc)
2. Lack of effective management planning provided in the document with intent to reduce requirement of gas flaring during sensitive bird migration periods in spring and fall that could minimize, or eliminate a repetition of the high avian mortality experienced at CANAPORT in St. John, New Brunswick.
3. Lack of monitoring in the EA proposed for the project to assess mortality impacts on birds and bats posed by flaring gas or acknowledgement of high potential risks.
4. Lack of clear address to assay impacts and identification of effective mitigation for endangered species and habitats including mainland moose (Endangered,

NS Endangered Species Act), three species of bats (Endangered, *NS Endangered Species Act*, COSEWIC).

5. Lack of effective, tangible mitigation and compensation defined with clarity to identify the mechanisms, thresholds and levels of expectations in the document based on probability of adverse effect (Monies for research, land acquisition, corporate stewardship etc.) that would be provided by Pieridae Energy (Canada) Limited as required to offset the direct and indirect losses incurred on endangered species, habitats, ecosystems, loss of landscape connectivity and other adverse effects, including cumulative effects of the project on wildlife.
6. Absence of effective review to assess impacts or commitment to monitoring of cumulative effects on endangered organisms, species of conservation and inadequate commitment to monitoring changes over the lifetime of the project. The failure to assess cumulative impacts at the species level makes it difficult to understand the scope and ramifications of impacts that will extend beyond the immediate project footprint's geography.

<u>Specifics Surrounding Identified Primary Issues:</u>

7. Projects of this geographic scale located in relatively unsettled areas of the province are rare and it is for this reason that one can expect elevated levels of risk and impact on wild species and habitats and ecosystem. Elevated risks associated with this project include loss of landscape connectivity, overt losses and degradation of habitats including wetlands, impacts on the coastal environment and on some radius of geography extending well beyond the project footprint under consideration in the EA.
8. Other potentially adverse effects overlooked in the EA include the impacts and risks of gas flaring in a foggy coastal environment on migratory birds with reasonably inferred expectations for mortality in the absence of effective management planning, monitoring etc. Anecdotal reports by fisherman and local people of an existing gas flare located near the proposed Goldboro site indicate Leach's Storm Petrels in fog are lured to the flare and die.
9. The proponents recognized the potential for impacts on habitats and species in earlier meetings with NSDNR prior to submitting the EA and gave verbal indication of their intention to invest in research, monitoring and stewardship in light of adverse effects. While the authors acknowledge a will to compensate to some level for these overt losses of landscape function, habitats and species at risk and conservation concern at various points in the EA, the document does not convey accurately the uncertainties or levels of risk. The level of compensation that is reasonable is not alluded to at all. The overwhelming conclusion of the EA to all of these points is that there will be no adverse effects posed by the project footprint, technologies and infrastructure on coastal habitats, terrestrial and freshwater environment. The conclusions in the EA are unsupported by review,

data or analysis. Finally, it is noted that a project of this magnitude warrants public confidence that the proponents recognize and accept their corporate responsibility and are prepared to provide a level of compensation and mitigation befitting the uncertainties of their undertaking.

Response:

1. Pieridae acknowledges the potential for gas flaring to impact migrating and locally breeding birds in the EA Report (Section 10.9.3.2). Based on information available, bird mortality associated with flaring is considered a rare event. It is expected to be particularly rare at the Goldboro LNG facility, since there will be no flaring under normal operating conditions (see also response below). Nevertheless, Pieridae is committed to developing an avian management plan that includes mortality monitoring for birds and bats. The objective will be to evaluate the impacts and better understand this seemingly rare and little-studied phenomenon. The monitoring program will be developed in consultation with EC-CWS and NSDNR, and will include corrections for searcher efficiency, scavenging, and searchable area (i.e. that takes into account areas that cannot be searched due to substrate, health and safety concerns, etc.). Should the monitoring identify flaring as a significant issue, mitigation measures will be developed again in consultation with EC-CWS and NSDNR.
2. It is recognized that there are particular meteorological conditions and times of year during which the risk of high mortality events such as the September 2013 incident at the CANAPORT facility in Saint John, NB is elevated, and Pieridae intends to minimize the requirement for gas flaring during these times. It is important to note that under normal operating conditions at the Goldboro LNG facility (> 90% of the time), flaring will not occur. Predictable flaring will occur during plant start-up and shut-down events; by avoiding start-up and shut-down during high-risk times (e.g. nighttime during the spring and fall migration periods) and low visibility weather conditions, Pieridae will reduce the potential for avian mortality. Flaring will also be required in emergency relief situations and these cannot be predicted; however, such events are anticipated to be very rare. It is of note that the SOEI gas plant located adjacent to the proposed Goldboro LNG facility has been operating a flare stack for over a decade with no reported major incidents of significant bird mortality, despite frequent and significant flaring.
3. As stated in the response above (#1) Pieridae commits to developing an avian management plan in consultation with EC-CWS and NSDNR. This plan will include a commitment to mortality monitoring for birds and bats. Mitigation measures will be developed in consultation with EC-CWS and NSDNR should the monitoring identify flaring as a significant issue.

4. In order to facilitate the assessment of impacts to moose and bats, surveys were carried out to identify moose sign in the area in and around the Project footprint, as well as for AMOs, which could potentially serve as hibernacula for bats. The field survey programme was discussed with NSDNR. The EA indicates the potential for adverse effects on moose and bats. Mitigation measures are outlined in general terms, with a specific commitment to contributions by Pieridae to moose and bat conservation programs. In order to be most effective and complementary to on-going recovery programs, Pieridae considered it most appropriate to develop the details of its contributions in consultation with NSDNR, as explained in the EA Report Section 10.12.5.2 (Terrestrial Fauna SAR and SOCC):

> "As the Project will be causing some loss of mainland moose habitat, Pieridae is committed to contributing to efforts on conservation of mainland moose, via support for the Mainland Moose Recovery Team and/or the Assembly of NS Chiefs' program for Moose recovery being administered by the Unama'ki Institute of Natural Resources. Details will be negotiated and finalized upon EA approval and in consultation with DNR. A Moose Management Plan may also be implemented to provide information and assist in the recovery of moose in the Project area";
>
> And,
>
> "To further mitigate against adverse effects the Project may have on bats, Pieridae is committed to contribute to the Province's bat recovery program. Specifics will need to be developed in consultation with NSDNR to ensure maximum effectiveness. Potential measures could entail the installation of 'bat houses' around the Project area, in areas unaffected by Project noise and light emissions. This could provide compensation for the loss of summer roosting habitat caused by site clearing. Additional bat monitoring and study could also be undertaken to aid the Province's recovery efforts by obtaining further insight into the significance of off-site AMOs for use as roosts or hibernacula".

Also, according to Poissant et al. (2010)[1], tricoloured bats (*Perimyotis subflavus*) are thought to exist as a disjunct population in Southwestern Nova Scotia. Moseley (2007)[2] stated this species (formerly known as the Eastern pipistrelle, *Pipistrellus subflavus*) is found in western and central mainland NS only. They are not known to occur in Guysborough County; therefore, only two species of endangered bats (*Myotis lucifugus* and *M. septentrionalis*) could potentially be impacted by this Project.

[1] Poissant JA, Broders HG, Quinn GM. 2010. Use of lichen as a roosting substrate by *Perimyotis subflavus*, the tricolored bat, in Nova Scotia. Ecoscience 14: 372-378.

[2] Moseley M., 2007. Records of Bats (Chiroptera) at Caves and Mines in Nova Scotia. Curatorial. Report 99, Nova Scotia Museum, Halifax, Canada.

It is of note that the above-mentioned Moose Management Plan and contributions to existing Moose Recovery programs could also include moose monitoring. This is not explicitly mentioned in the summary of monitoring commitments listed in Table 12.0-1 as it is considered to be part of the decision-making on what might be the most useful contribution to on-going recovery and conservation efforts.

5. Although specific details related to compensation plans are not covered in the EA document, commitments to detailing and implementing compensation plans are stated in the EA. As stated above in the Response # 4, to be most effective, Pieridae considered it most appropriate to develop the details of its contributions in close consultation with NSDNR, specifically with the recovery teams for mainland moose and bats. This is envisaged to include the development of tangible and specific commitments to the type of contribution(s) (e.g., research funds, land acquisitions, corporate stewardship, data collection/monitoring, habitat improvements etc), the extent of the contribution (e.g., dollar value, land area, time frame, monitoring data and timeframes etc) and mechanisms for the implementation. Compensation specifically for unavoidable impacts to wetland habitat will be developed as part of the wetland alteration permit application. This is expected to establish, in close consultation with Nova Scotia Department of Environment, tangible compensation measures, including specific quantitative, qualitative and monitoring requirements. This will ensure compensation strategies adequately replace significant wetland functions lost as a result of Project activities.
6. As described in the EA Report (Section 10.19.3.4, Future Developments in the Goldboro Industrial Park), there is no specific mitigation recommended at this time for potential cumulative effects with future developments in the industrial park. Pieridae acknowledges that cumulative adverse effects may occur. They cannot be quantified due to the lack of any Project specifics. Nevertheless, Pieridae makes a commitment (pages 10-213, 10-215, 10-217) to contribute to the provincial recovery programs for moose and bats. The specifics of such contribution(s) however need to be developed in consultation with NSDNR and MODG since neither timing, nor extent or nature of other developments is currently known or foreseeable. Pieridae also offers to enter discussion with other (future) industrial park users and the MODG to contribute to a coordinated approach to the use of water resources. Such coordination may also be effective in minimizing or compensating for adverse cumulative effects on moose and bats by consolidating contributions to the Province's moose and bat recovery programs. It is of note that the SOEI plant is scheduled to shut down by about 2018. This may provide opportunities for re-naturalization of the site. Similarly, at the time of the Goldboro LNG facility decommissioning, it may be possible to rehabilitate/re-naturalize parts or all of the Project site, depending on the after

use objectives of the municipality and the next owner. This could mitigate some of the direct and cumulative effects of the Project on local terrestrial habitat.

7. Although the focus of the assessment was within, and in close proximity to the Project footprint and the water supply pipeline (in terms of field surveys for flora, fauna, wetlands), regional conditions and concerns were addressed through various aspects of the EA including:
   - SAR assessment - the assessment looks at the occurrence of known SAR records within a 100 km radius of the site (as per requirements stated in the "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document", NSE 2009);
   - Cumulative effects assessment - it considers proposed and existing developments on a regional scale; and
   - Land use assessment - it identifies and addresses sensitive and significant habitats in the region.

   Key concerns from a regional perspective relate to the potential cumulative effects for wildlife. Since timing, extent and nature of other future developments in the region is largely unknown, the effects predictions and environmental risks for the region remain inevitably generic.
8. Pieridae recognizes the potential for adverse effects of gas flaring on migratory birds, and is committed to management planning and monitoring as outlined in Responses 1, 2 and 3. It should be noted that flaring events at the Pieridae facility are expected to be notably less frequent than at the nearby SOEI plant, where flaring occurs on approximately a weekly basis. No cumulative effects are expected either as SOEI is scheduled to close operation by about 2019.
9. As communicated through various responses above, Pieridae identified a number of potential adverse environmental effects on flora, fauna, and wetlands. The effects predictions in the EA have been substantiated through multi-season field surveys, assessment of habitat functions (wetlands), effects modeling (footprint effects, noise modeling, air emission models), literature research and an analysis of future developments in the region. The EA identified as key uncertainties the cumulative effects with potential new developments in the region. In light of the limited information a detailed discussion of associated risks is considered highly speculative and beyond what one proponent can mitigate against.

   Compensation measures related to adverse effects on wetlands, fish and fish habitat (marine and freshwater) will be detailed as part of the application processes for the relevant permits/authorizations from NSE and DFO. Pieridae considered it most appropriate to commit to the development of the details of its contributions to Mainland moose and bats recovery programs in close consultation with NSDNR. As stated above, this envisages the development of tangible and specific commitments including the type and extent of the contribution as well as and mechanisms and guarantees for the implementation.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 17, 2013	Page 1 of 5
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Mark Pulsifer, NS Dept. of Natural Resources	IR # NSDNR2

Preamble:

DNR has been requested to review the Environmental Assessment document and provides the following comments.

General Comments & Recommendations:

Regional Services:

Comments Submitted by: Mark Pulsifer

-Generally speaking this document is an improvement over past EA documents submitted by Keltic. Review and comment were submitted on sections pertaining to terrestrial wildlife and habitat.
- A project of this scope must have negative impacts on biodiversity and habitat in general. Between NSESA, COSEWIC and SARA there are 10 endangered species and 8 threatened species recognized as being impacted, or potentially impacted by this project [10.12-1 SAR Table]. This is a significant number of "species at risk" that will require some attention, and discussion on cumulative effects and possible compensation. Both DFO and NSE have provisions for no net loss of habitat and that compensation programs are to be negotiated. It would be prudent and a strong indicator of corporate stewardship if similar types of discussions were to take place with DNR.
- Pieridae has documented their desire to work with the province and First Nations on moose conservation initiatives. An initiative of this type has potential to benefit endangered mainland moose. This project will permanently eliminate moose habitat from the area and impacts to habitat need to be addressed. Discussions on the form of involvement and compensation [biodiversity offsets] should be held with the DNR Wildlife Division in Kentville.

Request:

Specific Comments

1. Page 8-16; Section 8.3.4.9 Terrestrial Fauna; There is literature to indicate that moose are sensitive/reactive to disturbances up to 1000 m from a disturbance; therefore, 500 m may not be conservative as a zone of influence.
2. The report acknowledges changes in information since the original report was prepared for Keltic, and appears to provide necessary updates that reflect current information and rankings/listings for species at risk.
3. 10.9.3.2 Monitoring of flare sights for birds? With recent evidence to show that flare sights are potentially hazardous to migratory birds, a radar based element to bird monitoring during and post construction may be valuable. Although incidences may be rare [or simply not reported] when they do occur they can have significant impacts.

4. Effects of lighting? The EA states that monitoring programs will be used to quantify the potential impacts of lighting on birds. So what will happen if the monitoring program indicates that excessive numbers of birds are being killed?
5. 10.9.2.1 Effects of Construction. Species will not only be displaced from the actual project footprint but also from the zone of disturbance outside the footprint. The project will result in a permanent loss of habitat for terrestrial fauna. This may be more significant for some species, such as endangered mainland moose, and even wintering deer herds. It would appear that moose habitat issues may be addressed through further discussions, but, there is scant acknowledgement of the impacts of this project on deer wintering areas. SIGHAB data indicates that the project is found within a DWA but I did not notice any discussion or specific mitigation for potential impacts.
6. 10.9.4 Mitigation. Re: Nesting Birds. 100 [osprey] – 200 [goshawk] m buffers around nests are typical. Contact the local DNR Regional Biologist if nesting raptors are encountered and mitigation needs to be discussed.
7. Radar monitoring during all phases of the project may be appropriate to better understand the impacts of construction and operational activities on migratory birds.
8. 10.12-2 Table SAR. No critical habitat for moose. How does the proponent define critical habitat? It is possible to define habitat “out of existence” if stringent enough parameters are placed on the definition. The mainland moose herd will not disappear with this project; however, the real loss of functional habitat combined with the zone of influence defined on the basis of disturbance [land clearing, noise, lighting] will result in a meaningful loss of habitat.
9. 10.12.3.1 Moose. This is area is [not may be] part of a core moose area identified by DNR

Response:

1. Agreed. The Project’s zone of influence for moose is likely to exceed 500 m. The statement on page 8-16 (Section 8.3.4.9) is incorrect for moose and should correctly state 1000 m. This larger zone of influence has actually been recognized in the EA with a geographic extent of the survey area for moose up to 1.5 km from the site boundary (see Figure 9.7-4 in the EA Report). The cumulative effects assessment reviews future developments even further beyond the Project site and identifies moose as potentially becoming adversely impacted through cumulative effects from regional developments.
2. Positive comment. Every attempt was made to update the original Keltic report with current information and rankings/listings for species at risk.

3. Pieridae acknowledges the potential for gas flaring to impact migrating and locally breeding birds in the EA Report (Section 10.9.3.2). Based on information available, bird mortality associated with flaring is considered a rare event. It is expected to be particularly rare at the Goldboro LNG facility, since there will be no flaring under normal operating conditions. Nevertheless, Pieridae is committed to developing an Avian Management Plan in consultation with EC-CWS and NSDNR. This management plan will include a method for tracking and forecasting avian migration with the intent of minimizing or eliminating large-scale mortality events such as the incident at the CANAPORT facility in September 2013. This tracking/forecasting may be achieved by daily monitoring of the regional migration forecast website provided by the Cornell Laboratory of Ornithology. Regular plant shut downs and start-ups could then be scheduled accordingly. (It is of note that at Goldboro LNG, flaring will only occur in association with facility shut downs and start-ups and emergency situations). The success of this approach will be reviewed annually and, if necessary, other techniques will be implemented which may include the use of radar based monitoring.
4. Pieridae will provide complete reporting protocols as part of the Avian Management Plan. The EC-CWS will be contacted within 24 hours in the event of mortality of an individual migratory bird species at risk or 10 or more migratory birds in one night; in the event of mortality of a single raptor, NSDNR will be contacted. If mortality is deemed to be excessive, Pieridae commits to working with regulators to develop suitable mitigative measures including alternative tracking/forecasting techniques and associated scheduling of flaring events.
5. The EA does address the potential effects within the Project's zone of influence and also identifies the potential effects on deer and the deer wintering area. In Section 10.9.2.1 of the report it is stated that "The Project area supports a large number of deer throughout the year, and is a known deer wintering area. Clearing and construction activities are expected to slightly reduce the available area used by deer and interrupt local movement to and from adjacent areas of suitable habitat"

   The EA Report (Section 10.9.2.1) also states that "Project related noise may cause deer in immediately adjacent areas to flee temporarily. The furbearers and wintering deer populations in the local area may temporarily move elsewhere along the coast toward Drum Head and Seal Harbour, during the construction period. Local populations are likely to return to normal after construction is complete".

   Also, deer tend to become accustomed to human presence and are often found very close to urban areas. It is doubtful the Project would have significant impacts on deer wintering in the area and therefore no mitigation measures specific to deer are being discussed.

6. Pieridae will consult with local DNR staff in the event that an active raptor nest is encountered in order to establish a buffer area and implement mitigation measures appropriate to the species.
7. As part of an Avian Management Plan that will be developed in consultation with NSDNR and EC-CWS, Pieridae will explore ways to better understand avian movements in the Project area during construction and operations. As stated in Response #3 this will involve the use of information from the regional migration forecast website provided by the Cornell Laboratory of Ornithology and possibly radar monitoring.
8. The Federal *Species at Risk Act*[1] defines "critical habitat" to mean habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

   The Nova Scotia *Endangered Species Act*[2] defines "core habitat" to mean "specific areas of habitat that are essential for the long-term survival and recovery of endangered or threatened species and that are designated as core habitat pursuant to Section 16 or identified in an order made pursuant to Section 18." Under the NSESA, the province of Nova Scotia may identify "core habitat" for provincially endangered species.

   However, the Recovery Plan for Moose (*Alces alces americana*) in Mainland Nova Scotia published by NSDNR (2007)[3] states that "insufficient qualitative, quantitative, spatial and temporal information exists at this time necessary to identify core habitat for mainland moose. Moose use a broad array of habitat types that are variable in space and time. Significant information gaps surrounding the life history, landscape ecology and biology of mainland moose will need to be addressed before core habitat can be defined" (NSDNR 2007).

   As there appears to be no accepted definition of core habitat for moose in Nova Scotia, it is impossible to state that such habitat exists on the Goldboro LNG Project site.
9. The map of core moose areas published in the "Recovery Plan for Moose (*Alces alces americana*) in Mainland Nova Scotia" (NSDNR 2007) does not depict the Goldboro LNG Project site as being within a core moose area. The area encompassing the Goldboro LNG Project site has been said to be within a "moose concentration area" by NSDNR Regional Biologist Mark Pulsifer (personal communication, April 10, 2013).

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[1]Government of Canada (2002). Species at Risk Act. http://www.sararegistry.gc.ca/approach/act/sara_e.pdf

[2]Government of Nova Scotia (1998). Nova Scotia Endangered Species Act http://nslegislature.ca/legc/bills/57th_1st/3rd_read/b065.htmhttp://novascotia.ca/NATR/wildlife/biodiversity/legislation_nsesa.asp

[3] Nova Scotia Department of Natural Resources. 2007. Recovery Plan for Moose (Alces alces americana) in Mainland Nova Scotia.

Pieridae recognizes that the Goldboro LNG Project site is located within a "moose concentration area", which encompasses most of Guysborough and Antigonish counties. As a consequence, Pieridae conducted a moose survey on and adjacent to the Project site and acknowledges the potential for adverse effects on moose. To mitigate against such effects, Pieridae made commitments to contribute to the province's moose recovery program (see also Response #4 to IR - NSDNR 1).

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Samantha Hines NS Dept. of Natural Resources	IR # NSDNR3

Preamble:

DNR has been requested to review the Environmental Assessment document and provides the following comments.

General Comments & Recommendations:

Land Services:

Comment submitted by Samantha Hines

- There are two major components of this project that affect Crown land:
  1. A proposed water supply pipeline that crosses over multiple parcels of Crown land (see attached map) and is for access to Meadow Lake which is surrounding by Crown Land (not in a 12% site).
  2. A marine facility that includes the following structures:
     - Jetty head with berthing and mooring dolphins
     - Loading berth with 4 LNG loading arms
     - Marginal wharf and causeway: wharf to be 220 meters long and 44 meters wide and causeway to be 260 meters long to join the marginal wharf with the upland
     - New road and causeway will run across the barrier beach that separates Dung Cove Pond from the bay
- This appears to be the site of a former proposed Keltic Project.

Request:

1. From the review, it appears that an easement would be required for sections of the water pipeline crossing Crown land and coastal permits/lease required for the marine facility on submerged Crown land and the beach.
2. As usually noted in the EA, permits are to be obtained from the required government departments but I did not see any mention of the Department of Natural Resources.

Response:

1. Pieridae acknowledges that a Lease and/or Right-of-Way agreement will need to be obtained from the Province for proposed activities on Crown Land and coastal areas related to the proposed raw water supply pipeline and pumphouse at Meadow Lake, and for the marine and intertidal components of the LNG jetty and

marginal wharf. These permit applications would be submitted shortly following issuance of the EA approval.

2. Table 4.1-1 in the EA Report identifies the need for permits under the *Beaches Act* and the *Crowns Lands Act* and Regulations. Pieridae will apply for the required Crown land and coastal permits/leases through NSDNR. As per the Provincial website, the application(s) shall be made to:

    Manager, Acquisitions and Leases
    Land Administration Division
    N.S. Department of Natural Resources

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 17, 2013	Page 1 of 2
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Beata Dera, Senior Consultation Advisor NS Office of Aboriginal Affairs	IR # NSOAA1

Preamble:

On behalf of the Nova Scotia Office of Aboriginal Affairs, Consultation Division, I have had the opportunity to review the Environmental Assessment document for the Goldboro LNG Project as submitted by Pieridae Energy (Canada) Ltd. and offer the following comments:

Request:

1. The Proponent has submitted a Mi'kmaq Ecological Knowledge Study (MEKS), which is an update to the previously completed MEKS for the Keltic Project. The Proponent indicated that the MEKS was submitted for review to the KMKNO. The Proponent is encouraged to follow up / meet with the KMKNO to discuss the findings of the MEKS.
2. The Proponent has been proactive in engaging the Mi'kmaq of Nova Scotia, including:

    a) Several meetings with Chiefs and Mi'kmaq communities (Paq'tnkek, Millbrook, Shubenacadie)
    b) Presentations and meetings to various Mi'kmaq organizations, including KMKNO staff, KMKNO Benefits Committee, Aboriginal Employment Partnership, and Assembly of NS Mi'kmaq Chiefs through the KMKNO
    c) Invitation for Mi'kmaq representative to participate on the already established CLC
    d) Sharing of draft EA document with KMKNO
    e) Signing of MOU between Pieridae and the Assembly of NS Mi'kmaq Chiefs Benefits Committee in September 2013, to guide discussions in anticipation of and commitment to sign a Collaborative Benefits Agreement (CBA)
    f) Commitment to provide project updates to the Assembly of NS Mi'kmaq Chiefs
    g) Commitment to coordinate future engagement efforts with the Mi'kmaq.

    The Proponent is encouraged to fulfill the commitments made to continued engagement with the Mi'kmaq, and to continue to pursue the signing of a CBA. It is expected that the Proponent will clearly document the continued engagement process with the Mi'kmaq, including all concerns raised by the Mi'kmaq and efforts made to address the concerns. Regular update reports should be shared with the NS Office of Aboriginal Affairs.

Response:

1. Pieridae, has been in contact with the KMKNO to initiate continued discourse on the traditional knowledge and interests of the Mi'kmaq of Nova Scotia. Pieridae is committed to continuing open communication with the KMKNO during all stages of the Project.
2. Pieridae appreciates the comments from the NS Department of Aboriginal Affairs and will continue to follow up with the identified First Nations and the KMKNO in fulfillment of the commitments made under the terms of the Memorandum of Understanding. Pieridae will document its continued efforts to engage First Nations communities, implementing the signed MOU, and the establishment and implementation of a Collaborative Benefits Agreement. Updates on Pieridae's efforts and progress in the engagement process will be communicated to NSOAA.

Preamble:

Bird Species at Risk

1. Roseate Tern

The Roseate Tern is listed as Endangered on Schedule 1 of SARA. Virtually the entire Canadian population of this species nests at 2 locations in Nova Scotia. One of these locations is Country Island, where Roseate Terns form a mixed colony with Arctic and Common Terns. This congregation of the Canadian population into so few sites makes the Roseate Tern extremely vulnerable to oil spills, catastrophic weather events, disease, and other stochastic events. Furthermore, the reproductive rate of the species is limited by small clutch size, delayed maturity to age of first breeding, low annual survival for a seabird, and relatively low survival to first breeding; thus limiting the species' ability to recover from adverse events. Since Roseate Terns preferentially nest in larger colonies with Arctic and/or Common Terns, it is important to also consider potential effects of projects on these "companion" species. Therefore, situations where these other species could be impacted by deleterious effects may also result in adverse effects to Roseate Terns.

Tern foraging habitat in the project area will be impacted by construction activities, and the potential for terns to be adversely affected by project activities during the breeding season is a concern. Although the Deep Panuke pipeline-laying activities in Stormont Bay likely did not affect tern foraging distribution in the bay (Whittam and Goulet 2010)[1], results from that study cannot be used to conclude that construction and operation of the LNG tanker terminal and associated marine facilities would not adversely affect foraging terns, including Roseate Terns.

It should also be noted that for a species listed as endangered, such as the Roseate Tern, loss of one individual due to project-related activities or accidents (e.g. oiling, flare), would be considered a significant effect. The grounding of a vessel or vessel collision in the vicinity of Country Island that resulted in disturbance to colonial nesters or adverse effects to the critical habitat of the Roseate Tern would also be considered a significant effect.

Request:

For the reasons discussed above, EC recommends avoidance of construction activities in marine waters between May 1 and August 31. If complete avoidance of such activities during that timeframe is not possible, then an environmental effects monitoring program

[1] Reference
Whittam, B. and P. Goulet. 2010. The nearshore distribution of terns and other seabirds in relation to EnCana's Deep Panuke natural gas pipeline construction in Stormont Bay, Nova Scotia. Report by Bird Studies Canada (Atlantic Region) Produced for EnCana Corporation. 44pp.

should be implemented (one option would be participation in the ongoing Acadia University Country Island tern movement study) with adaptive management responses being implemented as required.

Response:

Pieridae recognizes the importance of protecting the Roseate Tern and its habitat, and as such, is committed to minimizing construction activities during the breeding season (May 1 to August 31). However, it is unlikely that such activities can be avoided entirely. Pieridae; therefore, further commits to developing and implementing an appropriate environmental effects monitoring program as recommended by EC-CWS, and to implementing adaptive management responses as required.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jeffrey Corkum, Regional Director, Environment Canada	IR # EC2

Preamble:

Bird Species at Risk

2. Landbird Species at Risk (SAR)

On page 9-129, the EA Report states that breeding evidence has been recorded in the project area for Common Nighthawk (Threatened, Schedule 1 of SARA), Olive-sided Flycatcher (Threatened, Schedule 1 of SARA), Barn Swallow (Threatened, no SARA status) and Canada Warbler (Threatened, Schedule 1 of SARA). However, the specific locations where these birds have been detected are not identified. It is therefore not possible to adequately evaluate the potential effects of the project on these species based on the limited information provided.

For federal environmental assessments, SARA 79(2) requires that persons responsible for an environmental assessment "must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans." While there is no federal environmental assessment for this project, EC advocates a similar approach for the provincial environmental assessment.

Also, if wetlands providing habitat for bird SAR will be lost or if this habitat function will be lost, it should be clarified how the proponent proposes to compensate for the loss of wetland habitat function for bird SAR.

Request:

- Prior to starting construction, the proponent should be required to confirm the presence and location of species at risk identified as being in the project area. Appropriate avoidance and mitigation measures reflecting applicable recovery strategy and action plans should be submitted for review and implemented.
- Proposed compensation for any loss of wetland function for bird species at risk needs to be submitted for review and approval by appropriate regulatory agencies.

Response:

Pieridae agrees to confirm the presence and location of species at risk that were identified in field surveys as being in the Project area. Pieridae will submit, as part of the Avian Management Plan, appropriate avoidance and mitigation measures for EC-CWS' review and input.

Pieridae agrees to submit for regulatory approval a plan for compensation of any wetland function for avian species at risk that may be lost as a result of the Project.

Preamble:

Bird and Lights and Flares

On page 10-62, the EA Report indicates that "A significant impact on ambient light conditions would be any unmitigated "light trespass" (i.e., unintentional direction of lighting off-site) or interference with migrating bird populations, causing bird fatalities." EC agrees with this statement, but also expands it to also include attraction and fatalities, not only to migrating birds, but also to nesting storm-petrels or individual species at risk (e.g. Roseate Tern), due to lights and flares — especially given that flares will likely be the facility's brightest and most visible light source.

A catastrophic mortality event at an LNG facility in New Brunswick in the fall of 2013 resulted in the deaths of over 7500 landbirds in one night. Bird collisions at lit and floodlit structures are also a known problem. In Atlantic Canada, nocturnal migrants and night-flying seabirds (e.g. storm-petrels) are the birds most at risk of attraction to lights and flares. Attraction to lights may result in collision with lit structures or their support structures, or with other birds. Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of depredation. Incineration or partial incineration in flares is also a major concern, and flaring at night should be avoided.

The largest storm-petrel colony along the Atlantic coast of Nova Scotia is located on Country Island, approximately 9 km from the Project area. Storm-petrels can travel hundreds of kilometers during one single foraging trip during the breeding season; hence 9 km is no distance at all for this long-distance forager. Furthermore, this nocturnal species is known to be attracted to artificial lighting and is vulnerable to being incinerated in flares. Environment Canada's Canadian Wildlife Service (CWS) has received anecdotal reports of dead storm-petrels being found during the breeding season in Goldboro, on the current site of the SOEI gas plant which also flares on occasion. The Country Island population has decreased by more than 50% since 1997. Despite their small size, storm-petrels are long-lived birds (30+ years), delay breeding until the age of 5 or 6 years and only produce at most one chick per breeding season; this type of breeding strategy makes their populations vulnerable to adult mortality as recruitment is naturally slow. In light of this downward trend and known mortality, flaring should be kept to a minimum during the storm-petrel's breeding season (May-October).

Other than the 2013 mortality event at a flare in New Brunswick and reports of storm-petrel deaths at offshore facilities, the impacts of flaring on birds are largely undocumented, as monitoring is challenging in part because mortality events tend to occur at night and birds that are incinerated may not necessarily leave a carcass behind. Therefore, in addition to bird mortality monitoring, the monitoring program should incorporate the use of radar technology in the vicinity of the flare to monitor bird abundance and its interaction with flare operations and environmental conditions. This

will lead to further understanding of this issue, and to further define adaptive management requirements.

Request:

Operation of Flares

- As a first priority, the proponent should avoid flaring at night. In cases where this is not possible, a plan to address risks to nocturnally migrating birds and breeding seabirds,
- As part of an avian management plan, the proponent should demonstrate how they would identify periods of high risk for bird/flare interactions (e.g. for nocturnal migrants, daily monitoring of the migration forecast using the Cornell Laboratory of Ornithology's regional migration forecast website) and monitor for those interactions in cases where flaring cannot be avoided.
- There should be an effort to explore whether flaring can at the very least be reduced to intermittent events at night.
- Project design should include the installation of flare shields to reduce light emissions and potentially reduce bird mortality
- A mortality monitoring plan would be expected to be submitted for review and implemented which would include corrections for searcher efficiency, carcass persistence (i.e. scavenging), and searchable area (i.e. that takes into account areas that are not able to be searched due to substrate, health and safety concerns, etc.)
- In addition to bird mortality monitoring, the use of radar technology to detect bird abundance and interaction with the flare should be implemented.
- The Canadian Wildlife Service expects to be contacted within 24 hours in the event of mortality of an individual migratory bird species at risk or 10 or more migratory birds in one night. Complete reporting protocols should form part of the Avian Management Plan.

Lighting

- To minimize the risk to migrant birds, the minimum amount of pilot warning and obstruction avoidance lighting should be used on tall structures. The use of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada, is recommended. Also, using the minimum number of lights possible is recommended. The use of solid-burning or slow pulsing warning lights at night should be avoided.
- The operation of exterior decorative lights such as spotlights and floodlights whose function is to highlight features of buildings, or to illuminate an entire

building should be avoided or restricted. Especially on humid, foggy or rainy nights, their glow can draw birds from far away. It would be best for the birds if these lights were turned off, at least during the migratory season, when the risk to birds is greatest and also during periods when Leach's storm-petrels would be dispersing from their colony.

- Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety.
- Street and parking lot lighting should also be shielded so that little escapes into the sky and it falls where it is required. LED lighting fixtures are generally less prone to light trespass and should be considered.
- Should storm-petrels or other species become stranded on vessels or on land, the proponent is expected to adhere to appropriate handling protocols. The protocol described in Williams and Chardine's brochure entitled, *The Leach's Storm-Petrel: General information and handling instruction* should be used for stranded seabirds. The proponent should also develop a similar-type protocol for birds other than seabirds (e.g. landbirds, shorebirds) which may become stranded on vessels.
- A permit is required to implement the Williams and Chardine protocol or other similar protocols, as well as to handle migratory bird carcasses during post-construction monitoring programs. Proponents should be advised that they are required to complete a permit application form prior to proposed activities. Permit application forms can be obtained by contacting CWS (email: Permi.atl@ec.gc.ca).
- The Canadian Wildlife Service expects to be contacted within 24 hours in the event of mortality of an individual migratory bird species at risk or 10 or more migratory birds in one night. Complete reporting protocols should form part of the Avian Management Plan.

Response:

Pieridae commits to preparing and adhering to an Avian Management Plan, to be developed in consultation with EC-CWS and any other relevant regulatory bodies (e.g., NSDNR). The Avian Management Plan will include the elements noted in the above discussion: reporting protocols, carcass searches (with corrections factors for searcher efficiency, scavenging rates and area searched), and handling protocols for birds that may become stranded at the facility or on vessels. The appropriate permits for handling migratory birds will be obtained. Consideration will be given to the implementation of radar monitoring for migrating birds to detect bird abundance and interaction with the flare. Pieridae agrees to contact the Canadian Wildlife Service within 24 hours in the event of mortality of an individual migratory bird species at risk, or of 10 or more individual migratory birds in one night.

It is recognized that there are particular meteorological conditions and times of year during which the risk of high mortality events such as the recent incident in Saint John, NB is elevated, and Pieridae intends to minimize the requirement for gas flaring during these times. It is of note that under normal operating conditions (> 90% of the time) at the proposed Goldboro LNG facility, flaring will not occur. Predictable flaring will occur during plant start-up and shut-down events; by avoiding start-up and shut-down during high-risk times (e.g. nighttime during the spring and fall migration periods) and low visibility weather conditions, Pieridae will reduce the potential for avian mortality. Flaring will also be required in emergency relief situations and these cannot be predicted; however, such events are anticipated to be very rare. In order to reduce light emissions, and potentially bird mortality, the flare stack design will consider the installation of flare shields.

To minimize the risk of attraction and disorientation of migrant birds, the recommendations outlined above by EC for lighting of the Project, including warning lights, street and parking lot lighting, safety lights and other exterior lighting, will be adhered to.

Preamble:

Migratory Birds Convention Act and Associated Regulations (MBCA)

Regulatory Context

Compliance with the *Migratory Birds Convention Act* and associated regulations (MBCA) is expected at all times and for all project-related activities.

Migratory birds protected by the *Migratory Birds Convention Act* and associated regulations (MBCA) include all seabirds except cormorants and pelicans, all waterfowl, all shorebirds, and most landbirds (birds with principally terrestrial life cycles). Most of these birds are specifically named in the Environment Canada publication, *Birds Protected in Canada under the Migratory Birds Convention Act*, Canadian Wildlife Service Occasional Paper No. 1.

Under Section 6 of the *Migratory Birds Regulations* (MBR), no person shall disturb, destroy or take a nest or egg of a migratory bird; or to be in possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. It is important to note that under the current MBR, no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities. Furthermore, Section 5.1 of the MBCA describes prohibitions related to deposit of substances harmful to migratory birds:

> "5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.
>
> (2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds."

It is the responsibility of the proponent to ensure that activities comply with the MBCA and regulations. In fulfilling its responsibility for MBCA compliance, the proponent should take the following points into consideration:

- The breeding season for most birds within the Project area occurs between May 1st and August 31st; however same species protected under the MBCA nest outside this timeframe.
- Most migratory bird species construct nests in trees (sometimes in tree cavities) and shrubs, but several species nest at ground level (e.g., Common Nighthawk, Killdeer, sandpipers), in hay fields, pastures or in burrows. Some bird species

may nest on cliffs or in stockpiles of overburden material from mines or the banks of quarries. Some migratory birds (including certain waterfowl species) may nest in head ponds created by beaver dams. Some migratory birds (e.g., Bam Swallow, Cliff Swallow, Eastern Phoebe) may build their nests on structures such as bridges, ledges or gutters.

One method frequently used to minimize the risk of destroying bird nests consists of avoiding certain activities, such as clearing, during the nesting period for migratory birds in the region. Risk of impacting active nests or birds caring for pre-fledged chicks, discovered during project activities outside the May 1st to August 31st window, can be minimized by measures such as the establishment of vegetated buffer zones around nests, and minimization of activities in the immediate area until nesting is complete and chicks have naturally migrated from the area. It is incumbent on the proponent to identify the best approach, based on the circumstances, to complying with the MBCA.

Further information can be found at the web site Incidental Take of Migratory Birds in Canada: httQ://www.ec.pc.c&paom-itmb/default.asp?lang=En&n=C51 C41 5F-1.

Project-Specific Considerations

Information in the EA Report regarding potential breeding locations for shorebirds is rather vague (page 10-5-89). However, information in the Keltic/Maple project (p. 8-78 and figure 8-8-1 of the EIA final draft for the Keltic Petrochemicals Inc. Proposed LNG and Petrochemicals Plant Facilities) provided additional information, identifying:

- Greater Yellowlegs exhibiting breeding behaviour at the edge of the cobble beach along Dung Cove/northern Betty's Cove and in the wetlands along Gold Brook north of the SOEI gas plant);
- Willet as a common breeder near Betty's Cove and along the shore southeast of the terminal area; and
- Spotted Sandpiper observed on the marine shore in spring, as well as the shores of freshwater streams in the area, and possibly breeding at Meadow Lake (Appendix 8 of the EIA final draft for the Keltic Petrochemicals Inc. Proposed LNG and Petrochemicals Plant Facilities).

Kildeer was identified as a possible breeder at the project site (Appendix H), but the precise location is not provided. If this species was not found in the areas listed above, further details including proposed buffer zones need to be provided.

Common Loons were described as "definitely/probably breeding at Meadow Lake" during field work for the Keltic/Maple project (Appendix 8 of the EIA final draft for the Keltic Petrochemicals Inc. Proposed LNG and Petrochemicals Plant Facilities). It should therefore be determined whether Common Loons nest within such close proximity to the proposed project area, and if so, buffers implemented as recommended by CWS.

Certain species of migratory birds (e.g. Bank Swallows) may nest in large piles of soil left unattended/unvegetated during the breeding season. To discourage this, the proponent may want to consider measures such as covering these large piles of unattended soil during the breeding season. However if migratory birds start occupying these piles, any industrial activities (including hydroseeding) will cause disturbance to these migratory birds and inadvertently cause the illegal destruction of nests and eggs. Alternate measures will then need to be taken to reduce potential for erosion, and to ensure that nests are protected until chicks have fledged and left the area. Far a species such as Bank Swallows, the period when the nests would be considered active would include not only the time when birds are incubating eggs or taking care of flightless chicks, but also a period of time after chicks have learned to fly since swallows return to their colony to roost.

The proponent should be made aware that in some coastal areas, man-made structures have been used as nesting structures by gulls and terns. Since these birds "swoop down" at potential predators of their eggs and/or chicks, and since they view humans as potential predators, the birds nesting on these structures have in some cases been viewed as a menace by human users of the facility. The proponent should be made aware that if they build a structure that could be used as a nesting platform by migratory birds, EC-CWS will not issue permits to destroy nests of these birds should these birds take aggressive measures to protect their eggs/chicks.

Request:

- An Avian Management Plan should be prepared which demonstrates how impacts to birds will be avoided and compliance with the *Migratory Birds Convention Act* can be maintained. The plan should identify measures to be taken in the event that breeding migratory birds are discovered outside May 1st to August 31st Also, in the event of a delay between clearing/grubbing and other construction activities in an area, ground nesters may be attracted to the area. The avian management plan should describe measures to verify the presence/absence of ground nesters in such a circumstance, as well as measures to be taken if birds are nesting in the area. The avian management plan should also describe measures to be taken in the event that birds (gulls, terns, nighthawks, swallows) nest on project infrastructure.
- Shorebird breeding periods extend outside the general timeframe mentioned above. For this reason, disturbance (e.g. construction, maintenance activities) in the areas noted in the discussion above, and any other areas with breeding shorebirds, should be avoided from mid April until chicks have naturally fledged from the area.

- The location of Killdeer in the project area needs to confirmed and further details as with other shorebird species, including proposed buffer zones, should be included in the Avian Management Plan.
- CWS recommends a 200m buffer from Common Loon nests during the months of May, June and July. Also, no high disturbance activities (i.e. blasting) within 1km of active Common Loon nests should occur during the nesting season (May, June and July).

Response:

Pieridae commits to preparing an Avian Management Plan in close consultation with the appropriate regulators, including EC-CWS and NSDNR. The plan will include the identification of measures that will be taken in the event that breeding migratory birds are discovered outside of the main breeding bird season (May 1st to August 31st) and identification of appropriate buffer zones for nesting species (including Killdeer). The plan will address measures to deter ground nesting species from nesting in active construction areas and to verify the presence/absence of ground nesters in such a circumstance, as well as measures to be taken if birds are found to be nesting in the area. The Avian Management Plan will also describe measures to discourage birds from establishing nests on construction stockpiles or Project infrastructure or measures to be taken in the event that birds are found nesting on such Project features.

In the 2013 field surveys, Killdeer was observed on the cobble beach along Dung Cove/northern Betty's Cove. Willet, Greater Yellowlegs and Spotted Sandpiper were not observed in the 2013 field surveys. Due to the potential for disturbance to nesting shorebirds, disruptive activities (e.g., construction, maintenance activities) in the areas noted in the discussion above, as well as any other areas with breeding shorebirds, will be as much as possible avoided from mid April until fledging is complete.

The recommended buffer zone (200 m) and activity restrictions (no high disturbance activities within 1 km) for Common Loon nests will be adhered to during the nesting season of May to July.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jeffrey Corkum, Regional Director, Environment Canada	IR # EC5

Preamble:

Spill Response

It is not clear what measures would be taken to protect birds (including avian species at risk) or sensitive habitats in the event of a spill of a substance harmful to birds. Even a small spill could be significant if it were to impact avian species at risk, sensitive habitats, or large numbers of birds.

Request:

- A spill response plan should be prepared for each phase of the project, and which includes a response plan for environmental emergencies that involve wildlife, and including detailed information regarding:
  - measures to be taken to contain a spill and to clean up an area;
  - individuals/groups responsible for the cleanup;
  - equipment to be available to contain spills;
  - measures to be taken to prevent birds from becoming oiled (i.e. deterrents/measures to get oil off the water or land);
  - wildlife monitoring in the area (i.e. surveys)
  - a strategy to deal with accidents where birds were oiled (i.e. discussion of rehabilitation or euthanization) and/or sensitive habitat(s) was(were) contaminated.

In order to assist proponents in preparing a plan for dealing with an oil spill which would potentially threaten birds, CWS has prepared the attached draft guidance document.

Response:

As outlined in Section 3.7.2 of the EA Report, Pieridae will develop a comprehensive EMP for all phases of the Project. This will include a Contingency and Emergency Response Plan that establishes Project-specific policies and procedures related to spills and address topics ranging from spill prevention to clean up preparedness, equipment, response and recovery/clean up.

Pieridae appreciates EC's advice and guidance on emergency/spill response components specific to the protection and recovery of avian species. Pieridae has reviewed the CWS guidance document dated June 2012 (Birds and Oil – CWS Response Plan Guidance) that EC provided. That guidance document will be followed in the establishment of the EMP for the Goldboro LNG Project to ensure that EC's list of plan components and measures specific for avian species are being addressed.

Preamble:

Accidents and Malfunctions

Environmental Emergencies Regulations

Environmental emergency prevention, preparedness, response and recovery are important to mitigating potential environmental impacts and to complying with the *Fisheries Act* (sections 36- 42), the *Migratory Birds Convention Act*, the SARA, and the CEPA. Any spill, release, or deposit could result in an adverse environmental effect and a violation of legislation.

In the EA Report, the Proponent recognizes the applicability of the *Environmental Emergencies Regulations*, SOR/2003-307 under CEPA (Section 3.3.13). The *Environmental Emergency Regulations* set out specific requirements for the preparation of environmental emergency plans and reporting of accidental releases. It is the responsibility of the Proponent to ensure that environmental emergency plans are consistent with the requirements of CEPA and the Regulations. The Environment Canada *Implementation Guidelines* for Part 8 of the *Canadian Environmental Protection Act*, 1999 — *Environmental Emergency Plans* (Implementation Guidelines) provide direction on meeting these requirements.

The *Environmental Emergency Regulations* requirements are specific to the substances listed in Schedule 1. However, for any industrial accident or malfunction scenario that could result in adverse environmental effects, Environment Canada generally recommends that environmental emergency prevention, preparedness, response and recovery plans, reflect a consideration of applicable standards and best practices including the following:

- Canada Standards Association (CSA) *Emergency Planning for Industry* (third edition of CAN/CSA—Z731 -03)
- 2004 *Emergency Response Guidebook* (ERG2004) accessible at http://www.tc.gc.ca/canutec/en/guide/guide.htm
- Council for Reducing Major Industrial Accidents/Conseil pour Ia reduction des accidents industriels majeurs (CRAIM) *Risk Management Guide for Major Industrial Accidents* (2002 edition) accessible at http://www.uneptie.org/pc/apell/publications/pdf files/CRAI M POF EN.pdf

These publications were developed with the input of Environment Canada and/or Transport Canada. The CRAIM and CSA publications are specifically identified as pertinent references in the Environment Canada Implementation Guidelines.

Risk Assessment

In Section 10.17 of the EA Report it is stated that "The EA does not intend to address all conceivable abnormal occurrences, but rather, to address only those scenarios that have a reasonable probability of occurring (considering the specific aspects of site conditions and Project design) that may have an environmental effect or consequence." EC's view is that modelling of worst-probable case scenarios is recognized as an industry best practice that provides greater value for emergency preparedness planning. The presence of two residential areas within 2 km of the project site and the sensitive environmental features that have been identified in the project area further demonstrates the value of considering worst-probable case scenarios.

Using PHAST7.1 software to analyze liquefied natural gas for iust one product storage tank with a maximum capacity of 230,000 m3 (i.e. the single largest storage tank), EC has generated consequence results for a potential uncontrolled ignition and explosion worst-case scenario due to an accident or malfunction. This is referred to as a vapour cloud explosion for a wind speed of 1.5 mIs and category F scenario, or "worst case".

The PHAST7.1 model prediction indicates that a possible worst-case vapour cloud explosion from a catastrophic failure of a single storage tank could have a high impact incident radius of approximately 24 km. Please note that in such a worst-case vapour cloud explosion scenario, the remaining product storage tanks at the project site would likely be significantly impacted and would therefore have a high probability of experiencing their own catastrophic failures, resulting in unknown cumulative impacts that would be based on the total volume of LNG involved. There is no mention of any shoreline sensitivity mapping initiatives and/or shoreline classification initiatives that would help to inform spill response plans for potential diesel spills from transport ships accessing the marine terminal.

Request:

- To help ensure applicable regulatory requirements and industry standards and codes are met and to undertake a best practice approach to project planning and design with respect to LNG and hazardous material releases the following should be considered:
  - modelling of worst-probable-case scenarios should be undertaken.
  - identifying and calculating the magnitude of a worst-probable-case vapour cloud explosion scenario using modelling software that is capable of predicting a worst case impact radius.
  - identifying and calculating the magnitude of a worst-probable-case accident or malfunction scenario for Oxygen displacement by free product in low-lying areas.
  - an Emergencies Communications Plan for the surrounding communities should be developed that would 1) proactively educate area residents to the

LNG product stored and utilized on-site as well as to the types of accidents that could occur, including likely incident response actions; and 2) provide emergency instructions to area residents (such as shelter in place instructions) during an emergency incident at the facility.

- it should be determined whether other stakeholders in the project area have collected information on shoreline sensitivity and classification that can be utilized. Alternatively, the proponent should undertake this initiative in strategic areas near the marine terminal and adjacent to ship transit routes.

Response:

During the next phase of the Project, included in Fire and Explosion Reports and/or Quantitative Risk Assessments will be events that are considered credible for a facility such as this.

This would normally not include a full/double containment LNG tank failure as described. A failure such as this would be considered beyond the scope of worse-probable-case (credible) due to the highly unlikely nature of the event.

Other large-scale events will be considered (e.g. those associated with any condensate tanks etc). Low probability events such as LNG tank failure may still be included in Quantitative Risk Assessments, at which point their probability will be considered alongside the hazard, this would be decided when writing the scope for these studies.

Typical FEED studies would include an investigation into potential explosions, using PHAST, considering areas where vapour may accumulate and ignite (areas of congestion in piperacks, valve platforms, coolers, etc). This will lead to plots of overpressures that are generated by these events. Typically in early stages such as FEED this will consider all areas of congestion as potential areas for gas accumulation and explosions. As design progresses there is potential for external studies that could then include more detail such as exceedance curves for overpressures.

For an LNG leak/spill the fire and explosion impacts or more concern than the asphyxiation effects. The concentrations at which asphyxiation becomes a concern are significantly higher than the lower flammability limits for LNG. Therefore asphyxiation is not normally considered in studies of LNG releases. Releases of LNG will lead to asphyxiation as the primary hazard and these would be considered in the safety studies that are completed during FEED. Release modelling is likely to be performed in PHAST. Low lying areas within the range of these releases will be considered and suitable low oxygen detection included in design (on site).

As described in Section 3.7.2 of the EA Report, Pieridae will develop an Environmental Management Plan (EMP) for the Project. This will include a Contingency and Emergency

Response Plan. Pieridae appreciates EC's specific advice and guidance pertaining to the development of such Response Plan. The references provided by EC will be used in the plan development and implementation. This will include a component that addresses emergency communications for surrounding communities. As stated in Pieridae's response to IR-EC# 5, the Emergency Response Plan will also include specific policies, procedures and prevention/clean up measures related to coastal wildlife, in particular avian species. It is envisaged that particularly sensitive coastal environments at and near the Project site will be identified established with input from local stakeholders (e.g., Community Liaison Committee) and discussed in that plan component.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jeffrey Corkum, Regional Director, Environment Canada	IR # EC7

Preamble:

Air Emissions

GHG Emissions

The Government of Canada is continuing to work with other levels of government, industry and stakeholders on new greenhouse gas (GHG) regulations for the oil and gas sector. The federal government is focused on an approach to GHG regulations that will reduce emissions.

Accurate tracking of greenhouse gas (GHG) emissions is an important part of assessing Canada's overall environmental performance. In March 2004, the Government of Canada announced the introduction of the Greenhouse Gas Emissions Reporting Program (GHGRP). An updated version of GHG Reporting information was posted on November 4, 2013 and can be accessed at the following link: https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=47B640C5-1&offset=2&toc=show .

Other Emissions to Air

In its review of the Keltic project, EC commented that it should be designed and operated in a manner consistent with the Continuous-Improvement and Keeping-Clean-Areas-Clean principles of the CCME *Canada-Wide Standards for Particulate Matter and Ozone*. These standards contain provisions for both federal and provincial governments to establish programs that apply best management practices to minimize emissions of the pollutants and their precursors.

This comment remains applicable for the Goldboro LNG project and it should also be noted that since that review, the Canadian Ambient Air Quality Standards for Fine Particulate Matter PM2.5 were published (May2013).

Request:

EC notes that the Proponent has undertaken air dispersion modelling in and surrounding the proposed facility site. Appendix N Air Dispersion Modelling Results, however, only provides the modelling outputs of the various simulations and does not provide the methodologies utilized, nor the data inputs that would need to be analyzed by a third party in order to verify the adequacy of the models. EC, therefore, was not able to conduct a technical review of the air dispersion model outputs.

Response:

Refer to Section 10.4.3.5 *Air Dispersion Modeling Methodology* under Section 10.0 Environmental Effects Assessment, Environmental Assessment Report (Class 2 Undertaking) Goldboro LNG – Natural Gas Liquefaction Plant and Marine Terminal, Pieridae Energy (Canada) Ltd. (September 2013) for a more detailed description of the modeling methodology and inputs. Additional information in the form of the raw modeling input and output files can be made available upon request.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jeffrey Corkum, Regional Director, Environment Canada	IR # EC8

Preamble:

Water Quality

Wastewater Treatment

The EA Report describes several Project activities that could result in discharges to water. It is the responsibility of the Proponent to ensure that all activities are managed so as to prevent the release of substances deleterious to fish. Section 36(3) of the *Fisheries Act* prohibits the deposit of deleterious substances into waters frequented by fish unless authorized by regulations.

A number of sections in the EA Report (3.1.7, 3.2.6.3, 3.3.14) are not consistent with the information provided in Table 3.5-1- Emissions, Discharges and Waste, where it states: "on-site use of sewage treatment 'package plant' during construction. Sewage will be treated to comply with regulatory requirements and monitored, prior to discharge into Isaac's Harbour and for the operational phase it stated: "On-site plant for partial treatment of sanitary wastewater, followed by off-site disposal at an approved location...".

No details regarding expected characteristics of the liquid wastes from the different process units and utilities have been provided. Although it appears that one single 600 m3/day wastewater treatment system is being proposed, it is not entirely clear. Given the various wastewater streams and varying wastewater quality, one treatment system for all may not render the wastewater acceptable for discharge. It is not clear where the final discharge point(s) from a treatment facility would be located. Similarly, no information on expected effluent quality is provided.

Other than generally stating that sewage will be treated to comply with regulatory requirements, The Report does not present any criteria or standards against which the proposed treatment systems and discharge schemes can be evaluated, including the need to comply with Section 36 of the *Fisheries Act*, or the potentially associated 'Wastewater System Effluent Regulations" (WSER). The proponent should review the applicability and requirements the WSER, which can be found at http://laws-lois.justice.gc.ca/enp/regulations/SOR-20 12-139/

Table 4.1-1 References the Petroleum Refinery Effluent Regulations as relevant. They do not apply to the activities as discussed in the EA Report. If the WSER are applicable to the project, they should be listed in Table 4.1-1.

Request:

- Provisions for treatment and management of all discharges to the aquatic environment should include consideration of the need to comply with Section 36(3) of the *Fisheries Act*.

- A more complete description of proposed wastewater treatment system is needed to confirm discharges will be in compliance with applicable regulatory limits. Necessary information includes:
  - confirmation of wastewater treatment system capacity and projected wastewater volumes for each phase of the project.
  - characterization of wastewater streams.
  - identification of regulatory standards and criteria that will be met.
  - confirmation of discharge points and receiving waters.

Response:

EA Report consistency

The reference from Table 3.5-1 is an error in the EA Report. In Table 3.5-1, the descriptions of wastewater treatment during construction and operation are reversed.

As stated in the other sections of the report, domestic wastewater produced during the early stages of construction, prior to the completion of the on-site wastewater treatment facility, will be partially treated by mobile units and removed off-site for disposal at an approved facility. When the on-site wastewater treatment facility becomes operational, all wastewater will be treated to comply with regulatory requirements and released into the harbour.

Waste water treatment system capacity and volumes

At this stage of the Project there is insufficient information available to provide details on wastewater treatment capacity and volumes. This information will be specified during FEED and submitted to NSE as part of the permit applications pursuant to Part V of the *Nova Scotia Environment Act*.

Characterization of wastewater streams

During FEED all wastewater streams will be identified and classified so that drainage design and appropriate treatment method(s) can be defined. Classifications and definitions of wastewater streams may include the following:

- Onsite Uncontaminated Runoff (OUR) - runoff from areas where surface rainwater cannot be contaminated by hydrocarbons or chemicals.
- Offsite Intercepted Runoff (OIR) - runoff from areas where surface rainwater run-off flows may be intercepted outside of the plant boundaries
- Potentially Contaminated Water (PCW) - surface water from areas not designated as continuously contaminated which normally meets the required

specification but on occasions can be contaminated through non-routine activities e.g. maintenance.

- Considered Contaminated Water (CCW) - effluent that contains significant percentage of hydrocarbons that do not meet the required water effluent specifications - including certain drainage streams (washdown water, and drainage from process areas subject to leaks and spills during normal operations).
- Domestic Sewage Effluent (DSE) - effluent derived from domestic sources, typically containing a significant BOD/COD load.
- Process Water (PW) - effluent derived from process sources.
- Chemical drains - spills and contaminated water shall be contained locally for off-site treatment.

Regulatory Standards

The FEED documents will specify key expected contaminants for each wastewater stream, establish the applicable discharge standards, ensure compliance with Section 36 of the *Fisheries Act* and the associated "*Wastewater System Effluent Regulations*" (WSER). The information will be submitted to NSE as part of the permit applications pursuant to Part V of the *Nova Scotia Environment Act*. This process will finalize the applicable regulatory standards for all phases of the Project and define the associated compliance monitoring.

Discharge Point

The discharge point for treated wastewater is expected to be offshore using the jetty to support a drainage outflow pipe. This will be specified during FEED. Detailed drawings will be submitted to NSE as part of the above referenced permitting process.

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jeffrey Corkum, Regional Director, Environment Canada	IR # EC9

Preamble:

Water Quality

Blasting

Blasting activities are a particular concern to Environment Canada when occurring near a wetland or water body as site runoff (containing silt and blasting residues) from blasted areas can adversely affect water quality. For example, elevated concentrations of ammonia in surface waters have sometimes resulted from blasting operations, which could be toxic to aquatic organisms. Other blasting material constituents (e.g. nitrates, fuel oil and additives) may also impact water quality. In addition, blasting activities have the potential to disturb acid-generating rock, resulting in the release of acid and associated metals upon exposure to water and air.

Request:

- In addition to measures to minimize disturbance to birds, provisions for the assessment and management of water quality impacts related to blasting should be considered including the following:
  - the range of blasting materials and blasting techniques that are planned to be used;
  - the maximum extent of blasting that could be required;
  - the presence of potential acid-generating rock;
  - the proximity of blasting activities to wetlands and water bodies;
  - overall timing/scheduling of blast work;
  - identification of blasting residues that could be present in any discharges;
  - potential impacts on water quality within wetlands and water bodies taking into account baseline conditions and the CCME *Canadian Environmental Quality Guidelines*; and,
  - options for management including mitigative measures (e.g. runoff collection, treatment), monitoring, and contingency planning during construction and operation phases taking into account opportunities to reduce residues at source (i.e. pollution prevention).

Response:

The above considerations will be included in the development of the blasting program. Also, the Project's Environmental Management Plan for the construction phase will include specific provisions for the use of explosives and ensure that the relevant guidelines are addressed (e.g., Guidelines for the Use of Explosives in or near Canadian Fisheries Waters; CCME Canadian Environmental Quality Guidelines).

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GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jeffrey Corkum, Regional Director, Environment Canada	IR # EC10

Preamble:

Water Quality

Hydrostatic Test Water

Hydrostatic test water has not been characterized and provisions for management have not been identified.

Recent assessments of similar projects have included characterization of hydrostatic test water and attention to the management of spent hydrostatic test fluids which may contain biocides and other chemicals required for treatment of the water and exposed steel. This has included provisions for analyzing inorganic, metal and physical water parameters in hydrostatic test water and actions to be taken depending on the results of the analysis. For example, the circumstances under which mitigation would be implemented (e.g. treating water prior to discharge), and/or further analysis conducted have been identified.

An important consideration in planning hydrostatic testing is the evaluation of alternatives that could reduce discharges and minimize impacts. In the case of pipelines, this could include testing shorter lengths or reusing hydrostatic fluids in other sections. Opportunities to reduce the use of biocides and other additives should also be considered.

Request:

- It should be confirmed whether hydrostatic test water will be utilized and if so, it should be characterized and provisions for management and possible alternatives should be discussed.

Response:

Hydrostatic test water will be used. This will consist of fresh water with one possible exception - the LNG tanks may be tested using seawater.

The EMP that will be established for the construction phase will include specific provisions for the management of hydrostatic test waters. This will include the chemical characterization, and discussions of alternative uses and discharges and their application. As a principal, where possible water will be reused for testing to reduce the amount of treatment required prior to disposal. Also, all hydrostatic test water will be treated prior to disposal and tested to ensure it meets all relevant regulations.

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Preamble:

Water Quality

Exposure to Contaminated Sites/Acid Rock Drainage

The EA Report indicates that for cases where construction may be in or near acid producing rock, the NS Sulphide Producing Material Disposal Regulations will be followed. It is also indicated that a remedial management plan for tailings and contaminated soil will be developed. It is not clear from the EA Report how areas of contaminated soil will be delineated and in fact it does mention that these areas are poorly defined.

It should also be noted that the Province of Nova Scotia now has *Contaminated Sites Regulations*. The EA Report references the former Contaminated Sites Guidelines.

Request:

- As part of the remedial management plan further details on the following should be included:
  - how areas of contaminated soil will be delineated.
  - provisions for management of sites where tailings areas cannot be avoided

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Response:

During the next phase of the Project, comprehensive site surveys will be undertaken including soil sampling and testing to identify mine locations and associated tailings and areas of acid bearing rock. A Risk Management Plan will evaluate the potential environmental and health risks associated with the tailings areas. The Risk Management Plan will also determine the necessary environmental safeguards and health protection.

As part of FEED, when the finalised plot plan is developed and the extent of site clearance is determined, a Site Remediation Plan will be established to address the findings of the Risk Management Plan. The Remediation Plan will establish remediation objectives, as well as techniques and measures to be applied in the remediation process. The plan development will follow the Nova Scotia Contaminated Sites Regulations (NSE 2013) and Guidelines for the Management of Contaminated Sites in Nova Scotia (NSEL 1996).

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 18, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Rodger Cuzner, Member of Parliament for Cape Breton-Canso	IR # MPCBC1

Preamble:

Support for the Project

Request:

I am writing in support of the Goldboro LNG megaproject to construct a natural gas liquefaction plant and marine terminal in Goldboro, Guysborough County, Nova Scotia. As Member of Parliament, I have seen many hardships and outmigration and this project would certainly go a long way in revitalizing the area. This would be a massive economic boost for the area and we boast a highly skilled work force more than willing and capable of taking on this project.

I have been informed thai this would create approximately 3,500 jobs from a construction perspective that will span over four years and provide 200 full time permanent jobs once the facility is constructed. This would be a significant boost and a crucial economic turning point for not only the region but for province as well. The outcome of the public opinion poll conducted during the EA phase were quite compelling showing 86% in support of the Project with 77% of those identifying economic benefits as their main reason. After reviewing these results, I was reaffirmed that this project is welcomed by the community.

The conclusive result is that this project is predicted to have long lasting and extensive beneficial effects on the local, regional and provincial economies and it is strongly supported by the affected communities. As Member of Parliament for Cape Breton-Canso, I support this project.

Sincerely,

Rodger Cuzner, MP
CapeBreton-Canso

Response:

Comment Noted.

SECTION 4.0

NON-GOVERNMENT ORGANIZATIONS

GOLDBORO LNG

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 09, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Ann Marie Bagnall Guysborough and Area Board of Trade	IR # GABT 1

Preamble:

Support for the Project

Request:

Dear Sir or Madam,

On behalf of the Guysborough and Area Board of Trade, I am writing to express our support for Pieridae Energy's proposed Goldboro LNG project.

Economic development is a critical issue facing us in Guysborough County. We believe that the significant capital investment and job creation offered by this project will be of substantial economic benefit to our area in both the short and long terms.

Thank you for your consideration.

Yours truly,

Ann Marie Bagnall
Chair, Guysborough & Area Board of Trade

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 05, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Ben Chisholm** **UA Local 244**	**IR #** **UAL244 1**

Preamble:

Support for the Project

Request:

I write this letter in support of the Goldboro LNG Project and its Proponent Pieridae Energy Canada Ltd.

As Nova Scotian's we can clearly see the exodus of our young people each year because employment opportunities in the Province are almost non-existent. This is especially true in the Construction Industry.

Most Industrial Construction workers are part of a highly mobile workforce and are currently working in other Provinces.

Dues to the nature of the Construction Industry most Tradespeople still maintain their residence and family in Nova Scotia when they travel across Canada and around the World in search of employment.

This experienced, highly skilled workforce is looking forward to Pieridae Energy's Project and a long awaited chance to work in Nova Scotia and be close to their Families once again.

The Province of Nova Scotia needs the economic boost as much as working people so everyone should be working with the Proponent to avoid delays.

Thank you.

Ben Chisholm
Business Manager
UA Local 244

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 10, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Brad Smith** **Mainland NS Building and Construction Trades Council**	**IR #** **MNSBCTC 1**

Preamble:

Support for the Project

Request:

To Whom It May Concern,

The Mainland NS Building and Construction Trades Council supports the Pieridae Energy Canada Ltd. Goldboro LNG Project.

The Goldboro LNG Project will create significant direct and indirect economic benefits for Guysborough and surrounding communities, the province and region. These benefits include jobs and training in the community and the region; up to 3500 jobs at the Goldboro site in the construction phase and up to 200 positions for ongoing operation and maintenance.

We believe this project to be a major boost to the Nova Scotian and regional economy; resulting in enhanced employment and much desired direct and indirect economic benefits to the local community.

Sincerely,

Brad Smith
Executive Director
Mainland NS Building and Construction Trades Council

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 11, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Allan Stapleton** **NS Construction Labour Relations Association Limited**	**IR #** **NSCLRA 1**

Preamble:

Support for the Project

Request:

To Whom It May Concern:

Re: Goldboro Liquid Natural Gas Project

I am writing to you on behalf of the Nova Scotia Construction Labour Relations Association (NSCLRA) in support of the proposed Goldboro Liquid Natural Gas project.

Our association (NSCLRA) holds the bargaining rights for unionized labour contractors in Nova Scotia, and since 1972 has been responsible for negotiating collective agreements and handling labour relations with construction industry unions in the province.

The NSCLRA feels that the Goldboro LNG project would be advantageous for the Province of Nova Scotia, and would like to endorse the project moving forward. The beneficial effects that the construction and maintenance of the project infrastructure will have on Nova Scotia's economy and on the construction sector are apparent, and it seems from reviewing the Environmental Assessment report that the work on the project will be carried out carefully, efficiently, and with minimal adverse environmental effects. Goldboro LNG would be a boom to this province, and I hope you will consider our support of the proposal in your decision

Sincerely,

Nova Scotia Construction Labour Relations Association Limited

Allan Stapleton, President

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 12, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Tim Gilfoy CEO, Strait of Canso Superport Corporation	IR # SCSCL1

Preamble:

Support for the Project

Request:

Please accept this letter as a statement of support by the Strait of Canso Superport Corporation for Pieridae Energy's proposed Goldboro LNG Project.

At a time when Federal, Provincial and Municipal Governments are attempting to find a solution to declining economic conditions in rural areas, projects such as this provide valuable tax revenue and employment opportunities.

Within the parameters of the Environmental Review Process we encourage you to move forward with a speedy approval.

Thank you for your review and consideration of this matter.

Tim Gilfoy
Chief Executive Office
Strait of Canso Superport Corporation

Response:

Comments Noted

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Damien MacInnis, Executive Director, Strait Area Chamber of Commerce**	**IR #** **SACC1**

Preamble:

Support for the Project

Request:

To Whom it may concern,

The Strait Area Chamber provides unique opportunities to promote and develop business, through advertising, seminars, trade shows, and more. Behind every forward-looking community, there is an organization of energetic, broad-visioned men and women. The greatest natural advantage of any community is the organized leadership of its business people, and we believe our organization offers that. Our Chamber is constantly working to make the Strait Area and surrounding communities a better place in which to live, play, and conduct business.

The Strait Area Chamber of Commerce knows the opportunities that the Goldboro LNG project could mean for Trade and Commerce in the Strait Region and we fully support any efforts made to move this project forward. We currently represent nearly 300 businesses in the Area and a LNG plant will not only help these businesses but it would reverse the out-migration of young families in the area. it will also improve moral and the entrepreneurial spirit throughout the Strait Region which is needed to ensure a healthy economy.

If you need any more information or if you need to contact us, we would gladly be open for conversation.

Kind Regards,

Damian MacInnis
Executive Director
Strait Area Chamber of Commerce

Response:

Comments Noted.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 3
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Barbara B. Pike, Chief Executive Officer, The Maritimes Energy Association	IR # TMEA1

Preamble:

The Maritimes Energy Association is a not for profit industry association representing businesses that provide goods and services to the energy industry in eastern Canada – offshore & onshore, renewable & non-renewable. Our membership primarily consists of local businesses that are part of the supply chain and employ thousands of people, injecting millions of dollars into our local economy.

The Goldboro LNG project represents a massive undertaking that will provide significant economic and social benefits for the entire region. The project takes advantage of the shift in the North American natural gas market over the past decade. A significant increase in the supply of natural gas has contributed to making export terminals, like the proposed Goldboro LNG facility, feasible. The site for the proposed project is identical to the Keltic Petrochemical Plant and LNG Facility that was released from Environmental Assessment (EA) in 2007 for the purpose of exporting LNG.

The advancement of drilling technologies, primarily related to obtaining natural gas from unconventional sources such as shale, is the main contributor to this shift in the natural gas market. The rapid increase in supply has slashed the price of natural gas in much of North America, leading to an increased price gap between world and North American markets. The Goldboro LNG project will take advantage of this increased resource supply and price gap by exporting natural gas to markets in Europe and Asia that are paying three to five times the North American price.

The project's Environmental Assessment documents are comprehensive in both scope and detail. The project schedule, included in the introduction, details the project targets for each year leading to the commencement of operations in 2019. The proponent shows a dedication to the successful development of this project with minimal impact on the environment.

The Valued Environmental Components (VECs) for this project were selected through a process that involved a review of the requirements in the Terms of Reference, baseline studies, cumulative effects, and concerns identified by the public, stakeholders, government and First Nations. A comprehensive list of VECs are identified in the EA document including ground and surface water resources, air quality, noise levels, wetlands and terrestrial fauna among others. For each identified VEC an environmental effects assessment was conducted. These assessments are described as involving "qualitative and quantitative analyses using existing knowledge, professional judgment, and computer modeling where appropriate and feasible".

Mitigation measures are proposed in those instances where adverse environmental effects are identified. Mediation and/or compensation measures are identified in those few instances where an adverse effect is considered unavoidable. The potential project effects are analyzed through the construction, operation and decommissioning phases. This ensures that plans are in place throughout the lifetime of the project.

Concerns over air quality and greenhouse gas emissions (GHGs) are addressed in the EA document. An estimated inventory of annual emissions is included. The proponent notes that the facility will "be new and will be constructed of state of the art equipment" therefore contributing to a reduction in the overall environmental impact.

Even with the adoption of the most technologically advanced equipment, GHG emissions in the province will increase as a result of this project. The proponent recognizes this and has committed to contributing to additional "provincial programs aimed at off-setting the anticipated GHG emissions of the Project". Potential off-set measures are listed and include: contribution to a technology research fund, partnership in provincial alternative or clean energy projects and assessment of opportunities for technological innovation. Such measures and investment would further add to the value of the project for the province and the region.

The full identification of VECs, potential effects and mitigation measures are comprehensive in detail and do not need to be fully reiterated in this submission of comments. Those who are interested in the development of this project are encouraged to review the EA documents as any concerns should be adequately addressed there. It is worth noting that the Keltic Project, similar in nature and location, received EA approval in 2007. Overall the environmental impact is likely to be minimal while the economic benefits are significant. It is estimated the project construction phase alone will result in more than 22,000 person-years of employment.

The project will obtain natural gas through the already constructed Maritimes & Northeast Pipeline (MNP). Commissioned in December 1999, the 1,101 kilometre transmission pipeline provides transportation of natural gas from developments offshore Nova Scotia to markets throughout the Maritimes and the northeastern United States. The MNP will be a key piece of infrastructure in transporting natural gas to the Goldboro LNG facility from points offshore as well as resources elsewhere in the Maritimes and the United States. As that pipeline infrastructure is already in place, the cumulative impact of that portion of the project on the environment will be minimal.

The total contribution of the project to the provincial GDP, both direct and indirect, is estimated at $4.7 Billion during the construction phase. Over the same period, it is estimated the project will generate more than 47,000 person-years of employment in Nova Scotia. Also, for consideration, is the continued contribution to the province's GDP during the operating phase, as well as additional property taxes paid to the municipality.

Request:

The Maritimes Energy Association strongly supports Pieridae's commitment to "maximize the economic benefits for the local and regional communities". This region has a long and successful history with the oil and gas industry. With more than four decades of experience with offshore exploration alone, this region has developed a

world-class energy supply chain capable of meeting the demands of major projects such as the Goldboro LNG facility.

Ensuring the local community benefits economically from a project is an important component of obtaining a social licence. We are encouraged to read of Pieridae's commitment to ensuring Aboriginal participation in the project. The Memorandum of Understanding that Pieridae has signed with the Kwilmu'kw Maw-klusuaqn is an encouraging first step, and we anticipate further developments that will include additional engagement with Aboriginal peoples.

Pieridae Energy's proposed Goldboro LNG project represents a significant undertaking that will contribute billions of dollars to the provincial economy. However, approval of such projects cannot just consider the economic benefits. It is as important to assess the environmental impact and identify the best measures to minimize the potential impact on the local environment.

It is our view that the Environmental Assessment registration represents a comprehensive review of the project and the affects it may have, proposing mitigation measures to reduce any potential impact. Almost all of the VECs are identified as not being significantly impacted by the project. Greenhouse gas emissions are listed of concern "in the context of provincial reduction targets". Recognizing this, the proponent has committed to the "development of strategies for GHG management and contributions to GHG offsets".

Upon concluding a detailed review of the filed Environmental Assessment documents, The Maritimes Energy Association is satisfied that the proponent has conducted a comprehensive review of the project and its potential impacts and benefits. The Goldboro LNG project has the potential to become a significant economic generator for Nova Scotia and the entire Atlantic region.

The Maritimes Energy Association supports approval of the project and looks forward to its continued progress.

Thank you for the opportunity to provide comments on this and other energy projects of importance to the province. Should you have any further questions, please contact me.

Respectfully submitted,
Barbara B. Pike
Chief Executive Officer,
The Maritimes Energy Association

Response:

Comment Noted.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 2
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Keith MacDonald President and CEO, Cape Breton Partnership**	**IR #** **CBP1**

Preamble:

Support for the Project

Request:

The Cape Breton Partnership was formed with the idea of uniting businesses and communities across Cape Breton to drive the economy forward. The Partnership has shaped an effective forum for private and public investors to come together with the common goals of forging partnerships, capitalizing on opportunities and building a stronger Cape Breton. To date, over one hundred and fifty organizations have demonstrated their confidence in, and commitment to, this region's economic growth.

Nova Scotia, and Cape Breton Island in particular, has long been the energy engine for the region. Residents of the area are proud of our history of safely providing energy for the citizens of Nova Scotia. With a healthy mix of wind, coal powered generation stations, hydroelectric and biomass assets, the eastern region is the energy hub of the province.

Eastern Nova Scotia's future role as a leader in energy production is uncertain. Canadian regulations targeting the coal-fired electricity sector will lead to the closure of Cape Breton's three generating plants and the loss of the jobs at these facilities. The region now has to now re-examine our position within the future energy map of Canada. Pieridae Energy's Goldboro LNG project is an integral component for Cape Breton's neighbouring Guysborough County to reposition itself as the gateway for exporting liquid natural gas.

Steps have already been taken to familiarize local companies with the procurement opportunities that the Goldboro LNG project presents. As part of the Environmental Impact Assessment process for the project, a host of community engagement sessions are planned over the coming months. The project has received positive support in Cape Breton and many businesses, communities and organizations are preparing for the advancement of the project.

The facts of the project speak for themselves. The development of the Goldboro LNG project in Guysborough County will create:

- A supplemental export market for natural gas that is not currently available;
- Additional government royalty revenue from increased gas sales;
- A significant boost to the provincial and regional economy, enhancing employment rates and providing a host of direct and indirect economic benefits to the local economy; and,

The Cape Breton Partnership fully endorses the Goldboro LNG Project. Our area wants to be a part of the Eastern Canada and United States energy map and to continue to play a leading role in the Nova Scotia energy industry.

Yours truly,
Keith MacDonald President and CEO,
Cape Breton Partnership

Response:

Comments Noted.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jack Wall, President Cape Breton Building Trades	IR # CBBT1

Preamble:

Support for the Project

Request:

To Whom It May Concern:

We as members of the Cape Breton Building Trades believe that an LNG Plant in the Province of Nova Scotia is very important for our economy. It would be a large construction project that would create many much needed jobs for the province. We have many highly skilled Tradespeople in the province that would require very little training to get themselves prepared for this project. We have too many of our Tradespeople leaving the province and their families to find work in other parts of Canada. A project this size would not only create many spin off jobs but would keep a lot of our Nova Scotians home here in the province with their families working and spending their pay cheques at home which in turn would create many more spin off jobs.

As we look across Canada, many of our Provinces have a large majority of Industrial Projects keeping their workforce going. Nova Scotia could use a major project “Right Now” to help keep our Tradespeople home and grow our economy. I am looking forward to this project becoming a reality and our Tradespeople show their skills and abilities.

Sincerely yours,

Jack Wall
President

Response:

Comment Noted.

Preamble:

Guysborough County Inshore Fishermen's Association (GCIFA) will be responding to the key components of the proposed LNG project that directly or indirectly pose effects on the marine environment and subsequently the commercial fishing industry within the area of the project. These comments are based on our existing knowledge of the proposed project but in no way include any arising concerns due to variations of the project in the future or during the FEED process. Specific content will refer to:

1. A jetty trestle for the LNG transfer lines and access road, and two LNG ship loading berths (the second berth for future development).
2. A marine wharf for the unloading of construction equipment and materials and for mooring of the tug and pilot vessels.
3. GCIFA will also provide some general comments on the overall project and our capacity to respond is as follows.

GCIFA is a non-for profit NS Provincially Accredited (FHOSA) fish harvester's association that represents multi-species CORE enterprises and their crew persons. The association consists of 109 CORE enterprises and 300+ crew persons. The enterprises are primarily inshore, small boat, fixed gear fishermen as well as a small fleet of offshore vessels > 65". All license fishermen hold a variety of species licenses as well as temporary permits to fish new exploratory fisheries. The role and responsibility of the association are:

- To provide community based management of the fishing resource and to ensure a sustainable resource fishery and habitat, healthy fish stocks (where they do not inhibit recovery if the industry is in decline).
- To act as an information liaison between inshore fishermen and the Dept. of Fisheries, as well as provide effective representation within the industry and other associations.
- To secure training and regulation requirements as the industry dictates.
- To engage in industry related research that is both relevant and participatory.

The capacity of the association to formulate a response comes from its 400+ fishing industry participants, fulltime association manager, marine lobster technician and a service provision and training facilitator. The association owns and operates a meeting / training hall, marine lab facility and staff offices in Canso, NS for the fishing industry of Guysborough County.

The association has been directly engaged in marine and social science research on various levels with federal, provincial, university and independent research facilities since the early 1990's. GCFA has developed and delivers a very robust data collection series on the local lobster fishery leading to a much more engaged and science based management plan with DFO through its revised IFMP with a Precautionary Approach

and detailed reference points for this and other fisheries. GCIFA has gained much capacity in the area of marine research and all aspects of the fishing industry but we do not pretend to have the capacity to completely evaluate the possible effects of an LNG terminal and facility and our response will more than likely reflect this incapacity.

Request:

A jetty trestle for the LNG transfer lines and access road, and two LNG ship loading berths (the second berth for future development).

A marine wharf for the unloading of construction equipment and materials and for mooring of the tug and pilot vessel.

Project description: 3.1.3

The marine facilities will be designed and operated in general accordance with key guidelines from the following organizations:

- Transport Canada (TC) (Technical Review Process of Marine
- Terminal Systems in Transhipment Sites (TERMPOL) process);
- International Maritime Organization (IMO);
- Oil Companies International Marine Forum; and
- Society of International Gas Tanker & Terminal Operators.

Question: Where are the operational standards/ guidelines for the general accordance with the Fishing Industry and Canada Food Inspection Agency as a food source is being harvested and produced directly in the marine component of the project site. Unfortunately the Fisheries Act is much older than LNG development so no direct operational standards or guidelines were included accept the habitat replacement under a required HADD strategy.

The construction of the jetty trestle will see infilling in Isaac's Harbour to accommodate the jetty and access road. This will permanently take away access to lucrative lobster, sea urchin, rock crab and scallop bottom currently being utilized by the existing eight license holders and their crews within the project area. This triggers a HADD (as mentioned in Section 4.1.2) replacement strategy will need to be developed.

GCIFA suggests this be done in complete partnership with the affected marine users to ensure the replacement habitat benefits those who will be absorbing this loss. This could be completed with a fisheries liaison committee including the proponent, DFO, GCIFA and license holders.

Response:

During the development of the EA Report for the Goldboro LNG Project, Pieridae has been in close contact with the DFO to discuss the Project, potential adverse effects and required mitigation and fisheries offsets. Recently DFO informed Pieridae that the habitat protection provisions of the *Fisheries Act* have been replaced by changes to the Act that came into force on 26 November 2013. In accordance with these changes, the Goldboro LNG Project is now being reviewed by DFO to determine whether it is a work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.

At this point, Pieridae assumes that the Project will require an authorization pursuant to the changed *Fisheries Act* and will need to implement fisheries offset plans. The EA Report establishes Pieridae's commitment to such offsets and outlines the approach and options in Sections 10.10.3.1 and 10.11.3.2 respectively. Pieridae will seek input to the detailing of the offset plans from GCIFA as well as individual fishers. The offsets will be finalized in consultation with DFO and in the context of the application for authorization.

Fishery issues including offset plans will also be fully reviewed and discussed with the Community Liaison Committee, which includes all local stakeholder groups including the Fishery and First Nations.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Eugene O'Leary, President Guysborough County Inshore Fishermen's Association	IR # GCIFA2

Preamble:

The construction and operation phase including the international terrorist risk to the marine jetty by LNG vessels, will result in further access loss by fishermen to the area. The exclusion zone around the movement and docking of LNG vessels and around the jetty itself closes off access to Isaac's Harbour and surrounding area to existing fishermen.

This area is currently being used by fishermen from Fishermen's Harbour to the west, Drum Head to the east and one license holder in Isaac's Harbour. If the eight existing fishermen and their crews have to leave the project area and set lobster, rock crab, scallop, and sea urchin gear to the west and east of Isaac's Harbour they will ultimately be encroaching on some other fishermen lucrative grounds and will inadvertently affect that areas' landing

– they will have to share the fishable biomass and effort location or bottom with more license holders and this will result in and decrease in Catch per Unit effort (CPUE). In essence a ripple effect will be felt throughout the fishing areas in the surrounding areas.

Request:

GCIFA suggests an individual compensation strategy be developed directly with the proponent and those fishermen who are affected by this permanent and temporary loss during construction and operational phases. It is GCIFA's mandate to facilitate, coordinate and provide supportive fisheries data to the industry, to determine if a loss or negative effect has or could occur but not to negotiate direct personal economic loss or compensation to fishermen. That is between the proponent and the individuals.

Response:

Pieridae is cognizant of the fishing effort in and near the Project site, and therefore has initiated discussions with individual fishers pertaining to potential impacts, mitigation measures, and impact management.

Pieridae is also in the process of finalizing a Memorandum of Understanding with the GCIFA on future cooperation and Pieridae is looking forward to working with GCIFA with respect to environmental data collection, monitoring and the development of fisheries management and offset plans.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Eugene O'Leary, President Guysborough County Inshore Fishermen's Association	IR # GCIFA3

Preamble:

The LNG marine terminal will increase subsidiary marine traffic during the construction phase of the marine jetty and marginal wharf firstly, as these will be used for further marine deliveries of materials and supplies to the work camp site and the construction. The delivery of and construction of the LNG tank storage and the processing facility construction will be dependent on marine shipping. That will add considerable marine traffic in and around the shipping lane breakaway point. It is not just the space the jetty and wharf will be using that will be lost to the fishing industry. This is all fishable bottoms and is also currently being used. Where will this fishing activity move to and whose area will they encroach upon?

The proposed operation of the LNG facility, jetty and marginal wharf as well as the exclusion zones around the LNG vessel traffic and while LNG vessels are in port are permanent. The increase in vessel traffic from the breakaway point of the existing shipping lane will be permanent. The four tugs, two line vessels plus the continued coming and going of LNG vessels as well as subsidiary vessel traffic by way of fuel, construction and operational vessel suppliers will fill the traffic lanes to capacity and then some. Where will the displaced fishermen set and tend gear and if fortunate enough to get gear set during a down time of traffic then get access to return and haul this set gear?

Request:

GCIFA suggests that once the Fisheries Liaison Committee is established it be given a mandate to discuss and review proposed marine traffic corridors and an amicable process for gear conflict as well as traffic control notification systems. As well the proponent should take into consideration this additional displacement in the compensation conversation with fishermen.

Response:

Pieridae notes the issue raised by the GCIFA regarding potential spatial conflicts between vessel traffic and fishing gear. Pieridae does not intend to establish and manage a Fisheries Liaison Committee. Instead, fisheries issues will be discussed with the established Community Liaison Committee, on which one seat is explicitly reserved for a local fisher who will maintain communication with GCIFA. The Community Liaison Committee will address environmental and economic issues relevant to the local communities and stakeholders. As such, the issues mentioned by GCIFA will be on the agenda for discussion by the Community Liaison Committee. It is of note that the vessel navigation, navigational aids, and notification systems are also expected to be addressed in the context of the TERMPOL review process with participation by Transport Canada, the Canadian Pilotage Authority, and Coast Guard.

Preamble:

Accumulative effects:

The loss and displacement outlined above does not compare to the temporary displacement and loss of access absorbed by the license holders, during the construction phase of previous oil and gas pipelines installed in this same corridor. That proven fishery related economic and habitat loss was compensated, was temporary and was somewhat confined to the construction phase not the operational. The fisheries have resumed operations once the pipelines were installed and covered over on the ocean floor and still have limitations to any trawling or dragging gear types.

This does not pose a great loss to the inshore but an LNG marine facility and plant operations is a different operation. It will not become inconspicuous in operations or buried into the ocean floor. The industry will be continually affected by way of lost access. The industry in the area is starting to and will continue to on a greater scale be loaded with accumulative effects. Each individual project has a footprint and viewed by them and to each other is seen to be less invasive and detrimental but the combined accumulative effect is directly felt by the fishing industry.

There does not seem to be much appetite to discuss or acknowledge accumulative affects and we have yet to see proponents or the NS environmental review process place much importance on accumulative effects. There have been two pipelines, SOE gas plant, and two proposed LNG facilities in the Goldboro area and all with marine impacts. How much development should the fishing industry absorb with little or no consideration of the whole accumulative effects? Even this association's human and financial capacity to respond to all of these proposals and monitoring never gets discussed or appreciated.

Request:

GCIFA proposed that the .S environmental review process take a close look at accumulative effects and have all existing and proposed proponents complete and show results of an accumulative results study on other industries within the project area, paying particular attention to the stakeholders affected capacity to respond to accumulative effects and even their capacity to identify these affects. For example E.CA.A and SOE are both situated financially and have the human resource to identify and prepare a written submission to a proposed project and the possible and real accumulative affects, more so than the fishing industry or individual fishermen.

Again, it is possibility that this be part of the mandate / role for a very busy and quickly becoming, time dependent Fisheries Liaison Committee.

Response:

Pieridae understands the concerns expressed by the GCIFA regarding cumulative social economic and environmental effects. The EA report addresses potential cumulative effects in Section 10.19 and identified a number of potential adverse effects that could result from planned and reasonably foreseeable land based developments in the area. Adverse cumulative effects from future marine operations have not been predicted as no future marine based undertakings have been identified that could overlap with the Goldboro LNG Project. The SOEI gas plant and associated marine and on-shore pipelines are expected to be decommissioned by about 2018 but no potential for overlap of adverse effects was predicted.

Pieridae is open to working collaboratively with GCIFA, the NS Government, and other users of the coastal/marine environment on potential cumulative effects in the Stormont Bay area and to identify means and measures for mitigation and continued sustainable economic development in the region.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 3
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Eugene O'Leary, President Guysborough County Inshore Fishermen's Association	IR # GCIFA5

Preamble:

Marine Water Quality and Runoff:

The proposed jetty and marginal wharf users may experience spills or leakage from LNG traffic, tugs, line vessels and subsidiary delivery and supply vessels. This has potential to negatively affect the water quality in the immediate area of operation as well as mixing or flushing to nearby harbours. contaminants from oil, fuel, lubricants, paints and possible unscheduled ballast discharge could occur and result in contaminated water where the fishing industry is harvesting a food source most of which will be under MSC sustainability labels and CFIA restrictions for international exports.

There is proposed extensive paving, roadway development for use within the marine facility and adjacent storage tank and processing facility. The proposed project is situated on the water line and a steep incline hill with the bottom reaching the waterline of all of Isaac's Harbour. The construction phase on the water and the land-based construction of the LNG facility will result in possibly contaminated water from vehicle spills, construction materials and as well as silt and soil deposit run off into the ocean. This activity must be monitored for water quality as well as sewage treatment for the area during the camp construction phase and operational phase. It is proposed this will be collected and trucked away for disposal.

Request:

GCIFA is suggesting the proponent identify their existing catch monitoring system for water runoff for this proposed project. The proponent should set up a water monitoring and quality testing program with more aggressive testing being completed during the construction phase less aggressive but continual during the operational phase. This will ensure the safety of a chain of custody and food security system that the fishing industry is subjected to by our certifiers and regulators. As well if a spill or contaminant is identified, sources located and an action plan will already be in place and a clean –up process will be ready to rollout for expedient response.

As well GCIFA is concerned about just regular day to day run off of fresh water from localized paving congregation and the piping system that may be run overboard. An increase in fresh water destabilized the marine ecosystem by way of salinity. Marine species react quickly to a decrease or increase in salinity and this varies or halts their feeding, movements, reproduction, larvae survival etc. GCIFA's would suggest as part of the water quality testing salinity testing be conducted on a regular basis or at times of scheduled or weather related fresh water runoff.

As for the possible sewage runoff or spills the proponent should consider a more permanent on or near site sewage treatment process that should take great concern and consideration for any runoff into the nearby ocean.

Response:

On-site Wastewater Treatment System

An on-site wastewater treatment plant will be constructed relatively early in the Project schedule that will receive all contaminated site run-off. Sewerage and contaminated run-off will be treated to regulatory standards and released into the harbour. The wastewater treatment plant effluent will be monitored constantly and will be equipped with a shut off device. Prior to completion of the wastewater treatment plant, sewerage and contaminated run-off will be partially treated on-site in mobile units and removed for disposal at an approved facility. The details of the design, operation and monitoring of the wastewater treatment plant will be subject to approval by NSE pursuant to Part V of the *Nova Scotia Environment Act* and the associated *Activities Designation Regulations*.

Storm Water Control

During construction, uncontaminated site run-off will be collected by a storm water control system with sediment removal structures (including settling ponds). Stored run-off will be released into the freshwater environment (Betty's Cove Brook and/or the Unnamed Tributary to Dung Cove Pond) when TSS has been reduced to meet regulatory requirements.

During operation, storm water run-off will be segregated into clean and potentially contaminated waste streams, where the potentially contaminated run-off will be directed to the on-site wastewater treatment plant. All storm water drainage systems will include petroleum traps. Similarly to the wastewater treatment plant, details of the Storm Water Control System will be subject to approval by NSE.

Water Quality Monitoring

A water quality monitoring plan will be developed as part of the EMP and will comply with all regulatory requirements and conditions of the EA approval and subsequent approvals pursuant to Part V of the *Nova Scotia Environment Act*. Monitoring procedures (i.e., parameters, frequency, and trigger concentrations) will follow any specifications established in the relevant permits.

Pieridae is in the process of finalizing a Memorandum of Understanding with the GCIFA on future cooperation and Pieridae is looking forward to GCIFA's assistance in the development and implementation of future monitoring plans. As stated above, specifics of the programs parameters need to be established in close consultation with the

regulators. It is expected that water temperature and salinity measurements would be included in the monitoring.

Spill Response

The Project's EMP will also include emergency and contingency planning for accidental spills and releases during construction and operation. Emergency spill response planning will be an integral part of the EMP, including provision of necessary equipment, services, and trained personnel.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 2
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Eugene O'Leary, President Guysborough County Inshore Fishermen's Association	IR # GCIFA6

Preamble:

Marine Water Usage Removal and Water Temperature

The proposed project will be using the marine water supply and or fresh water supplies to cool down the LNG process. This need will require large amounts of marine water to be removed from the Isaac's harbour Basin and then used, treated and returned in a lower salinity and at a much warmer temperature. This change in salinity has already been addressed but this does increase the occurrence and the degree of salinity change concerns.

The change in water temperature can have both positive and negative affects as a warmer temperature should increase larvae development if there is any to be produced in the area at the time of facility operations. Every area is seeding and feeding adjacent areas for larvae and reproduction. Warmer temperatures should help if the water quality is there but only if we maintain productive egg recruitment from all existing species.

The increase in water temperature will change the occurrence and survival of species non-native species and native species that are not abundant to a given ecosystem. Some such species that will affect existing and dependent commercial species includes invasive species very prevalent on in-coming foreign going vessels. Tunicates, green crab and other invasive species thrive in warm brackish water such as could be the result of this project. These invasive species starve out many of the native species of eel grasses, crustaceans and molluscs and replace them with non-commercial species that do not co-exist with the current ecosystem. Ultimately a new ecosystem is created and not necessarily a better one for the marine environment.

Request:

GCIFA suggests the component support and establish a temperature monitoring system year round bottom midway and surface for data on current and possible trends in temperatures. This data set will assist in determining algae, larvae and invasive species survival as well as providing data for trends in existing species behaviour.

GCIFA suggests the proponent develop, in partnership with the fishing industry and DFO, a species monitoring program to include at-sea sampling of commercial species with by-catch and ecosystem conditions during the construction phase as well as develop during the lobster fishery and out of season through juvenile trapping studies.

Response:

Pieridae is in the process of finalizing a Memorandum of Understanding with the GCIFA on future cooperation and Pieridae is looking forward to working with GCIFA with respect to environmental data collection, monitoring and the development of fisheries management and offset plans.

Pieridae is committed to develop and implement, with the assistance of GCIFA, fisheries related environmental monitoring plans for the Project's construction and operation phases. Specific parameters, methods, locations, frequency and reporting need to be established in close consultation with DFO and requirements defined in DFO's authorization pursuant to the *Fisheries Act.* It is expected that water temperature and salinity measurements would be included in the monitoring.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Paul Martin, President Melford International Terminal Inc.	IR # MIT1

Preamble:

Support for the Project

Request:

Melford International Terminal is the developer of the Maher Melford Container Terminal and Logistics Park at Melford, Guysborough County, Nova Scotia.

We are writing this letter in support of the proposed Goldboro LNG Project being developed by Pieridae Energy at Goldboro, Guysborough County, Nova Scotia.

The Goldboro LNG Project will enhance Canada's position as a major exporter of Energy products.

It will also create employment opportunities in an area that has historically experienced high unemployment as well as providing opportunities for local businesses during the construction phase and when the facility commences operations.

We urge you to approve this important project.

Yours sincerely,

Paul Martin
President

Response:

Comment Noted.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Jack Wall, Business Manager/Financial Secretary, Sheet Metal Workers & Roofers Local 56	IR # UAL56-1

Preamble:

Support for the Project

Request:

To whom it may concern:

We encourage our government to look hard at this LNG project, the province really needs a project this size to help boost our economy. We believe it will only help provide much needed jobs that our trades people need to stay at home, we have to many people leaving the province to look for work. When you look at other provinces across the country they have many Industrial Industry's keeping their province going, with jobs, spin off's, taxes etc. We fully support this project and would like to see it go forward.

Jack Wall
Business Manager/Financial Secretary
Sheet Metal Workers & Roofers
Local 56

Response:

Comment Noted.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 6
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Twila Gaudet, Kwilmu'kw Maw-klusuaqn Negotiation Office	IR # KMKNO1

Preamble:

I write in response to your notice received dated October 30th, 2013 on the above noted, I wish to take this opportunity to thank you for providing a copy of the environmental assessment, KMKNO has conducted a review of environmental assessment, and we wish to provide you with our comment, concerns, and/or recommendations at this time.

Request:

1. The Mi'kmaq Nation in Nova Scotia has a general interest in all lands in Nova Scotia as the Mi'kmaq Nation in Nova Scotia has never surrendered, ceded, or sold the Aboriginal title to any of its lands in Nova Scotia. The Mi'kmaq have a title claim to all of Nova Scotia and as co owners of the land and its resources it is expected that any potential impacts to rights and title shall be addressed, KMKNO wishes to advise you this area has been significantly utilized by the Mi'kmaq of Nova Scotia for traditional use and occupation for the purposes of hunting, fishing and gathering. It is expected that the proponent mitigate and compensate any potential impacts to traditional use activities.

   As part of the EA screening process, a number of VECs were considered to have a direct impact on the spatial and temporal boundaries on the project study area. The proposed mitigation measures intended to avoid and/or mitigate potential environmental impacts associated with the project activity are considered satisfactory. However, the Mi'kmaq of Nova Scotia remain concerned with potential impacts on traditional use activities occurring within and surrounding the project site including hunting, trapping, fishing and gathering.

2. KMKNO wishes to commend the proponent on completing a MEKS Study for the Goldboro LNG Project; however, we have the following concerns:
   - There appears to be no communications of any kind with Mi'kmaq of Nova Scotia regarding this MEKS. As per the MEKS Protocol, MEKS providers are to notify KMKNO and/or the Assembly of Nova Scotia Chiefs in writing that an MEKS will be completed for a project.
   - The MEKS states that interviews were not completed as interviews have been done in the past. I wish to take this opportunity to advise you this approach is unacceptable. There is value in conducting additional interviews as it deepens our understanding of traditional use activities of Mi'kmaq of Nova Scotia within the project study area.
   - It was indicated in the MEKS completed by AMEC that "Since the Keltic MEKS there has been some changes in the purpose and approach to indigenous knowledge studies. This update was conducted to enhance the findings of the initial Keltic MEK Study". I wish to advise the second edition of MEKS Protocol has not yet been ratified; therefore, this statement regarding

the changes in the purpose and approach rather confusing and we require clarification.

- This MEKS includes a number of statements that are inaccurate, presumptuous, lack context, and contains conclusions and perceptions of the Mi'kmaq that lacks reference of creditable Mi'kmaq and academic sources.
- a The methodology of this MEKS does not meet the requirements of the MEKS Protocol as ratified in November 2007.

Therefore, it is strongly recommended this MEKS be revised in accordance to the MEKS Protocol. KMKNO is willing to meet with the proponent and/or the consulting company to discuss the MEKS and provide clarification on the revisions that may be required.

3. I wish to take this opportunity to reiterate that KMKNO has identified the project area as a high use area for fishing, and we wish to advise you that a number of Food-Social-Ceremonial (FSC) licenses, and commercial licenses may be affected by the development of this project. Therefore, it is recommended that additional work should be completed by the proponent on any potential impacts to fish, fish habitat, and Mi'kmaq fishing activity and/or Mi'kmaq fishing licenses in and surrounding the project area as this project may have potential environmental and socio-economic impacts on the Mi'kmaq of Nova Scotia. We recommend a Mi'kmaq fisheries communication plan and Mi'kmaq fisheries compensation plan be developed for this project.

   It must be strongly noted that Mi'kmaq of Nova Scotia's concerns regarding fish and fish habitat were not satisfied as part of the MEKS as indicated in the environmental assessment. Therefore, I wish to take this opportunity to provide additional information regarding fishing activity by the Mi'kmaq of Nova Scotia. The Mi'kmaq have FSC licenses within and surrounding project site including, but not limited to, the following:

   - Clams, eels, trout, wound fish, flat fish, smelts, herring, lobster, Mackerel, Mussels, Seals, Striped Bass, Small Mouth Bass, Bar Clams, Quahogs, Razor Clams, Soft Shell Clams, Squid, Tomcod, Blue Shark, Yellow and White Perch, Haddock, Halibut, Pollock, and Scallops.

   As well, the Mi'kmaq have approximately 39 commercial licenses within and surrounding project site including, but limited to, the following:

   - Jonah Crab, Herring, Swordfish, Ground fish, Herring, Swordfish, Mackerel, Seal, Squid, and Scallop.

There are a number of species fished by the Mi'kmaq of Nova that are not listed above (i.e. Atlantic salmon, American eel, etc.); therefore, it is strongly recommended that additional research be conducted on Mi'kmaq fishing activity..

4. KMKNO has previously indicated that: "KMKNO understands the project area has been previously assessed archaeologically by Keltic Petrochemicals/Maple LNG, and a number of potential archaeological sites were identified and investigated, including some test pitting and excavations. KMKNO Archaeological Research Division (ARD) recommends that any areas that have not been assessed in the project area should be archaeologically assessed and it is expected that either systematic subsurface testing or photographic and fieldnote documentation of the rationale for not performing systematic subsurface testing."

   It does not appear that any additional shovel testing has taken place nor is there any indication that shovel testing is a key part of the proposed mitigation methodology. Therefore, KMKNO strongly recommends that the proposed mitigation methodology be amended to reflect these expectations. Further, KMKNO expects Mi'kmaw cultural information and pro contact archaeological resources to comprise notable components of the proposed sensitivity training. It is expected that these two components will be delivered by a qualified Mi'kmaw representative.

5. It is our understanding that a Community Liaison Committee (CLC) will be established, and it is recommended that the CLC include a Mi'kmaq representative. This may be coordinated with KMKNO.

   The Mi'kmaq of Nova Scotia wish to commend the proponent for signing a memorandum of understanding, and we look forward to continuing to work with the proponent in signing a benefits agreement.

   We look forward to continued consultation with Nova Scotia Environment on this matter.

Response:

1. Pieridae Energy wishes to thank the staff of the KMKNO for their review and comments on the EA Report and the MEKS. Pieridae is fully aware of the First Nations position respecting the treaty relationship and that the Mi'kmaq have a title claim to all areas of the province. Pieridae is also aware of the scope and nature of Mi'kmaq traditional use of the Project area. It was for these reasons that Pieridae initiated early on in the Project planning and EA process open and on-going communications with the local Bands, and with the KMKNO. It is also the reason why Pieridae signed a Memorandum of Understanding with the Assembly of Nova Scotia Mi'kmaq Chiefs pertaining to the development of a Collaborative Benefits Agreement. It is of note, that Pieridae also ensured that a seat on the established CLC is reserved for a First Nations representative. This is to provide for permanent representation of Mi'kmaq interests in the CLC and opportunities to actively engage in future discussions of Project development, construction and operation.

2. Pieridae built upon the MEKS completed for the Keltic Petrochemical project by conducting additional site-specific plant and moose surveys, and included the results of a fish inventory to augment the interviews and data contained in the Keltic MEKS. The initial MEKS addressed the identical location and a very similar development proposal. The decision for updating the MEKS was made with the assumption that the initial MEKS was satisfactory to the First Nations but could benefit from updating with current field data. Through Pieridae's communication with First Nation organizations, Band representatives, and government departments, no information was obtained that the previous MEKS lacked information from the interview process.

   As noted in the EA document, a number of meetings were held with the KMKNO and individual community leaders to brief the Aboriginal community about the Project and to initiate discussions on Project benefits such as employment and training opportunities. Several requests to KMK staff to make a presentation to the Assembly of Nova Scotia Chiefs on the Project and the EA process (including MEKS) were deferred to the Benefits Committee. The MEKS update was submitted to the KMKNO for review and comment on October 17, 2013, prior to submission with the EA.

   While it is understood that KMKNO wishes to add further information to the MEKS, Pieridae considers the work completed (i.e., the initial Keltic MEKS and subsequent updates) as being in line with the current MEKS Protocol. There is a considerable body of knowledge in the updated MEKS report. The information presented is based on interviews with Mi'kmaq representatives, and detailed, site-specific archaeological surveys, ecological field studies, and literature

research. Knowledgeable and experienced Mi'kmaq field researchers were hired to assist in this work. Pieridae is open to follow up discussions with KMKNO to explore how to further advance the understanding of Mi'kmaq traditional uses of and interests in the Project area.

3. Pieridae appreciates the input from KMKNO regarding fishing activities in the Project area. The MEKS update did make note of historical, current and potential food, social and ceremonial fishing interests in the area that were not included in the previous MEKS, however the commercial fishing activities conducted under DFO management plans and regulations were addressed in the Environmental Assessment document (Section 9.8.2.1).

   Pieridae is committed to cooperation with the commercial fishing industry (aboriginal and non-aboriginal) and to this end has ensured the commercial fishery and Aboriginal interests are represented on the CLC. Based on discussions with fishers and DFO staff, the only active commercial fishery in the immediate Project area is lobster, with one known commercial license holder using the area. The area had also been used in previous years for urchin fishing but the decline in the urchin population has resulted in a decline in activity in the area. All other commercial operations are outside the immediate Project area and not likely subject to any spatial conflicts with the proposed undertaking.

   As part of Pieridae's commitment to on-going communication with the Mi'kmaq of Nova Scotia, Pieridae looks forward to discussions with KMKNO to determine if there is a change in the level of Food-Social-Ceremonial licenses or commercial fishing activity by Mi'kmaq harvesters in the Project area, and, if applicable, seek appropriate measures to mitigate temporal or spatial conflicts.

4. Archaeological visual surveys were previously conducted in 2004 and 2007 (DAC 2004, DAC 2007a, DAC 2007b) of the entire Project area including areas with elevated potential for Native archaeological resources, such as shorelines. In addition, subsurface testing programs were conducted in areas deemed to have high potential for archaeological resources within the study area. No Native archaeological resources were identified during the course of these field studies.

   As stated in the EA, there are three areas that require field assessments prior to the initiation of construction activities in those areas. In the southeast of the Project area, desktop research indicated that there is potential for the remnants of Buckley Farm, which were not identified during the original visual survey (DAC 2004). As was recommended in 2004, it is proposed that "this area be resurveyed by an archaeologist once the brush is cleared from the impact area" (DAC 2004). This activity will be conducted following the pre-construction clearing of this area. Should archaeological resources be identified as a result of this resurvey, further mitigation measures will be recommended prior to

construction. The other two areas that have not yet been archaeologically surveyed are the two ends of the proposed Meadow Lake water supply pipeline route. These sections of the proposed linear corridor route, along with a yet to be determined location for a pump house, will be visually surveyed by a permitted archaeologist prior to construction activities in those areas. If subsurface testing is deemed warranted for either of these areas, an appropriate testing program will be developed in consultation with the provincial regulator, and will be conducted prior to construction.

The proposed archaeological awareness and sensitivity training for construction crews will be developed and delivered prior to the commencement of the construction of this Project. This training will likely be conducted concurrently with the Project safety training. The following is a draft outline of what will be included in the archaeological awareness and sensitivity training:

- Aboriginal cultural sensitivity.
- What is an archaeological resource?
  - pre-contact; and
  - historical.
- Indicators of archaeological resources (features and artefacts):
  - pre-contact; and
  - historical.
- Specific to the Goldboro Project:
  - research;
  - elevated potential areas; and
  - identification of archaeological resources.
- Potential for the recovery of human remains.
- Discovery of human remains protocol.
- Discovery of potential archaeological resources protocol.

The Project proponent will make an active effort to involve KMKNO in both the development and delivery of the pre-contact archaeological resources and the Mi'kmaw cultural information sections of this training.

5. Pieridae extended an invitation to the Paq'tnkek First Nation to have a representative on the Community Liaison Committee. The CLC has met once since its inception. Unfortunately, the Paq'tnkek First Nation did not participate. Considering the important role this committee will play with respect to communication on all Project phases, Pieridae very much encourages First Nation participation in future meetings and welcomes input from the KMKNO on how to facilitate such engagement.

SECTION 5.0

CONCERNED CITIZENS

GOLDBORO LNG

Preamble (by Pieridae):

During the public comment period ending on December 16th, 2013, the EA Review Panel received comments from 109 individual citizens. The overwhelming majority of these submissions represent short messages of general support for the Project and often include a brief rationale based on the expected economic benefits of the Project.

Pieridae recognizes the strong support for the Project within the local and regional communities and acknowledges the many potential direct and indirect benefits attributed by the commenting authors to the Project development.

Pieridae reviewed each one of the individual submissions and assigned them a unique Information Request number (IR #). Collectively they have been referred to as IRs from Concerned Citizens (CC).

Following the review Pieridae decided to not reproduce each one of these submissions in this IR Response Document. Instead, they are summarized in the table below. The original full submissions can be obtained by contacting NSE, EA Review Coordinator.

In the table below, the major topic of each submission is given. Where individuals identified issues/concerns (i.e., other than "Project Support"), or raised questions, these are addressed further in detailed responses. In some cases, names may be misspelled, as many were hand written and at times difficult to read.

Summary of Comments Received from Concerned Citizens

IR #	Name (representation)	Topic/Key Issue
CC1	William A. Digdon (resident)	Project Support
CC2	Randy Avery (business owner)	Project Support
CC3	Daniel J. McInnis (resident)	Project Support
CC4	Gary MacGregor (resident)	Project Support
CC5	H. Basil Mattie (business owner)	Project Support
CC6-1	Ken Giffin (former resident)	Project Support; Tailings
CC6-2	Ken Giffin (former resident)	Project Support; Noise
CC7	R. Bruce MacKeen (business owner)	Project Support
CC8	Natashia McSween (resident)	Project Support
CC9	Ronnie McSween (resident)	Project Support
CC10	Lawrence T. Tovey (resident)	Project Support
CC11	Franco Callegari (resident)	Project Support
CC12	Craig Macisaac (resident)	Project Support
CC13	Gary Lund (resident)	Project Support
CC14	Craig Robertson (resident)	Project Support
CC15	Ian B. Conway (resident)	Project Support
CC16	Rick Rutherford (resident)	Project Support

Summary of Comments Received from Concerned Citizens

IR #	Name (representation)	Topic/Key Issue
CC17	Ian Tate (business owner)	Project Support
CC18	Bill Gosse (resident)	Project Support
CC19	Thomas Brennan (resident)	Project Support
CC20	Miles MacDonald (resident)	Project Support
CC21	Myles MacPherson (business owner)	Project Support
CC22	Finlay Armsworthy (business owner)	Project Support
CC23	George MacDonald (resident)	Project Support
CC24	Eugene Decoste (resident)	Project Support
CC25	Garett Tait (resident)	Project Support
CC26	Kyle MacDonald (resident)	Project Support
CC27	Tim Brophy (resident)	Project Support
CC28	Colton Wood (resident)	Project Support
CC29	Gerard MacDonald (resident)	Project Support
CC30	George Desmond (resident)	Project Support
CC31	Tim Purro (resident)	Project Support
CC32	Rene Melanson (resident)	Project Support
CC33	James MacDonald (resident)	Project Support
CC34	Malcolm Redden (resident)	Project Support
CC35	Cody Wood (resident)	Project Support
CC36	Keith Sampson (resident)	Project Support
CC37	Chastity Morris (resident)	Project Support
CC38	Blaise Welory (resident)	Project Support
CC39	John Boyd (resident)	Project Support
CC40	Patricia Chisholm (resident)	Project Support
CC41	Judy Doyle (resident)	Project Support
CC42	Mary Miller (resident)	Project Support
CC43	Ken Miller (resident)	Project Support
CC44	Donny George (resident)	Project Support
CC45	Blair George (resident)	Project Support
CC46	Anne Marie Tramble (resident)	Project Support
CC47	Harold Hendsbee (resident)	Project Support
CC48	Alice Hendsbee (resident)	Project Support
CC49	Brent Molyneaux (resident)	Project Support
CC50	Craig Canning (resident)	Project Support
CC51	Dion McGrath (resident/fisherman)	Commercial Fisheries
CC52	Rickey McLaren (Councillor, MODG)	Project Support
CC53	Paula Farnsworth (business owner)	Project Support
CC54	Adam Farnsworth (business owner)	Project Support
CC55	R Walsh (trails assoc.)	Project Support
CC56	R Walsh (marina assoc.)	Project Support

Summary of Comments Received from Concerned Citizens

IR #	Name (representation)	Topic/Key Issue
CC57	Theresa Beiswanger (resident)	Project Support
CC58	[illegible] (United Baptist Church)	Project Support
CC59	Janice J. Langille (resident)	Project Support
CC60	Angela [illegible] (business owner)	Project Support
CC61	Fraser Gammon (fire cheif)	Project Support
CC62	Darrell Langille (resident)	Project Support
CC63	James Smith (business owner)	Project Support
CC64	Mary Rhynhold (Gun Club)	Project Support
CC65	James & Mary Rhynhold (business owner)	Project Support
CC66	Jolene Hudson (resident)	Project Support
CC67	Mel Gillis (resident)	Project Support
CC68	Stephen MacDonald (resident)	Project Support
CC69	Darren Arseneault (resident)	Project Support
CC70	Tim MacPherson (resident)	Project Support
CC71	Claude P. Bezanson (resident)	Project Support
CC72	Ryan Wallace (resident)	Project Support
CC73	Dave Naugler (resident)	Project Support
CC74	Jason Munron (resident)	Project Support
CC75	Robert Hodges (resident)	Project Support
CC76	Mary M. McLaughlin (resident)	Project Support
CC77	Andrew McLaughlin (resident)	Project Support
CC78	Anne Marie Melanson (resident)	Project Support
CC79	Ryan MacEachern (resident)	Project Support
CC80	Rene Deyoung (resident)	Project Support
CC81	Greg Chisholm (resident)	Project Support
CC82	Pierre Benoit (resident)	Project Support
CC83	Doug Ehler (resident)	Project Support
CC84	Andrew Davis (resident)	Project Support
CC85	Taylor Bezanson (resident)	Project Support
CC86	Robert Benoit (resident)	Project Support
CC87	Genevera Benoit (resident)	Project Support
CC88	Sean Cormier (resident)	Project Support
CC89	James MacGillivray (resident)	Project Support
CC90	Kara Deon (resident)	Project Support
CC91	Bernadette Davis (resident)	Project Support
CC92	Steve Clapperton (resident)	Project Support
CC93	Wilfred Melanson (resident)	Project Support
CC94	Ryan Bailey (resident)	Project Support
CC95	Gerard MacMillan (resident)	Project Support
CC96	Claude Fougere (resident)	Project Support

Summary of Comments Received from Concerned Citizens

IR #	Name (representation)	Topic/Key Issue
CC97	Sandy MacDonald (resident)	Project Support
CC98	Thomas MacDonald (resident)	Project Support
CC99	Bradley D. Logan (resident)	Project Support
CC100	Craig Gavin (resident)	Project Support
CC101	Trevor Deon (resident)	Project Support
CC102	John K. Chisholm (resident)	Project Support
CC103	Jonathan DeCoste (resident)	Project Support
CC104	Gregory Cameron (resident)	Project Support
CC105	Bill McLaughlin (resident)	Project Support
CC106	Dale Mattie (resident)	Project Support
CC107	Helen Murphy (business owner)	Project Support
CC108	Stephen Henley (resident)	Local Economy (Employment)
CC109	Art Kennedy (business owner)	Project Support

Request:

As identified in the above table, three submissions by concerned citizens went beyond a brief statement of Project support and addressed concerns, made suggestions, or raised questions. These include CC6-1/6-2 (Tailings; Noise), CC51 (Commercial Fisheries), and CC108 (Local Economy).

The complete text of these three submissions with their specific comments/requests has been reproduced verbatim on the following pages. Each is followed immediately by Pieridae's response.

Response:

See following pages.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: November 30, 2013	Page 1 of 2
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Ken Giffin Concerned Citizen	IR # CC 6

Preamble:

The Goldboro LNG proposal is a project that offers a great deal of opportunities to Goldboro, munipality of Guysborough, and the province of Nova Scotia on the socio-economic front with a minimum of long term risk to the immediate area of the project proper.

This project holds many similarities to the formerly proposed Keltic/maple project which fell victim to changing economics in the natural gas industry and unfortunately never came to fruition. The one aspect of this project which presents less risk is the lack of processing, storage and transport of long chain and cyclical hydrocarbons which present far greater hazard to the environment in the event of a release. After thorough review of the impact submission I am in agreement with other assessment that this project will present minimal negative impacts to the local community and residents.

For me the most important advantage of the Goldboro proposal is a revitalization of the local and regional economy through direct and indirect employment during the construction and O&M phases of the project. For myself this project offers the opportunity to return home, work, and receive a decent compensation in my home town. Like far too many residents of Guysborough county I have been forced to leave the area to find decent work to support myself and family. Though we maintain our home in Goldboro, I have been forced to find contract work in various areas of the country for the past 18 years.

Request:

There are two points which present some concern for me related to the project which I feel should be addressed in detailed mitigation planning phases which are:

1. There are several areas within the project which have been impacted by past gold mining activities including two sites where past milling activities were carried out utilizing amalgamation recovery. The largest of these would be the past Skunks Den site on the northeastern section of the property. The second and indeterminate size site would be the Dung Cove or Griffin mill adjacent to Dung Cove brook. I am unsure of where tailings from this mill were disposed of but they were most likely dumped into the brook and migrated into Dung Cove itself. Some investigation for mercury contamination and distribution should be carried out in this area, as it will be in the heavily impacted zone of the site.
2. Though the site can be considered somewhat remote from the communities of Goldboro and Isaac's Harbour LNG facilities, as noted in the EIS, utilize large numbers of fin fans, or aerial coolers to chill the gas. Mitigation plans need to include assurances that adequate noise attenuation measures are implemented so that the communities local to the project are minimally impacted. This may include the use of soil berms between the plant and the communities to deflect sound waves into the atmosphere.

Overall, it is my opinion that this project will have a great net benefit in a local and regional basis through increased economic activity and development directly and indirectly related to the project and the possibility of this project becoming a seed for further development in the area related to upstream production or downstream secondary industries such as gas to liquids (GTL) or petrochemical facilities. My family has lived in the Goldboro area since the mid 1800s and I find it quite depressing how my home town has declined during my lifetime, I hope that this project will be the impetus for a significant change in that trend, and commence the return of the area to prosperity.

Thank you for you consideration of my comments.

Ken Giffin
Project Superintendent
Sunny Corner Enterprises Inc. (Nuclear Division)

Response:

1. Given the mining history of the site one of the first activities during FEED will be the detailed site investigations with respect to soil chemistry (soil contaminants), presence of acid generating rock, and geotechnical characteristics (incl. presence and extent of mine openings and shafts). The survey will pay particular attention to the tailings areas delineated in the EA Report but would extend over the entire site area. The survey results will be used to formulate a RMP and a SBMMP. The management of the contaminated materials will follow protocols outlined in NS Guidelines for the Management of Contaminated Sites. This may include removal and off-site disposal of some of the materials. Any off-site disposal would be in accordance with the NS Guidelines for Disposal of Contaminated Materials at Landfills. The Project's overall Environmental Management Plan will ensure the establishment of the above referenced specific management plans, and the monitoring of their effectiveness as well general compliance with regulatory requirements.
2. The adjacent communities noted of Goldboro and Isaac's Harbour are remote from the site however preliminary noise modelling shows that a small number of receptor locations could be impacted. During the next stage of the Project design detailed modelling will be undertaken. This modelling will account for terrain characteristics (vegetation cover; existing topography adjacent to the site; new topography on site established through cut and fill activities), exact locations of equipment, and detailed equipment specifications. If at that stage (after design refinement and noise modelling) noise levels at receptors are still predicted to be above the Nova Scotia guidelines, further noise mitigation measures will be developed. This would include the consideration of mitigation at the receptor site(s) and possibly relocation of affected receptor(s).

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 16, 2013	Page 1 of 1
GOLDBORO LNG	Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia	Information Requested by: Dion McGrath Concerned Citizen	IR # CC 51

Preamble:

Restricted Sea Urchin Zone

Request:

Concern related to commercial diving in and around project area.
Safety zones, exclusion zones, interaction with LNG tankers Tugs etc.
No mention in Environmental assessment report.

Although cyclical in nature, and recovering the area supports a lucrative sea urchin fishery with over a million pounds of sea urchins landed within a unique restricted Zone from 94/00.No mention in report.

This zone is located in Country Harbour. The eastern border is a line running south from Drum Head at latitude 45 09.6N,longitude 61 36.6W and the western border is a line running south from Cape Mocodome at latitude 45 05.4,longitude 61 39.3W. The Restricted Zone incudes all of Stormont Bay.

Response:

Pieridae is aware of the previous sea urchin fishing activity in the area, and has initiated discussions with the existing Zone (license) holder. It is understood that there has been no urchin fishing in the area since 2001 due to a collapse in the fishery. As a result, this fishery was not considered as being potentially impacted by the Project.

Pieridae is, however, cognizant that this fishery could potentially rebound if habitat and markets return to favourable conditions. To this end, Pieridae is currently in discussions with the license (Zone) holder to enter into an arrangement that will meet the needs of the urchin fisher and the Project and enable continued operation of the urchin fishery in the waters near the Project site should the fishery recover. This will involve communication of vessel movements in the urchin fishing zone, and an evaluation of the potential direct loss of revenue from within those areas excluded for safety and security considerations.

Pieridae Energy Canada Ltd.	Nova Scotia Environmental Assessment Board	IR Date: December 17, 2013	Page 1 of 2
GOLDBORO LNG	**Proposed Natural Gas Liquefaction Plant and Marine Terminal Goldboro, Nova Scotia**	**Information Requested by:** **Stephen B. Henley Concerned Citizen**	**IR #** **CC 108**

Preamble:

Support for the Project

Request:

Please except my input/observations on the proposed LNG project.

First and most importantly is that this plant will contribute to the reduction of greenhouse gas production globally due to this proposed Ing plant making available to other countries the cleanest burning fossil fuel available, presently out of reach for them. They would otherwise have to rely on Coal or other carbon intensive petroleum products. Lng is the cleanest alternative we have to transition us away from fossil Fuels. Canada is receiving criticism internationally over the Carbon intense tar sands out west, yet they are vital to the economic stability of Canada as we are all benefiting directly or in directly. This LNG project will enable us to say as a country that we are doing other things that are helping to offset some of the negative impacts of the Tar sands projects.

Another observation or suggestion, the proponent should have a commitment to “buy local First” for any goods and services such as labour. The proponent should have a commitment to not bring in workers from away unless they are not available locally Although for peak construction it would be almost impossible to do that,

The proponent should be required to train local people for permanent operational positions. The government could assist that through a Taylor made training program within the community Collage system. We need to enter into dialog and Identify what specialized skills will be required and have those people ready to go.

Ps. This project should be fast tracked to beat out the competition, There is millions of potential tax revenue at stake here.

Respectfully

Stephen B.Henley PE

Response:

Pieridae agrees that LNG is the cleanest burning fossil fuel and shares the commentator’s views on the use of LNG and associated economic and environmental opportunities it presents to Canada and foreign nations.

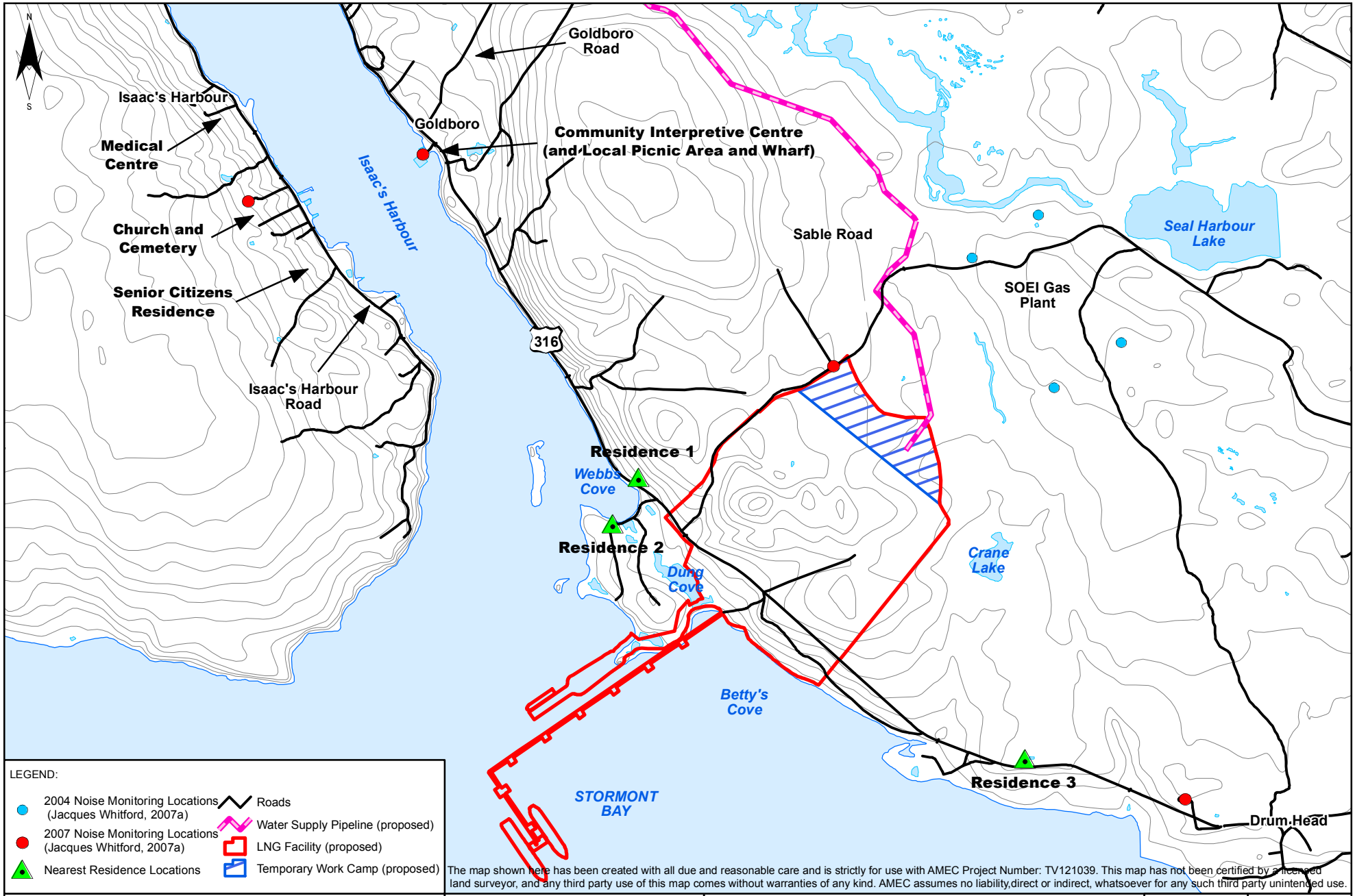
With respect to “buying local first”, Pieridae is committed to maximizing the Project’s benefits to the local community. As such Pieridae is making a concerted effort to identify local suppliers for the procurement of required goods and services to ensure they are given an opportunity to bid on the work being tendered. All bids are judged on their economic merit first but otherwise local bidders will be given preference.

With respect to employment of the local workforce, Pieridae will identify the actual skill sets required and will coordinate and consult with local and regional educational institutions to ensure that the employment opportunities presented by the Project will be known and brought to the attention of students for consideration in the development of curricula and career choices. In addition, given the long period of time that both Imperial Oil and Encana have been operating in the area, we believe there already exists a significant pool of local talent to draw from. Similar to the procurement of goods and services, job applications will be evaluated based on skills and experience first and a preference for local applicants.

APPENDIX 1

FIGURE 9.3.1

GOLDBORO LNG



CLIENT: Pieridae Energy (Canada) Limited

0 500 1,000 Metres

DATUM: UTM Zone 20

PROJECTION: NAD83

PROJECT NO: TV121039

PROJECT: ENVIRONMENTAL ASSESSMENT

GOLDBORO LNG

TITLE: NEAREST SENSITIVE RECEPTORS AND BASELINE NOISE MONITORING LOCATIONS

DWN BY: JT

DATE: Aug 2013

CHK'D BY: TM/CL

REV. NO: N/A

SCALE: 1:25,000

FIGURE NO: 9.3-1

AMEC Environment and Infrastructure
A Division of AMEC Americas Ltd.
50 Troop Avenue, Unit 300
Dartmouth, N.S., B3B 1Z1
(P) 902-468-2848 (F) 602-468-1314

Path: G:\GIS\PROJECTS\TV121039_Phase3000\MXD\20130816_EA_FINAL_Report\20130819_NoiseMonitoring_Fig9_3_1.mxd User: jonathan.thornton Date: 19/08/2013

SOURCE: SNSMR- Topographic Data

APPENDIX 2

NOISE STUDY (REV. C)

GOLDBORO LNG

Goldboro LNG

CB&I **Pieridae Energy Limited**

Document Title: **Noise Study**

Document No: **185352-000-ME-RP-00001**

Revision: **C**

Issue Date: **17-12-2013**

CB&I Contract No: **185352**

Revision Descriptions	Rev	Date	Originator	Checker	Approver
Issued for Use	A	31-01-2013	DJW	DAR	MW
Issued for Use	B	13-12-2013	RB	DJW	RDB
Issued for Use	C	17-12-2013	RB	DJW	RDB

INPUTS / REFERENCE DOCUMENTS

Document Number	Title	Status
	Keltic Petrochemical and Liquefied Natural Gas Facility Impact Assessment	2006-2007
	Health Canada, Environmental Health Program, Regions and Programs Bureau, Letter to Helen Yeh, Environmental Assessment Branch dated 9th December 2013	

REVISION NOTES AND HOLDS

Revision	Description of Changes & Holds	
A	Issued for Use	
B	Issued for use including comments from Health Canada Added conclusion, noise level prediction contours and noise modelling parameters including input data (Section 8).	
C	Issued for use including comments from AMEC	
HOLDS	Description of Holds	Rev Date
1	Deleted	
2	Deleted	
3	Finalised Equipment Layout	
4	Environmental Receptors	
5	Winterisation - extend of clad Modules	
6	Deleted	

Table of Contents

Contents **Page**

1.0 INTRODUCTION

Pieridae Energy Ltd is planning to construct a natural gas liquefaction, storage and export facility at the Goldboro Industrial Park in Guysborough County, Nova Scotia, an I-3 designated industrial area. The facility will ultimately be able to produce up to 10 Million Tonnes per annum of liquefied natural gas (LNG) for export to the global LNG market, nominally Europe, South America and Asia. The desire to construct an LNG export terminal has arisen as a result of the unconventional gas reserves coming on stream in Canada and North Eastern USA.

Gas will be fed to the facility from the existing Maritimes & Northeast Pipeline (M&NP), via a short tie-in pipeline that will follow the route of the Sable Offshore inlet pipeline that runs between the two facilities.

The Goldboro LNG Project (the Project) will be designed for total LNG storage of up to 690,000m^3 in three full containment, atmospheric storage tanks for export via a marine loading facility comprising a jetty and two berths located off of the Dung Cove headland in Stormont Bay. The marine works will also include a wharf to provide protection for tug boats as well as providing access for materials during the construction phase of the project.

2.0 SCOPE

This document provides a preliminary high level prediction of noise emissions for the Project, a review of applicable regulatory requirements, and noise abatement measures and options for the Project. The study's preliminary noise level predictions include noise levels at locations both inside and outside of the facility's site boundary.

3.0 REFERENCES, CODES AND STANDARDS

The design for noise control shall be in accordance with the valid editions of the applicable National and/ or International Codes and Standards. All Canadian national legal and regulatory standards require to be adhered to as well as the specific requirements and conditions of the provincial and local regulations from Nova Scotia and Guysborough County. Where a conflict between the codes, etc., might exist, the most stringent requirements shall take precedence.

Lists identified below should not be considered exhaustive.

3.1 Codes and Standards

Ref.	Document Number	Document Title
1	SOR/86-304	Canada Occupational Health and Safety Regulations
2	O.I.C. 76-1510, N.S. Reg. 112/76	Nova Scotia Occupational Health Regulations
3	ISO 9613-2	Acoustics – Propagation of Sound During Propagation Outdoors – Part 2: General Method of Calculation
4		Nova Scotia Department of Environment, Guideline for Environmental Noise Measurement and Assessment

4.0 DEFINITIONS

Refer to Appendix 2 for Noise Control Definitions

5.0 NOISE LIMITS

5.1 Occupational Health Limit

5.1.1 General

The Canada Occupational Health and Safety Regulations (Ref. 1) provide the main framework for the approach to noise control in Canada and sets high level occupational health noise limits to protect workers in Canada. The Provincial Regulations in effect in Nova Scotia (Ref. 2) take precedence over the National Regulations.

On inspection of these documents, it is deemed that the approach to occupational noise control shall comply with the national regulations requirements and that the occupational noise limits shall comply with the Provincial Regulations. The Regulations for Nova Scotia refer to the Threshold Limit Values published by the American Conference of Governmental Industrial Hygienists (ACGIH).

5.1.2 Normal Work Limit

ACGIH Dose is for a noise exposure equivalent to 85dB(A) for 8hrs. The threshold for action is noise levels of 80dB(A). See Appendix 1 for further details.

5.1.3 Max Allowable Noise

The maximum sound pressure level is 140dB(Peak), it is not permissible to expose personnel to sound levels that exceed this, see Appendix 1 for further details. For information, 140dB(Peak) corresponds to approximately 115dB(A).

5.2 Area Noise Limit

In order to control occupational noise exposure, area noise limits should be applied. Typically, these are in accordance with the following table.

Area	Typical Noise Level Limits - dB(A)
Outdoor Equipment Areas	85
Indoor Equipment Areas	85
Workshops	75
E&I Equipment Room	65 (Note 1)
Control Room	55
Offices	50
Note 1: 65dB(A) only applies in areas where there is a permanent workstation. In other areas, or unmanned room, 85dB(A) applies.	

5.3 Environmental Limits

Nova Scotia Environment has established the following criteria under its Guideline for Environmental Noise Measurement and Assessment document:

- Day (0700 - 1900) 65dB(A)
- Evening (1900 - 2300) 60dB(A)
- Night (2300 - 0700) 55dB(A)

These noise criteria will be used for assessing receptor impact during the construction period and normal operation of the LNG facility.

Noise control and management measures (including a noise monitoring plan) will be developed as part of FEED and incorporated with the Project's Environmental Management Plan. The noise management plan will also include a mechanism for receiving and responding to public complaints and be subject to the proponent's on-going community notification and consultation.

6.0 NOISE SOURCES

6.1 Continuous Sources

Typical LNG liquefaction plants contain items of equipment that will cause high noise levels, either due to the equipment being noisy or due to the sheer number of units producing noise. Typically, the high noise sources include the large refrigeration compressor trains, the boil off gas compressors, the power generation gas turbine exhaust stack and some utility equipment such as cryogenic nitrogen generation plants and instrument air compressors. Fin fan air cooled heat exchangers tend not to be excessively noisy in their own right however there are typically large numbers of these unit types installed adjacent to each other which will combine to produce high noise levels on and off site.

6.2 Intermittent Sources

Intermittent sources tend to be noisier in nature but operate infrequently and for short durations. Emergency flaring and operation of pressure relief valves are examples of noise sources that will emit high noise levels which require to be considered during the design phase as they could potentially be a safety concern for on-site personnel and have an effect on environmental receptors.

6.3 Construction Sources

These include truck movements, earthworks, blasting, piling etc. These are not included in the noise modelling.

7.0 OFFSITE RECEPTORS

There are both residential and industrial receptors located within approx. 1km of the proposed site boundary. These are:

- Two residential properties (3 buildings)located around Webb's Cove approximately 200-400m to the west of the gas plant entrance (Sable Road)
- One residential property (1 building) located approx. 900m southeast of the plant boundary.
- Sable Offshore Energy Inc. (SOEI) Gas Plant approx. 400m north of the plant boundary

Further to these receptors, the towns of Goldboro (northwest) and Drum Head (east) are outside a 1km radius.

8.0 NOISE MODELLING

8.1 Software Parameters

The noise model was developed in SoundPLAN V7.2. The software uses sound power level as the input data which is then propagated to give sound pressure level predictions at all locations on a chosen surface or at a specific location. The input data is a sound power level which is the property of the equipment and the output shown on the noise contours is a sound pressure level which is the sound perceived by a receiver which decreases as the receiver travels away from the source.

The sound power level is radiated according to ISO 9613-2 referenced above. An absorption coefficient of 0.05 was used for the area within the site boundary and 0.9 was used for the areas outside of the site boundary. This is considered acceptable per ISO 9613 Part 2.

The noise model does not include background noise levels as it is typically only given at specific locations that are sensitive to noise. Background noise data and the cumulative effects of existing noise sources is to be evaluated separately during FEED, when the noise model will be refined and specific approaches to noise abatement are being developed.

8.2 Wind and Ambient Conditions

The noise modelling software assumes that the wind blows equally from all directions.

Ambient conditions used are: 10 °C with 70% relative humidity.

8.3 Grade Elevation

A grade elevation of MSL + 5m has been used for major noise producers such as the LNG trains and the gas turbine generators.

8.4 Input Noise Data

8.4.1 General

The noise data for the model is as tabled below. Each of the sources shown represents a point source that has been spatially arranged on the Plot Plan and an estimate of the elevation of the equipment above the ground.

8.4.2 Noise Model

Given the early stage of the Project, the noise model is a simplified model. The tabled noise data therefore does not represent an extensive list of sources that can be expected in a gas liquefaction plant. The simplification is two-fold: (1) only the main noise contributors for each area have been included, and (2) multiple sources (such as the air coolers) have been combined into fewer sources.

The simplified model is calibrated using the noise map produced by noise survey measurements of an operational site (APCI Process). The overall sound power level from the model is also compared to the design model for the same plant. This allows for the hundreds of air coolers to be acoustically combined into fewer, more powerful sources.

8.5 Sound Power Level Data

The following sound power level data is on a per train basis.

Source	L_w dB(A)	Comment
BOG Comp	105	In building
GTG x 5	115	Only exhaust modelled
Inlet Area	110	
Inlet Compressor	118	In building
N2 Package	118	In building
LP MR / MP MR Compressors	126	In building, compressor string combined into one source
HP MR / PR Compressors	126	In building, compressor string combined into one source
Pipe	115	
ACHE x 12	120	
ACHE x 12	118	
Comp GT x 2 (Exhaust)	118	
Comp GT x 2 (Air Inlet)	118	
Note: Data taken from previous LNG Liquefaction Project		

8.5.1 Sound Frequency

Noise modelling is based on the following octave band spectrum shape. The actual values used for each source are scaled up to meet the overall dBA value stated above.

Equipment Noise Data - dB(A)								
63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	Sum
73.8	78.9	84.4	86.8	89.0	91.2	86.0	73.9	95.3

It is of note that absorption by terrain and the atmosphere is more pronounced at higher frequencies.

8.5.2 Building Properties

The transmission loss used for the equipment buildings described above is tabled below.

	Sound Reduction Index (Rw) - dB							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Sheet Steel	3	8	14	20	26	32	38	40

8.5.3 Acoustic Mitigation

The above noise data contains an amount of acoustic mitigation such as acoustic insulation on compressor piping. The data is based on vendor standard equipment (MR-PR Compressors, ACHE, GT Driver). Noise reduction for individual pieces of equipment (e.g., for GT Drivers, MR-PR Compressors, ACHE fans; and piping insulation) will be considered during FEED, where the engineering, operational and cost implications will be evaluated and considered together with other noise reduction measures, including measures at receptor locations or possible relocations.

9.0 PLANT NOISE EMISSIONS PREDICTIONS

9.1 On-Site Noise Predictions

Generally, the design of gas liquefaction sites can meet on-site noise levels of 85dB(A). There are some areas, such as compression areas and some utilities areas where noise levels of 85dB(A) cannot be met using practicable noise reduction measures. Noise levels in these areas typically will range between 95dB(A) and 105dB(A), particularly within buildings.

Within buildings (excluding machinery and other noisy areas), noise levels can be mitigated by using good building techniques and ensuring building services (such as HVAC) are suitably designed.

Operational upsets will cause noise levels up to 115dB(A) at accessible areas. All feasible design mitigations should be implemented to ensure that noise levels will not exceed 115dB(A) at accessible areas.

Construction noise could potentially also cause noise levels up to 115dB(A) at accessible locations and can also be impulsive in nature (piling). Noise monitoring is to be performed at all stages of construction operations to limit personnel exposure levels to acceptable levels.

9.2 Off-Site Noise Predictions

The noise model was performed to predict noise levels at indicative off-site locations (see Figure 1 below) to the east and west of the plant boundary. The noise model is based on previous gas liquefaction plant experience and considers that main equipment items (compressors, power generation and utilities) are contained within basic steel shelters.

Predicted noise levels at the closest off-site receptors is c. 58dB(A). The maximum predicted boundary noise level is c. 78dB(A) at locations adjacent to the LNG Trains.

It is also expected that operational upsets and construction phase sound power level emissions could be up to 20dB higher than from continuous operation.

The noise contours for the project are shown in Figure 1. Noise Predictions at specific locations are tabled below:

Receiver	dB(A)
S. E. House	57.2
W. House 1	57.8
W. House 2	55.5
W. House 3	55.6

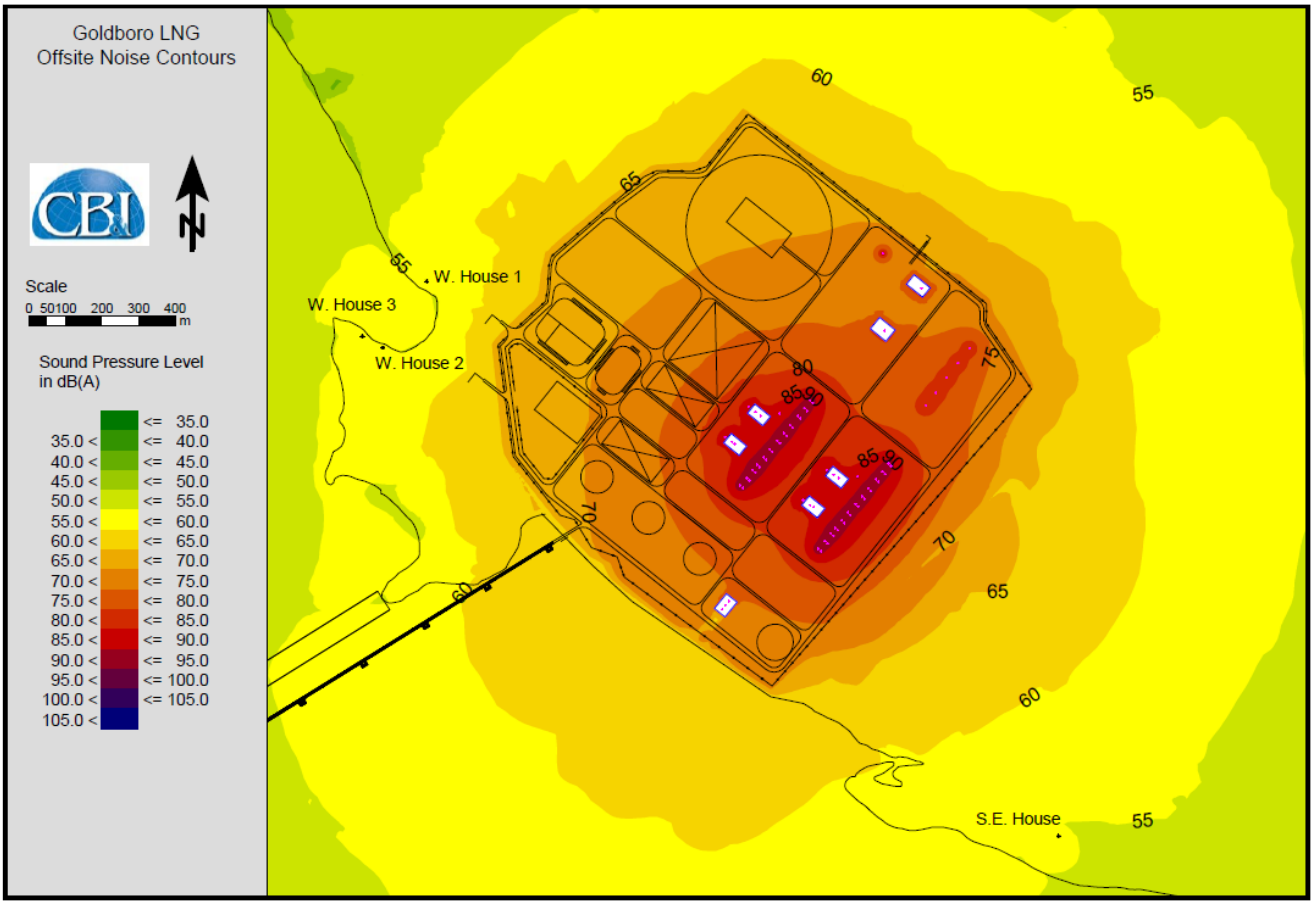


Figure 1 Noise Contours: Two LNG Trains

10.0 CONCLUSIONS

Based on the current simplified noise model there are 4 off-site receptors (three residential properties) which may exceed the 55dB(A) during normal operations of the LNG facility. The receptors are above the Nova Scotia guideline limits for night time. It is of note that these predictions are based on what is considered a conservative approach to the noise modelling. In particular, the preliminary noise model assumed a limited degree of on-site noise abatement, and no off-site mitigation.

During FEED, the finalised plot plan, finalized equipment specifications, and the new site topography, will be modelled to refine the predicted noise levels at the identified receptors. If required, noise abatement and mitigation measures will be implemented. This may include on-site as well as off-site measures.

All other receptors identified (local communities of Goldboro and Drum Head) will be within acceptable Provincial limits due to their relative distances to the proposed LNG Plant.

Cumulative effects with the SOEI plant, wind farm, traffic and other background noise sources has not yet been performed. The review of these cumulative effects shall be performed during the FEED Stage.

11.0 FURTHER WORK

This report contains a high level review of noise levels associated with gas liquefaction plants based on available documentation. The noise predictions made largely derive from previous experience with similar plants, environmental documentation produced for a different plant type and on publically available information.

In order to develop the noise model further and to finalize the site plot plan the following activities need to be undertaken during FEED:

- Further background noise level measurements,
- Review of proposed site contouring, contours adjacent to the site, existing vegetation and planned landscaping to refine model input parameters;
- Defined scope and extent of enclosures/winterisation, including building detailed design and scope and specifications of equipment contained within buildings.
- Plot layout review and adjustments for noise control purposes, including distances from major noise sources to the boundary, distances of major noise sources to off-site receptors, impact of low noise designs.
- Identification of up-to-date existing noise sources and incorporation with the model to ensure cumulative effects are included with the refined model predictions.
- Review extent of construction noise sources based on developed foundation designs and cut and fill requirements.
- Development of noise mitigation measures including a comprehensive Noise Management Plan for construction and operation phases.

APPENDIX 1 - LITERATURE SEARCH

What are the noise exposure limits in Canadian jurisdictions?

Jurisdiction (federal, provincial, territorial)	Continuous Noise		Impulse / Impact Noise	
	Maximum Permitted Exposure Level for 8 Hours: dB (A)	Exchange Rate dB(A) +	Maximum Peak Pressure Level dB(peak)	Maximum Number of Impacts
Canada (Federal)	87	3	-	-
British Columbia	85	3	140	-
Alberta	85	3	-	-
Saskatchewan	85	3	-	-
Manitoba	85	3	-	-
Ontario	85	3	-	-
Quebec	90	5	140	100
New Brunswick	85	3	140	-
Nova Scotia	85	3	140	100
Prince Edward Island	85	3	-	-
Newfoundland and Labrador (references ACGIH TLVs)	85	3	-	-
Northwest Territories	85	5	140	100
Nunavut	85	3 or 5*	140	-
Yukon Territories	85	3	140	90

+ When 3 dB exchange rate is used, generally there is no separate regulation for impulse/impact noise. The equivalent sound exposure level (L_{ex}) takes impulse noise into account in the same way as it does that for continuous or intermittent noise.

* In Nunavut, the General Safety Regulations reference a 5 dBA exchange rate. The Mining Health and Safety Regulations reference 3 dBA. Please contact Nunavut for further information.

Noise regulations in several jurisdictions treat impulse noise separately from continuous noise. A common approach is to limit the number of impulses at a given peak pressure over a workday. The exact figures vary slightly, but generally the regulations in which the exchange rate is 5 dB permit 10,000 impulses at a peak pressure level of 120 dB; 1,000 impulses at 130 dB; 100 impulses at 140 dB, and none above 140 dB.

Alternatively, using a 3 dB(A) exchange rate, impulse noise can be considered jointly with any continuous noise, in measuring the overall L_{eq} sound level.

Source: *http://www.ccohs.ca/oshanswers/phys_agents/exposure_can.html*
(Updated 4th Jul. 2011)

Table of Noise Criterion, ACGIH TLV and OSHA PEL

ACGIH Noise Level (dBA)	Exposure Duration (hours)	OSHA Noise Level (dBA)	Exposure Duration (hours)	ACGIH Noise Level (dBA)	Exposure Duration (hours)	OSHA Noise Level (dBA)	Exposure Duration (hours)
80	24.0000	80	32	117	0.00520	117	0.19
81	20.1600	81	27.9	118	0.00390	118	0.16
82	16.0000	82	24.3	119	0.00327	119	0.14
83	12.7000	83	21.1	120	0.00263	120	0.125
84	10.0800	84	18.4	121	0.00200	121	0.11
85	8.0000	85	16	122	0.00166	122	0.095
86	6.3500	86	13.9	123	0.00131	123	0.082
87	5.0400	87	12.1	124	0.00097	124	0.072
88	4.0000	88	10.6	125	0.00081	125	0.063
89	3.1700	89	9.2	126	0.00064	126	0.054
90	2.5200	90	8	127	0.00048	127	0.047
91	2.0000	91	7	128	0.00040	128	0.041
92	1.5900	92	6.1	129	0.00032	129	0.036
93	1.2600	93	5.3	130	0.00024	130	0.031
94	1.0000	94	4.6	131	0.00020		
95	0.7900	95	4	132	0.00016		
96	0.6300	96	3.5	133	0.00012		
97	0.5000	97	3	134	0.00010		
98	0.4000	98	2.6	135	0.00008		
99	0.3100	99	2.3	136	0.00006		
100	0.2500	100	2	137	0.00005		
101	0.2000	101	1.7	138	0.00004		
102	0.1600	102	1.5	139	0.00003		
103	0.1300	103	1.3	140	0.00000		
104	0.1000	104	1.1				
105	0.0800	105	1				
106	0.0600	106	0.87				
107	0.0500	107	0.76				
108	0.0400	108	0.66				
109	0.0300	109	0.57				
110	0.02521	110	0.5				
111	0.02044	111	0.44				
112	0.01567	112	0.38				
113	0.01304	113	0.33				
114	0.01043	114	0.29				
115	0.00781	115	0.25				
116	0.00650	116	0.22				

ACGIH uses a 3 dB doubling rate, whereas OSHA uses a 5 dB doubling rate for the allowed exposures. For instance, ACGIH TLV is 85 dB for 8 hours, and 88 dB for 4 hours. However, the OSHA PEL is 90 dB for 8 hours, and 95 dB for 4 hours. This discrepancy partially accounts for the differences in dose rates between the two criterion. The other discrepancy is the threshold at which instruments start to measure noise. OSHA's PEL threshold is 90 dBA, whereas ACGIH uses a threshold of 80 dB. The formula for noise is:

$$Dose = \frac{C1}{T1} + \frac{C2}{T2} + \cdots \frac{Cn}{Tn}$$

Where C is the number of minutes at a noise level, and T is the allowed number of minutes at that noise level using the criterion selected. The lower threshold allows more exposure to be measured.

Source : http://www.aiha.org/consumerinfo/Documents/Noise.pdf
(Note OSHA reference not applicable)

APPENDIX 2 - NOISE DEFINITIONS

The following definitions are explained in sufficient detail to define their meaning in relation to the requirements of this document.

Noise	Unwanted Sound
Sound Level	Is the A-weighted overall sound-pressure level.
Equivalent Sound Level (L_{AEQ})	Is a steady sound level which represents the same sound energy as a time varying sound level under consideration. (Applies for 3dB 'exchange rate') In this context it is used to provide a single sound level to represent the time varying sound level as an individual moves about the plant.
Sound Power Level	Is defined as:- $PWL=10xLog_{10}(W/ W_r)$ Where: PWL is the Sound Power Level in dB W is the Sound Power in watts W_r is the reference sound power of 10^{-12} watt.
Sound Pressure Level	Is defined as:- $SPL =10xLog_{10}(P/P_r)^2$ Where: SPL is the Sound Pressure Level in dB P is the sound pressure in N/m^2 P_r is the reference sound pressure of $2x10^{-5}$ N/m^2.
Directivity Index	Is the difference between the Sound Pressure Level in a particular direction compared with the average value for the source.
Attenuation	Is a reduction of Sound Level. This term is frequently used to describe the sound reduction property of walls or duct fittings. In this context it is frequently confused with Sound Absorption.
Absorption	Is the property of materials to convert incident sound energy to heat. Typical good sound absorbers are carpets, curtains, mineral wool and soft furnishings. Typical poor sound absorbers are concrete, ceramic tiles steel plate and hard plaster.
Reverberation	Is the persistence of sound in an enclosure caused by multiple reflections.
Reverberant Sound Level	Is the sound level which is due to reverberation within an enclosed space.
Direct Sound Level	Is the sound level from the sound that arrives from the source without undergoing any reflection.
Total Sound Level	Is the logarithmic addition of both Direct and Reverberant Sound Level.

APPENDIX 3

WATER SUPPLY

GOLDBORO LNG

Water supply – detailed precipitation and hydrologic analysis

1. Hydrometric stations – instrumentation and monitoring procedures:

There is only one established, federally operated hydrometric station in the area: on St. Mary's River at Stillwater, roughly 24 km west of Goldboro. Data from it cannot be easily applied to the Isaac's Harbour River watershed, as the St. Mary's River watershed is much larger than the Isaac's Harbour River watershed, topography is different, as is the bedrock type at the upper reaches of the St. Mary's watershed.

In an effort to properly assess the characteristics of the Isaacs Harbour River and the Gold Brook watersheds, four hydrometric stations were installed in the vicinity of the proposed Keltic plant site and operated from November 2001 through to May 2003. Three were installed on the Gold brook system: one (GB1) at a tributary to Gold Brook Lake from Oak Hill Lake, another (GB2) in Gold Brook a short distance below Gold Brook Lake, and the third (GB3) in Gold Brook just above Seal Harbour Lake. The fourth stream gaging station (ML1) was installed on the Issac's Harbour River just below Meadow Lake where the gas pipeline crosses the river.

The stations were established using Global Water model WL-14 data loggers and pressure transducers (0 to 4.5m, vented for automatic barometric compensation) placed as deep as possible at each stream location. For protection the transducers were placed inside schedule 40 PVC screens, except at GB1 where the transducer was jammed in a joint in a culvert under the road. The data loggers were placed inside PVC tubing with caps for protection. They were programmed to record stream water depth every 30 minutes.

Stream-flow was estimated using:

$$Q = VA$$

Stream profiles at stations GB2, GB3 and ML1 were obtained using total-station survey gear, and at GB1 the cross-section of the culvert was assumed to be circular with a diameter of 1.68 m. At the ML1, GB1 and GB2 stream locations, flow-velocity (measured using Global Water model FP101 Flow Probe), stream-depth and lake level (ML1 and GB2 only) were measured and recorded 45 times at high and low stream stages and before and after major precipitation events between November 2001 and April 2003.

In order to estimate a flow value for each of the 45 measurement days, the wet cross-sectional area of the channel was calculated for each of those days. At ML1, GB2 and GB3 the cross-sectional area was calculated by dividing the channel into a series of slivers defined by the location of each stream profile station. The height of water at each profile station was determined using measured depth and station elevation (see Figures 1, 4 and 7). The shape of each sliver was assumed to be trapezoidal and the area of each was calculated. The sum of the sliver-areas equals the total cross-sectional area of the channel.

At the time each velocity measurement was taken in the field, the channel was divided into equally spaced panels and average velocity was measured by sweeping the probe from top to bottom across each panel. At GB2 and GB3 the channel was divided into two panels and two average velocity

readings were taken. At ML1 the channel was divided into four panels and four average velocity measurements were made. The cross-sectional area of each panel was then calculated based on the assumption that at the time of every manual depth measurement, the channel width was equally divided into the same number of panels.

Isaacs Harbour River (ML1)

The stream profile at station ML1 on the Isaacs Harbour River is shown in Figure 1 below.

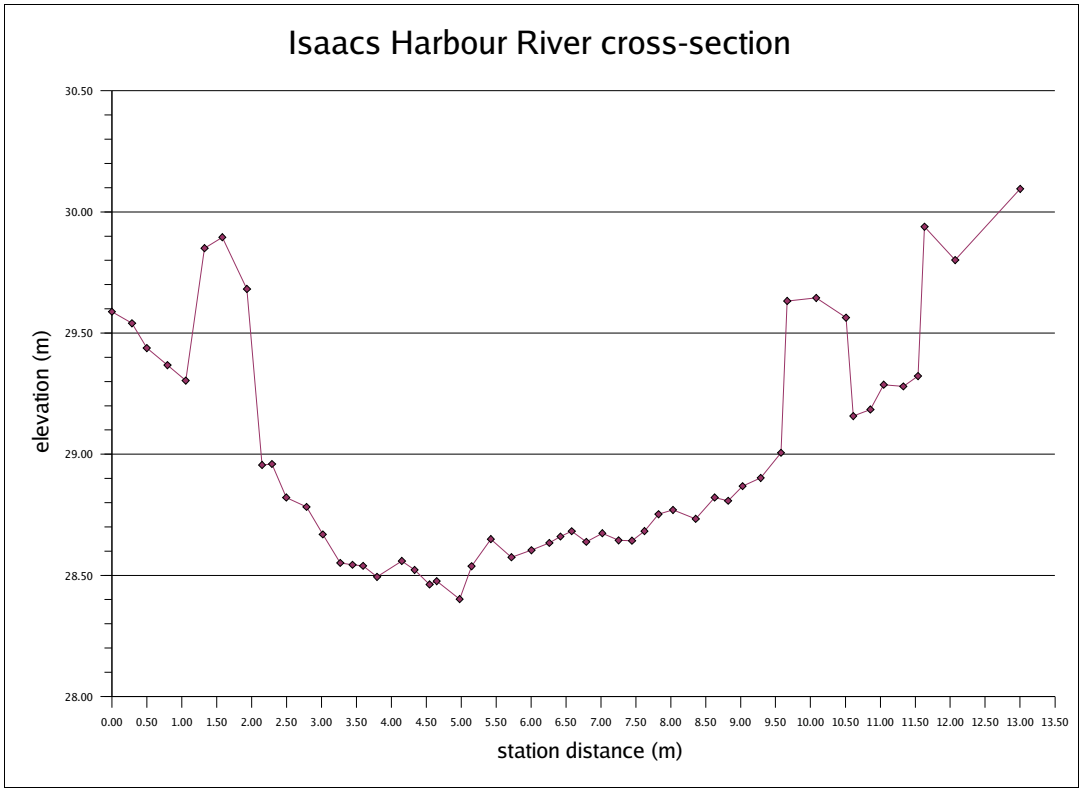


Figure 1. Cross-section of the Isaacs Harbour River at ML1.

A graph of flow (m^3/s) vs. depth (cm) was constructed in order to determine an appropriate flow-depth relationship (see Figure 2).

Two flow-depth relationships are necessary to describe the stream because of a "threshold condition" occurring at about 64 cm depth. For depth values less than or equal to 64 cm, the flow-depth relationship is best described with a power function and for those greater than 64 cm, the trend is linear. Several relationships were tested and the following were chosen because of the overall fit to both the upper and lower sections of the curve:

$$d \leq 64\,cm \qquad Q = 7.33\,x10^{-8}\,d^{4.1430}$$

$$d > 64\,cm \qquad Q = 0.153\,d - 7.562126$$

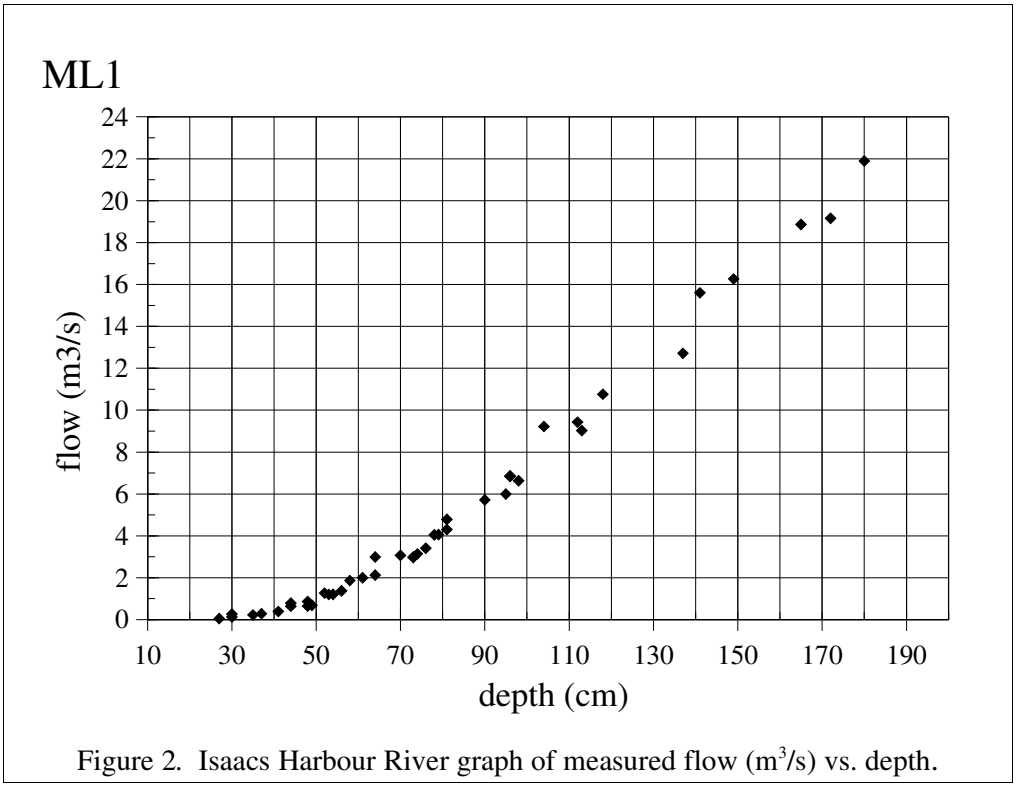


Figure 2. Isaacs Harbour River graph of measured flow (m^3/s) vs. depth.

Gold Brook Lake – GB1

At GB1, the cross-section of the culvert was assumed to be circular with a diameter of 1.68 m. A graph of flow (m^3/s) vs. depth (cm) was constructed in order to determine an appropriate flow-depth relationship (see Figure 3).

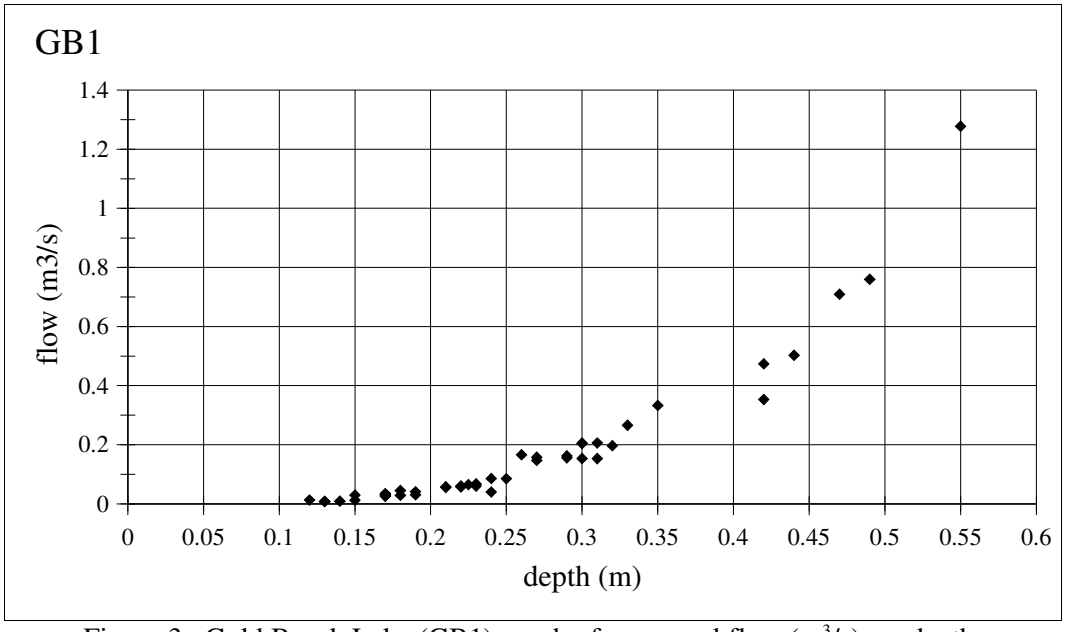


Figure 3. Gold Brook Lake (GB1) graph of measured flow (m^3/s) vs. depth.

Using Figure 3, the flow-depth relationship determined for GB1 was:

$$Q = 7.27\, d^{3.083}$$

Gold Brook Lake – GB2

The stream profile at station GB2 on Gold Brook a short distance downstream of Gold Brook Lake is shown in Figure 4 below.

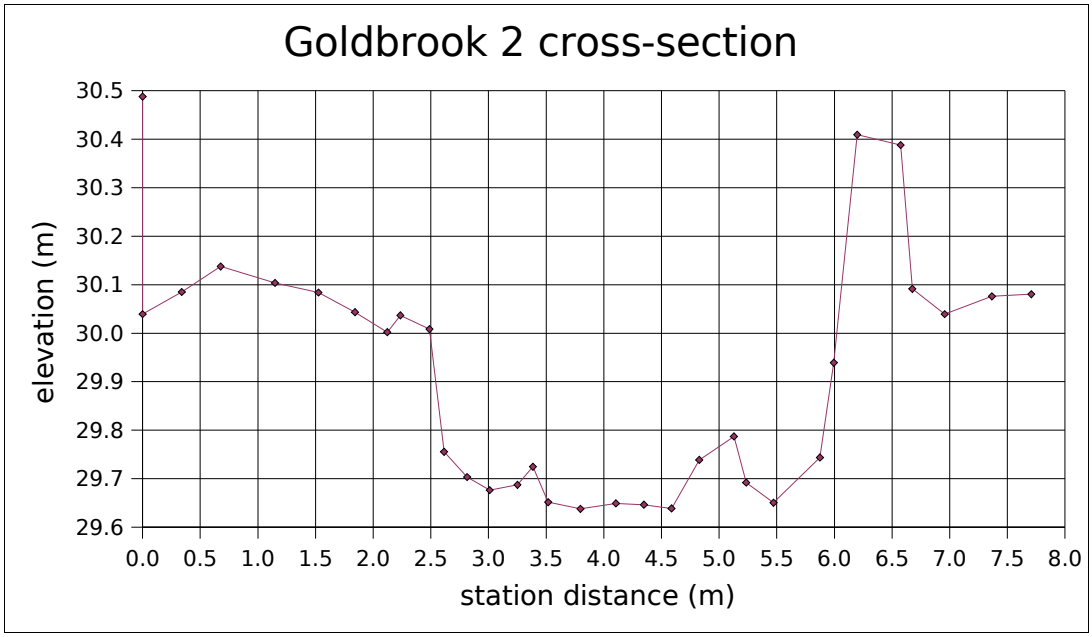


Figure 4. Cross-section of Gold Brook at GB2.

It became apparent at the time of data analysis (after data collection had already ended) that on several occasions during the data collection period (October 2001 to May 2003) the water level at GB2 had risen above the level of the banks. On these high-flow days, the channel was still separated into two panels for velocity measurements using the original channel dimensions. Since there is no way to estimate the vertical or horizontal extent of the water on the high-flow days, it was assumed that the channel behaved as a column of water whenever the channel depth was greater than the bank height of 36 cm. "Phantom elevation stations" were created at the actual channel edges between stations 9 and 10 and also between stations 26 and 27 (see Figure 5) and the stations beyond the channel edge were assumed to always be dry. This method underestimates the actual flow at GB2 on high-flow days, but keeps the actual dimensions of the channel without introducing additional errors by re-calculating the shape of the channel.

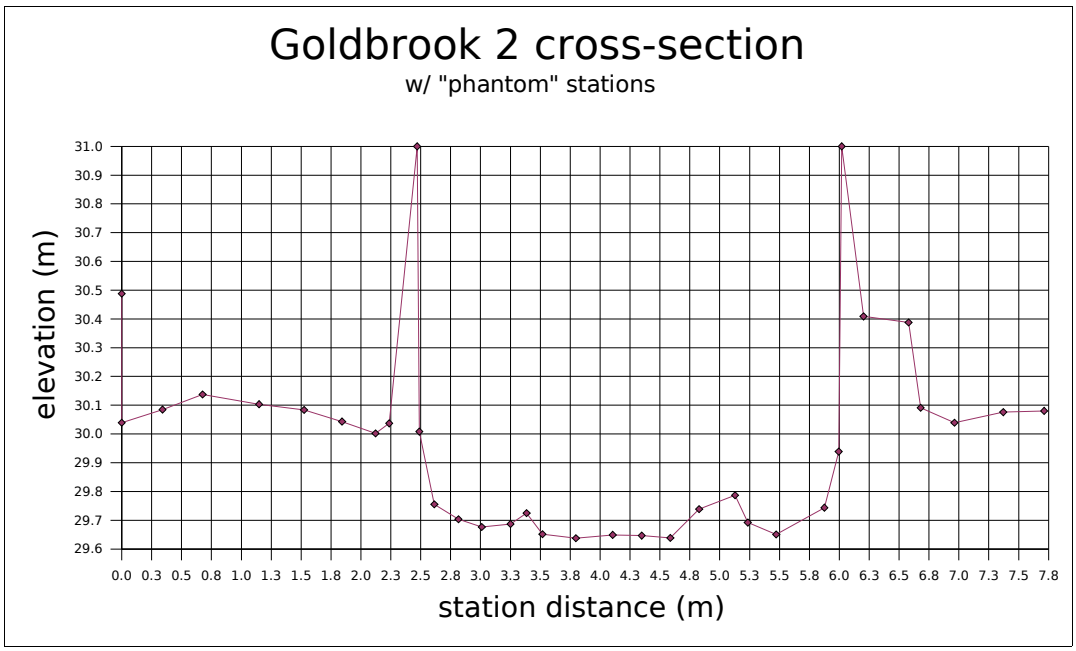


Figure 5. Cross-section of at GB2 showing "phantom elevation stations".

A graph of flow (m^3/s) vs. depth (cm) was constructed in order to determine an appropriate flow-depth relationship (see Figure 6).

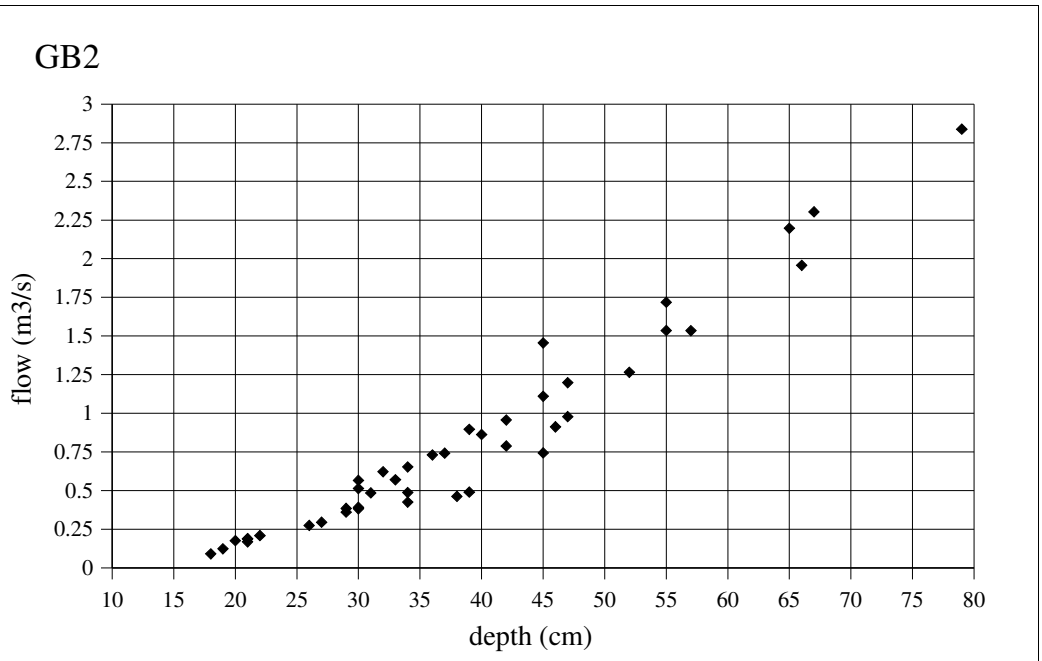


Figure 6. Gold Brook Lake (GB2) graph of measured flow (m^3/s) vs. depth.

Due to the assumption of vertical channel walls for stream depths greater than the bank height (36 cm), the bank height was chosen as the boundary depth. The depth-to-flow relationship is described using a power function relationship for depths less than or equal to 36 cm and a linear relationship

for depths greater than 36 cm. This division is confirmed by studying the graphical relationship between depth and flow (see Figure 6). Several relationships were tested and the following were chosen because of the overall fit to both the upper and lower sections of the curve:

$$d \leq 36\,cm \qquad Q = 6.2\,x10^{-5}\,d^{2.580}$$

$$d > 36\,cm \qquad Q = 0.0520\,d - 1.229827$$

Gold Brook – GB3

The stream profile at station GB3 on Gold Brook is shown in Figure 7 below.

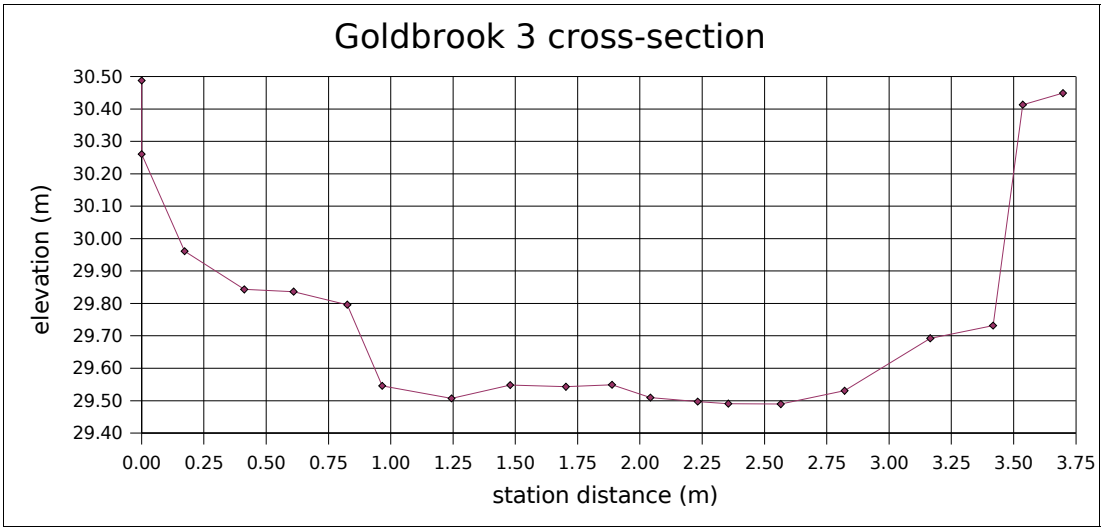


Figure 7. Cross-section of Gold Brook at GB3.

On several high-flow occasions, it was noted that the stream formed several channels upstream of the measurement site, which resulted in over-bank leakage at GB3. Therefore the depth and velocity measurements do not accurately represent the conditions at GB3, particularly on days when high-flows were present. Because of this and the damage incurred by the data logger placed at ML1 on 04 March 2002, the data logger at GB3 was removed on 09 March 2002 and placed at ML1 for the remainder of the data-collection period.

A graph of flow (m^3/s) vs. depth (cm) was constructed in order to determine an appropriate flow-depth relationship (see Figure 8)

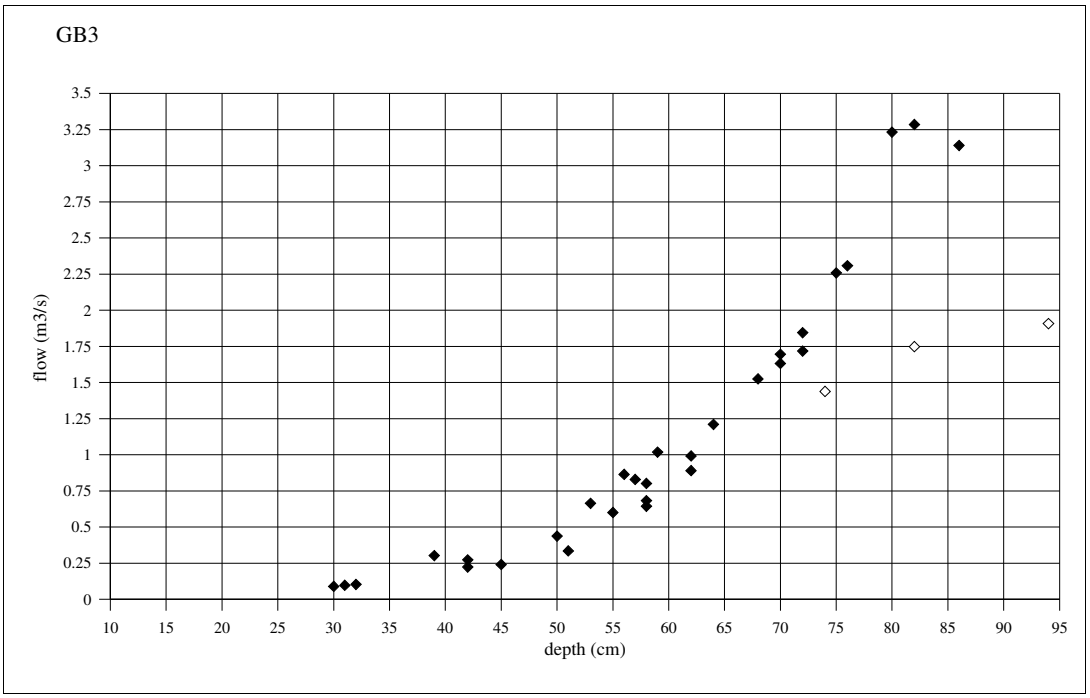


Figure 8. Gold Brook Lake (GB3) graph of measured flow (m^3/s) vs. depth (cm)

Three points which are considered outliers are shown as open circles in Figure 8. These points represent measurements made during high-depth conditions. The high-depth conditions should correspond to high-flow conditions, but that is not the case for these three points, likely due to over bank leakage which occurred on many occasions during high-flows. These three points were not used in the determination of the flow/depth relationship.

The following power function was determined to be the best relationship between depth and flow:

$$Q = 1.25\,x10^{-6}\,d^{3.315}$$

Gage-depth calibration

The manual flow and depth measurements were made at the same location (at the measured stream profile) every time, but these measurement could not be made directly at the pressure transducer location and so the depths recorded from both instruments could not be the same. Therefore, to apply proper flow/depth relationships to the depths recorded by the data logger at each site, the relationship between the data logger depth values and the manually-measured depth values was determined for each site. Also, the data logger clock did not account for time changes (daylight savings), and so an average of instantaneous pressure transducer depth measurements taken within one hour of the manual measurement was used as the equivalent value. In this way each manual measurement had an equivalent data logger measurement, and a linear relationship between the two could be determined.

At ML1 two data loggers were used to collect stream-depth data. The first was installed on 29 September 2001 and removed on 04 March 2002 when, because of rising stream levels, the data logger became submerged and stopped operating. The second data logger unit, which had originally

been placed at GB3, was installed at ML1 on 13 March 2002 and remained in place until May 2003. Since the two data loggers at ML1 could not be placed at exactly the same location within the stream, two data logger–measured depth relationships were determined, as follows:

29 September 2001 to 04 March 2002 $d_c = 1.38\ d_d - 23.73$

13 March 2002 to 24 May 2003 $d_c = 1.19\ d_d - 0.67$

where d_c is corrected depth in cm, and d_d is data logger depth in cm. The data logger relationships for the GB1, GB2 and GB3 in the Gold Brook watershed were:

$$d_c = 1.07\ d_d + 10.01$$

$$d_c = 1.22\ d_d + 2.61$$

and $$d_c = 0.98\ d_d + 19.73$$

At the time of installation, each data logger was calibrated, and so the relationships between measured depths and data logger depths should theoretically be 1:1. The equations above show that this is in fact the case as all relationships have a slope which is very close to 1. The y-intercepts represent the depth at which the data logger was installed at each site.

2. Hydrograph construction – measured stream flows

Stream-flow hydrographs were constructed for 01 October 2001 to 23 May 2003 for each of the four stream gaging stations (shorter period for GB3). The depth measurements collected by the data loggers at each site were collected at 30 minute intervals, then the appropriate data logger-measured depth relationship was applied, followed by the corresponding flow/depth relationship. The end result was an instantaneous flow value in m^3/s for each 30-minute interval. The hydrographs for each station were constructed by plotting the time of each depth measurement and the instantaneous flow values in m^3/s. The stream-flow data in Tables 1 to 6 was obtained from these hydrographs.

Table 1 Total 2002 Outflow (m^3) for ML1, GB1 and GB2

ML1	***GB1***	***GB2***
118,752,483	3,712,699	23,098,767

Table 2 Statistics of 2002 flow (in m^3/hour) for ML1, GB1 and GB2

Station	***mean***	***mode***	***minimum***	***25th percentile***	***median***	***75th percentile***	***maximum***
ML1	13,895	11,033	156	3,262	10,286	20,176	79,755
GB1	424	196	37	187	279	490	10,445
GB2	2,637	1,139	216	1,177	2,136	3,258	10,850

Table 3 Monthly summary statistics of flow values for ML1 (m^3/hr)					
Month	***mean***	***mode***	***minimum***	***median***	***maximum***
October 2001	2,038	295	233	1,285	12,075
November 2001	4,274	917	698	3,508	13,961
December 2001	11,445	10,189	1,597	10,078	34,043
January 2002	14,117	16,291	2,475	12,907	45,360
February 2002	16,550	3,679	2,651	18,455	54,126
March 2002	32,783	18,123	9,167	34,171	79,755
April 2002	27,282	20,736	8,401	23,348	64,959
May 2002	13,473	11,406	3,174	12,152	30,812
June 2002	1,353	552	156	1,027	4,582
July 2002	3,905	2,533	1,225	2,683	12,899
August 2002	5,297	1,027	705	1,601	34,357
September 2002	3,560	3,537	323	2,840	13,272
October 2002	11,588	5,575	2,461	9,540	36,783
November 2002	26,021	11,033	6,724	19,430	61,414
December 2002	16,572	7,868	5,443	15,511	37,529
January 2003	6,699	6,129	2,320	4,817	25,401
February 2003	20,274	5,575	4,817	17,004	56,562
March 2003	15,708	12,899	3,632	12,152	78,394
April 2003	20,746	5,575	3,352	10,846	65,705
May 2003	11,186	12,152	1,357	12,339	27,640

Table 4 Monthly statistics of flows for GB1 (in m^3/hour)					
Month	***mean***	***mode***	***minimum***	***median***	***maximum***
October 2001	278	235	132	235	1,195
November 2001	383	302	246	315	913
December 2001	452	235	215	368	1,531
January 2002	528	235	215	441	2,238
February 2002	836	279	246	490	10,445
March 2002	638	279	37	382	5,887
April 2002	607	659	179	474	4,710
May 2002	362	215	187	302	790
June 2002	253	162	126	215	701
July 2002	261	196	106	225	618
August 2002	173	126	50	119	1,164
September 2002	179	50	43	126	723
October 2002	330	154	119	225	2,192
November 2002	640	279	162	382	4,867
December 2002	320	196	154	235	1,019
January 2003	239	179	95	162	1,226
February 2003	578	279	132	327	3,637
March 2003	560	196	89	246	6,839
April 2003	149	79	46	119	1,047
May 2003	111	65	22	106	279

Table 5 Monthly statistics of flows for GB2 (in m^3/hour)					
Month	***mean***	***mode***	***minimum***	***median***	***maximum***
October 2001	704	283	260	604	1,745
November 2001	1,009	566	530	943	1,769
December 2001	1,752	2,164	656	1,672	4,113
January 2002	2,168	2,000	740	1,895	5,427
February 2002	2,345	994	784	2,404	6,610
March 2002	5,161	6,873	1,488	5,033	10,324
April 2002	4,119	2,667	1,139	3,456	10,225
May 2002	2,119	1,625	617	1,895	4,770
June 2002	948	1,065	441	960	2,601
July 2002	2,167	2,277	861	2,164	3,488
August 2002	1,642	579	316	994	6,150
September 2002	1,261	316	216	1,083	3,423
October 2002	2,625	2,000	1,139	2,306	5,657
November 2002	4,609	1,973	1,555	3,390	10,850
December 2002	2,464	1,158	1,065	2,404	4,836
January 2003	1,128	1,236	484	994	3,225
February 2003	3,251	960	799	2,601	9,272
March 2003	2,004	894	670	1,745	11,507
April 2003	4,981	2,930	1,870	3,439	11,934
May 2003	3,283	3,488	815	3,521	5,789

Table 6 Monthly statistics of flows for GB3 (in m^3/hour)					
Month	***mean***	***mode***	***minimum***	***median***	***maximum***
October 2001	1,190	849	481	1,068	3,375
November 2001	1,331	810	771	1,192	2,735
December 2001	2,061	2,185	810	2,033	4,620
January 2002	2,589	2,970	870	2,690	5,385
February 2002	3,785	1,324	1,117	3,875	16,206
March 2002*	5,147	4,053	2,345	4,753	9,339
*indicates a month for which the full month of data is not available.					

3. Water available to the watershed – precipitation analysis

Total annual flow for 2002 (full water year for which stream data is available) for the Isaacs Harbour River was 118,752,483±3,000,000 m^3. An estimate of total water available to the watershed for 2002, based on a 77,462,500 m^2 watershed and total annual precipitation of 1,379 mm (mean from three closest Environment Canada climate stations at Collegeville, Deming and Sherbrooke for

January to December 2002), is 106,820,787 m^3. This suggests that about 11 percent more water was present as stream discharge at ML1, than was available as total precipitation falling onto the Isaac's Harbour River watershed for the year 2002. It was clear from this that using simple means from the nearest climate stations would not produce reliable data for the Keltic water supply and so a study of the precipitation at the watershed was initiated in order to better understand the water balance in the area and, therefore, total quantity of water moving through the watershed system.

Data Acquisition

Climate data was obtained for all Environment Canada climate stations within 100 km Goldboro. This included historic data (daily monthly, annual summaries), available in digital format, plus paper copies of all raw field data for the three closest stations at Collegeville, Deming and Sherbrooke for the period October 2001 to May 2003. In addition, rain gages were placed immediately above the Isaac's Harbour River watershed at Salmon River to give an indication of precipitation amounts in the upper reaches of the watershed, and at Goldboro to give an indication of precipitation amounts the coastal region at the lower reaches of the watershed for the period October 2001 to May 2003. Figure 9 shows the locations of the study rain gages and Environment Canada climate stations.

The study gages used were RainWise® tipping-bucket type rain gages, calibrated to tip every 0.254mm (0.01 in) and equipped with HOBO® electronic data loggers programmed to record the time at each bucket tip. In order to compare the study rain-gage data to the Environment Canada climate station data (which is collected twice a day, usually at 8:00 and 18:00) the rain-gage data collected at Goldboro and Salmon River Lake was grouped to match “Environment Canada days”. The rain-gage data collected at Goldboro ad Salmon River was also grouped into actual 24 hour days to help study the stream-flow hydrographs in detail.

Over the 20 months during which rain-gage data was collected, continuous data from Goldboro is available for the periods 01 October 2001 to 16 October 2001, 09 November 2001 to 30 June 2002 and 19 October 2-02 to 28 May 2003. Continuous data from Salmon River Lake is available for the periods 09 November 2001 to 08 March 2002, 28 June 2002 to 19 October 2002, and 07 February 2003 to 28 May 2003. The gaps in the data are mainly due to human interference and/or equipment malfunction. Because of the larger gaps in the data available from the Salmon River station, the Goldboro data was used as a primary indicator of precipitation in the watershed and the Salmon River data was used when no Goldboro data existed.

Daily Environment Canada precipitation data (digital format) for Collegeville was available from 1916 to 2003, for Deming from 1956 to 2003 and for Sherbrooke from 1967 to 2003. These three station were chosen as indicators of precipitation amounts in the area, to establish historical precipitation trends and to confirm the reliability of data collected within the Isaac's Harbour River watershed at Goldboro and Salmon River Lake.

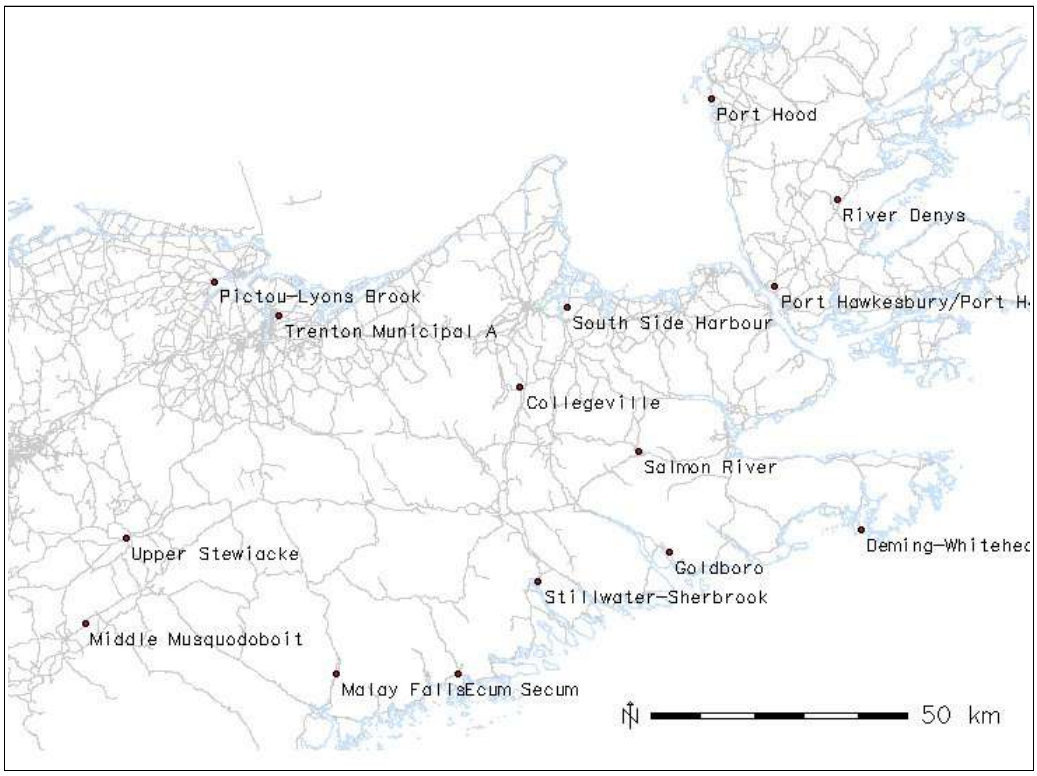


Figure 9. Locations of study rain gages and EC climate stations.

Data validation

For the period October 2001 to May 2003, the data collected at Goldboro was compared to daily precipitation data for Deming and Sherbrooke. These two were selected for the validation process because the coastal conditions at these two stations most resemble coastal conditions at Goldboro.

For each day data was available, the Goldboro data was examined in terms of quantity of rain recorded and the timing of the precipitation. If the precipitation at Goldboro was confirmed by either of these two Environment Canada climate stations, it was considered a valid reading. If not, the stream-flow hydrographs were examined for the same period and if the stream-flow response within a few days of the supposed precipitation seemed to confirm the occurrence of precipitation, then it was also considered valid precipitation. Precipitation falling as snow was generally found to melt shortly after each event and, therefore, tipping bucket readings generally matched the Environment Canada rainfall equivalent for each snowfall event. There was no doubt moisture loss due to sublimation before snow melted, but this would likely not account for any large errors.

Precipitation recorded on 28, 29 and 30 June 2002 was the only Goldboro data found to be erroneous. On 28 June 2002, the data from 09 March 2002 to 28 June 2002 was downloaded at 12:30. This data included 10.92 mm (0.43 in) recorded on 28 June 2002. After the download, between 28 June 2002 at 12:34 up until 30 June 2002 at 18:50, the rain gage at Goldboro recorded an additional 113.54 mm (4.47 in) of precipitation. This amount was not confirmed by any of the three nearby stations nor by the stream-flow response on the hydrographs. This suggested that someone may have tampered with the rain gage, possibly dumping water into it. The data was adjusted accordingly and the additional 113.54 mm (4.47 in) was not used in calculations.

The data collected at Salmon River was analyzed for the period during which no data from Goldboro was available (28 June 2002 to 19 October 2002) and was compared to Collegeville data since both stations are located inland. The Salmon River data appears to match Collegeville data in terms of timing of precipitation events, but not in terms of quantity recorded. The precipitation amounts recorded at Salmon River for the months of July, August and September (complete months during which data was collected) seem to be significantly lower than the amounts recorded at Collegeville. The total precipitation for September (4.57 mm (0.18 in) was so low that it was considered unusable.

Total monthly precipitation for Collegeville, Deming, Sherbrooke, Goldboro and Salmon River for the period October 2001 to May 2003 was calculated (see Table 7 and Figure 10). Table 7 and Figure 10 serve as a means of visually comparing the precipitation at the different stations during the period October 2001 and May 2003. They reinforce similarities in data observed between Goldboro and the Environment Canada stations, Deming and Sherbrooke in terms of climatic conditions and precipitation events, and that between Collegeville and Salmon River also.

Table 7 Total monthly precipitation (in mm)

Date	***Deming***	***Sherbrooke***	***Goldboro***	***Collegeville***	***Salmon River***
Oct-01	99	53	36	69	-
Nov-01	124	84	89	80	99
Dec-01	118	90	122	64	101
Jan-02	131	102	174	106	94
Feb-02	158	146	148	75	108
Mar-02	179	87	247	78	60
Apr-02	191	62	230	52	-
May-02	100	89	117	55	-
Jun-02	100	71	104	92	14
Jul-02	129	103	-	81	25
Aug-02	104	61	-	44	34
Sep-02	119	123	-	107	5
Oct-02	178	155	67*	127	77*
Nov-02	235	254*	305	150	-
Dec-02	98	101*	93	98	-
Jan-03	144	128	83	40	-
Feb-03	131	206	135	52	40*
Mar-03	88	92	110	131	142
Apr-03	206	127	197	104	102
May-03	96	98	105	79	65

* indicates a month for which the full month of data is not available.

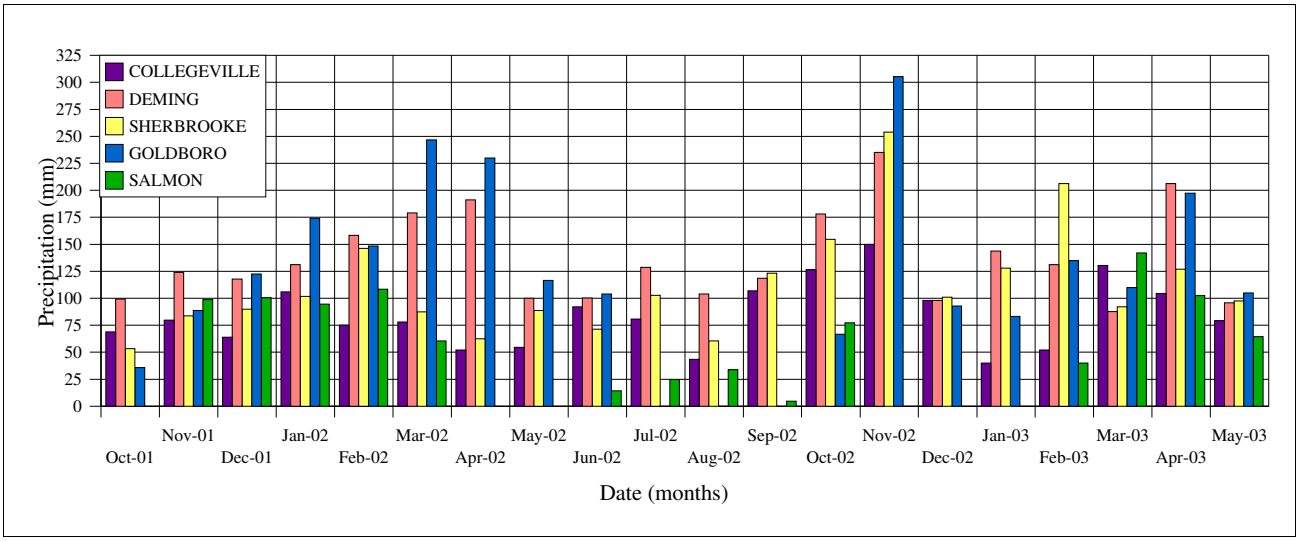


Figure 10. Total monthly precipitation (mm) for October 2001 to May 2003

Although there is a correlation between precipitation recorded in the watershed (at Goldboro and Salmon River Lake) and precipitation at nearby Environment Canada stations (Collegeville, Deming and Sherbrooke), due to the lack of data for Goldboro for July, August and September 2002, the unreliability of the Salmon River data for this same period, and the relatively short period available for comparison between stations (October 2001 to May 2003), a more detailed precipitation study and precipitation modeling using GIS were initiated to better understand the relationship between climatic conditions within the watershed and the surrounding Environment Canada stations.

Historic precipitation trends

To identify long-term precipitation trends in the study area, running decadal means were calculated using total monthly and annual precipitation for all Environment Canada climate stations within 100 km of Goldboro with a record of at least 20 years.

The precipitation record for the Deming station was extended from 1967 to 2003 to cover the period 1883 to 2003, by linking it to data from the Whitehead station (see Figure 9) at the same location, which has data available for 1883 to 1960. A period of overlap of 45 months between the years 1957 and 1960 exists, during which both stations recorded climate data. During this period, the two-station average was used and a record for Deming-Whitehead was created for 1883 to 2003.

The precipitation record for the Sherbrooke station was extended from 1956 to 2003, to cover the period from 1915 to 2003, by linking it to data from the Stillwater station at nearly the exact same location, which has data available from 1915 to 1960 and 1978 to 1979. In this case a period of overlap did not exist, so the record for both stations was simply combined and a record for Stillwater-Sherbrooke was created for 1915 to 2003.

Regardless of the amount of "data smoothing" provided by running decadal means, there were still years for which little or no data is available for many months (less than nine months of data), such as: at Collegeville between 1944 and 1948 and between 1961 and 1964; at Deming-Whitehead between 1883 and 1889, and between 1908 and 1926; and at Stillwater-Sherbrooke between 1961 and 1966 and between 1971 and 1980. Nevertheless, between 1926 and 1944 and from 1982 to 2002

there exists a near-complete record for these three stations – which indicates that there has been a general increase in total annual precipitation amounts over time. This increase is most obvious in the Deming-Whitehead and Collegeville areas. Overprinted on this long-term trend, mean total annual precipitation (values obtained from GIS at roughly the center of the Isaac's Harbour River watershed) increased from 1,475mm during the period 1982-1987, to 1,507mm during the period 1988-1994, decreasing to 1,341mm during the period 1995-2002. Total annual precipitation over the watershed averaged 1,554mm during the year 2002 (value obtained from GIS). The individual records for total annual precipitation for 2002 at Collegeville, Deming-Whitehead and Stillwater-Sherbrooke were 1,065mm, 1,722mm and 1,357mm, respectively. For these three stations, eleven, eleven and nine out of twelve months in 2002 recorded more precipitation than in 2001.

Three quasi-distinct periods were identified within the more recent data by which to characterize total annual precipitation amounts. These are from 1982 to 1987, 1988 to 1994 and 1995 to 2002. Also, by studying the seasonal total precipitation at Collegeville, Deming-Whitehead and Stillwater-Sherbrooke, "precipitation seasons" were defined, as follows:

Fall	- September to November;
Winter	- December to February;
Spring	- March to May;
Summer	- June to August.

Precipitation modeling

The 11 percent excess runoff versus precipitation observed at the start of this section suggested that simply using mean precipitation from the three nearest Environment Canada climate stations might not correctly represent the precipitation amounts actually falling onto the Isaac's Harbour watershed – it was thought that one or more climate station could be biasing the mean.

Nearly complete data from several other Environment Canada stations is available for the period 1982 to 2002, including at Ecum Secum, Malay Falls, Middle Musquodoboit, Pictou-Lyons Brook, Port Hastings, Port Hawkesbury, Port Hood, River Denys and Upper Stewiacke. Use of this data allowed an accurate simulation of precipitation over the Isaacs Harbour Watershed using GRASS-GIS, where rainfall data interpolation from the stations listed in Table 8 and (raster surface) modeling was done to tabulate the following:

Seasonal means (1982-2002)
Seasonal means (1982-1987)
Seasonal means (1988-1994)
Seasonal means (1995-2002)
Average annual total (1982-2002)
Average annual total (1982-1987)
Average annual total (1988-1994)
Average annual total (1995-2002)
Monthly totals (October 2001 to May 2003)
Seasonal totals (2002)
Annual total (2002)
Average monthly totals (1982-2002)

To illustrate how rainfall distribution has varied over time, Figures 11 to 14 show total mean annual precipitation for eastern Nova Scotia for the periods 1982-1987, 1988-1994, 1995-2002 and 1982 to 2002, respectively. Also, mean average total monthly precipitation for the period 1982 to 2002 (shown in Figures 15 to 26) and individual monthly totals for October 2001 through May 2003 were tabulated for the stations listed in Table 9. These data are used later to calculate the October 2001 to May 2003 and overall average (1982 to 2002) monthly and annual flow versus precipitation at Isaacs Harbour River, and thus, reservoir storage requirements.

Table 8 Period of record for stations used for historic (1982-2002) rain modeling

Station Name	***Period of Record***
Collegeville	1982-2002
Deming-Whitehead	1982-2002
Ecum Secum	1982-1985
Malay Falls	1988-2002
Middle Musquodoboit	1982-2002
Pictou-Lyons Brook	1985-2002
Port Hawkesbury/Port Hastings	1982-1995/2001-2002
Port Hood	1982/1985-1987/1990
River Denys	1982-1987
Stillwater-Sherbrooke	1982-2002
Upper Stewiacke	1982-2002

Table 9 Period of record for stations used for modeling October 2001 to May 2003

Station Name	***Period of record data available***
Collegeville	Oct-01 to May-03
Deming-Whitehead	Oct-01 to May-03
Goldboro	Oct-01 to May-03
Malay Falls	Oct-01 to Mar-03
Middle Musquodoboit	Oct-01 to Mar-03
Pictou-Lyons Brook	Oct-01 to Mar-03
Port Hawkesbury	Oct-01 to Mar-03
Salmon River	Oct-01 to May-03
South Side Harbour	Oct-01 to Feb-03
Stillwater-Sherbrook	Oct-01 to May-03
Trenton Municipal A	Oct-01 to Mar-03
Upper Stewiacke	Oct-01 to Mar-03

Figure 11 Precipitation distribution – mean annual total, period 1982-1987.

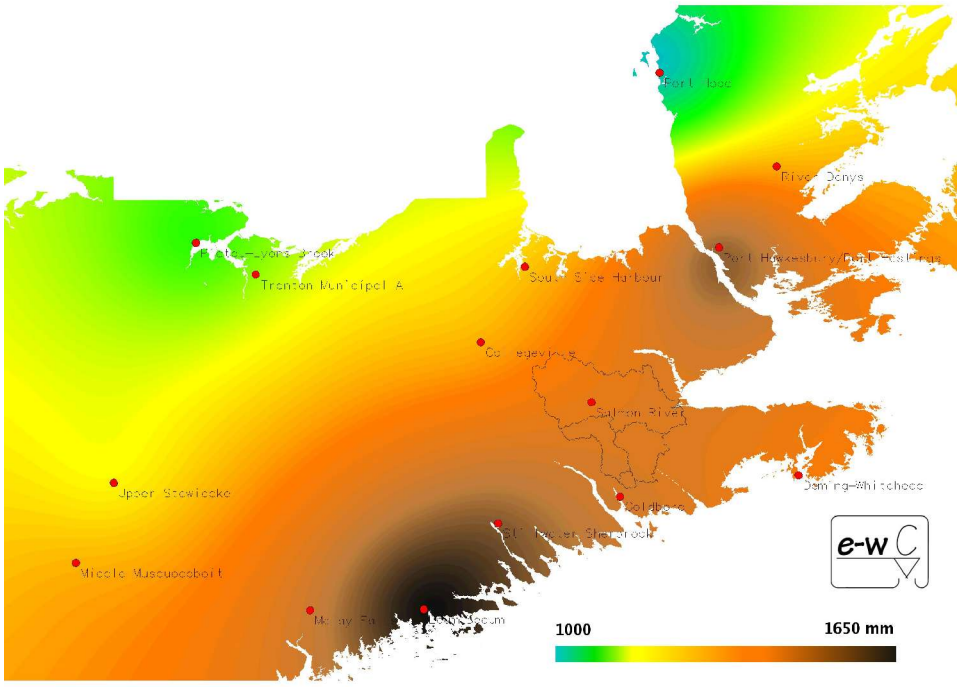


Figure 12 Precipitation distribution – mean annual total, period 1988-1994.

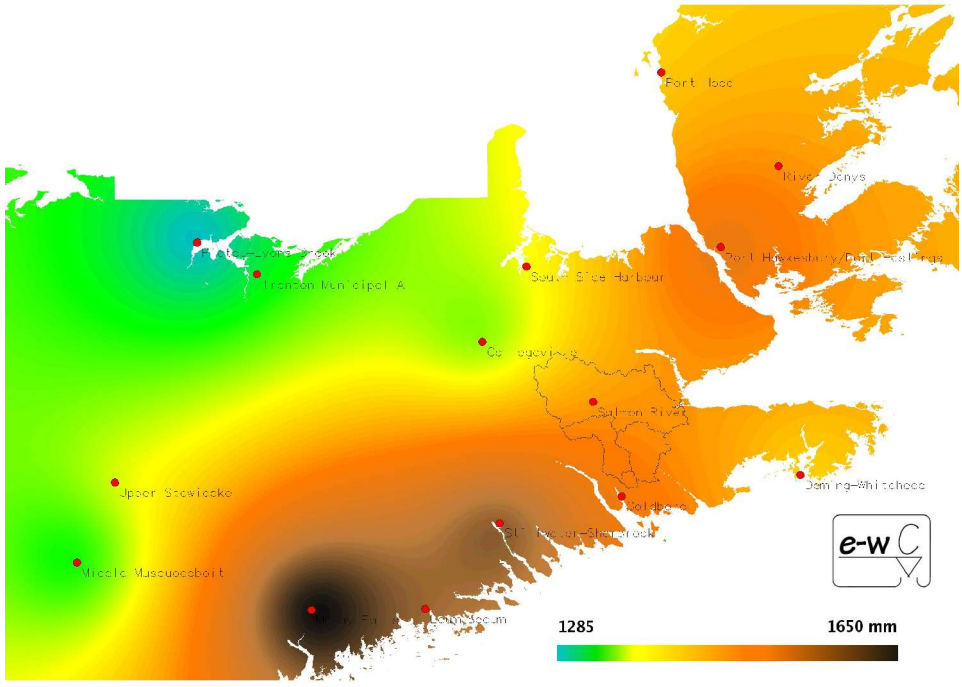


Figure 13 Precipitation distribution – mean annual total, period 1995-2002.

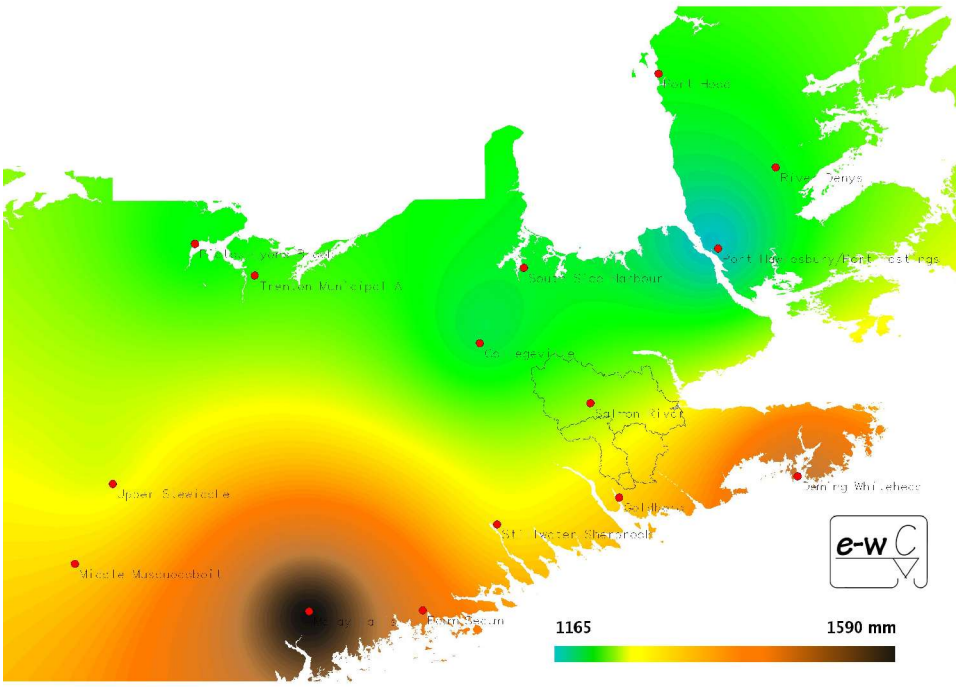


Figure 14 Precipitation distribution – mean annual total, period 1982-2002.

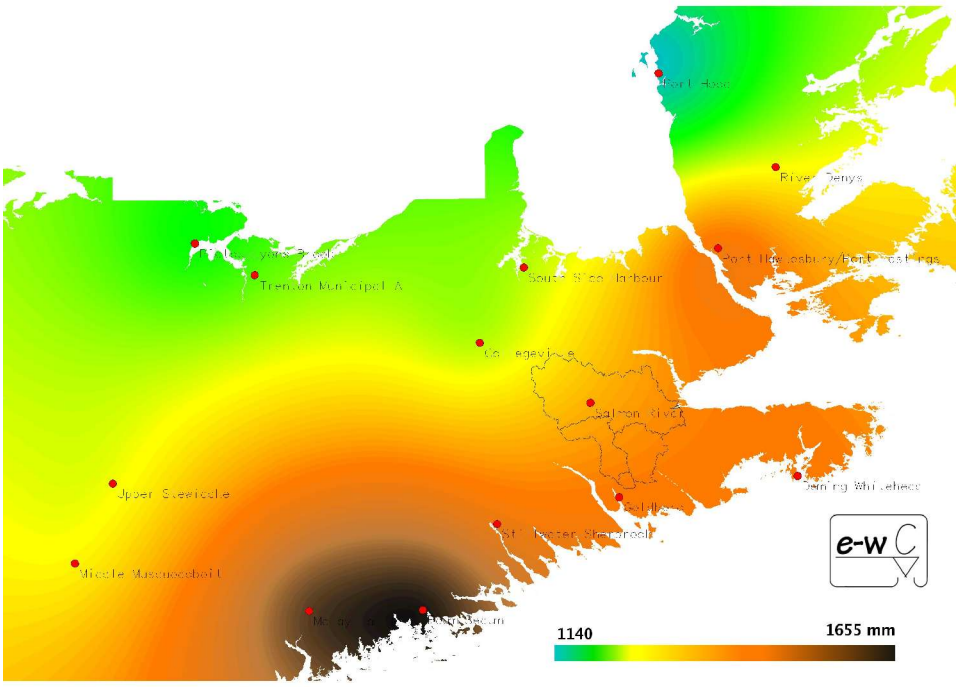


Figure 15 Precipitation distribution – mean January monthly total, 1982-2002.

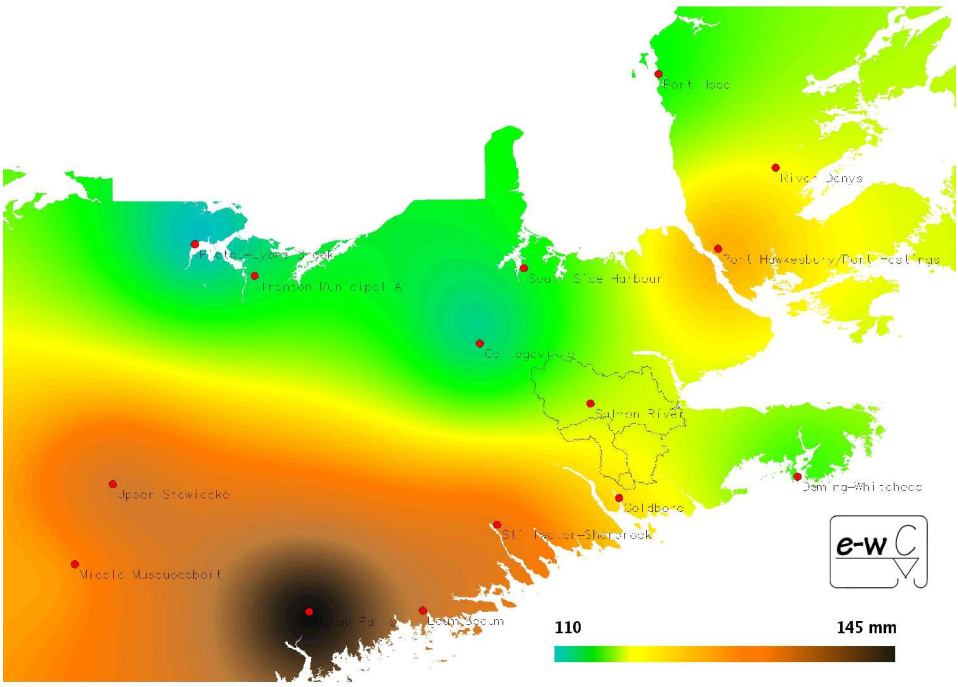


Figure 16 Precipitation distribution – mean February monthly total, 1982-2002.

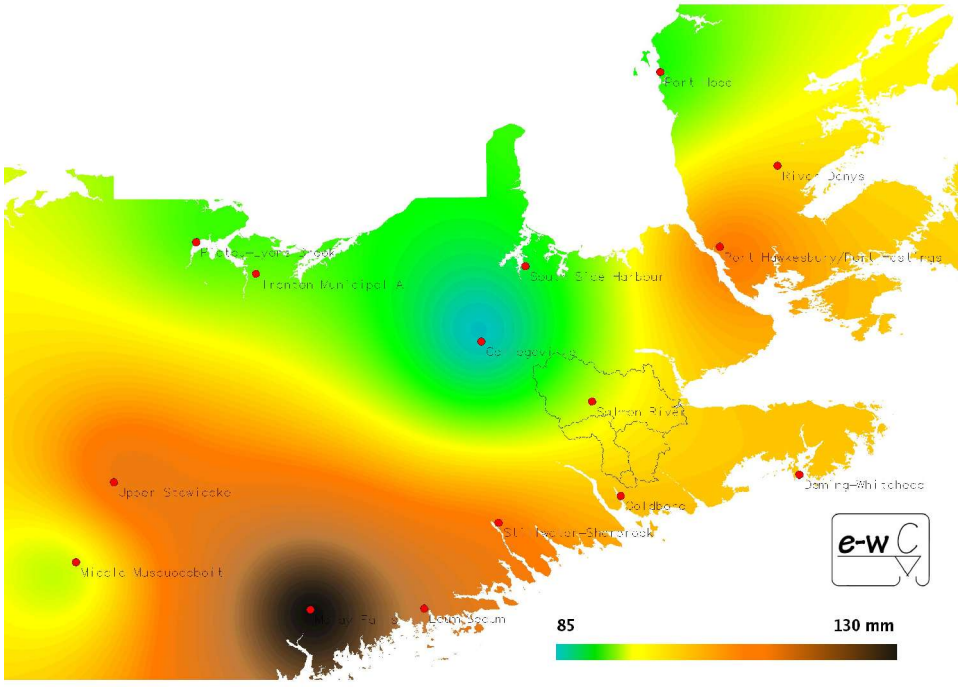


Figure 17 Precipitation distribution – mean March monthly total, 1982-2002.

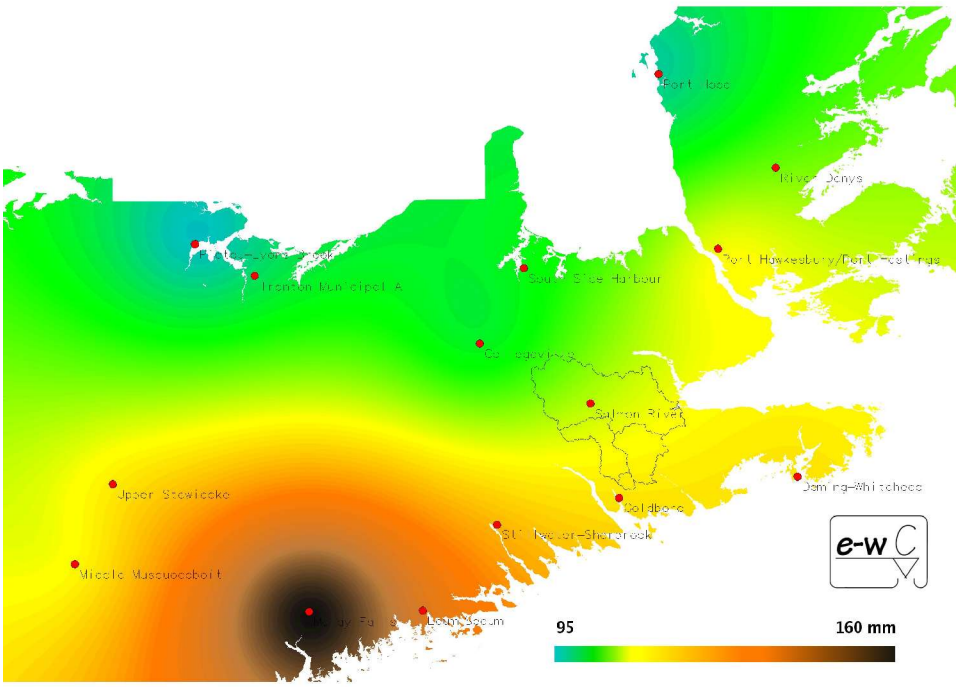


Figure 18 Precipitation distribution – mean April monthly total, 1982-2002.

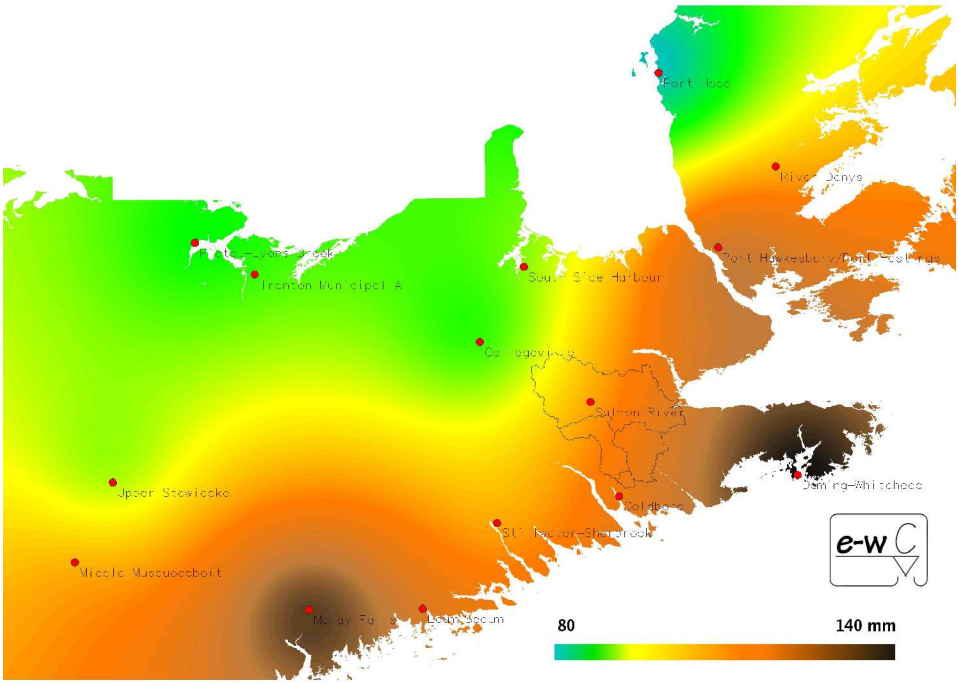


Figure 19 Precipitation distribution – mean May monthly total, 1982-2002.

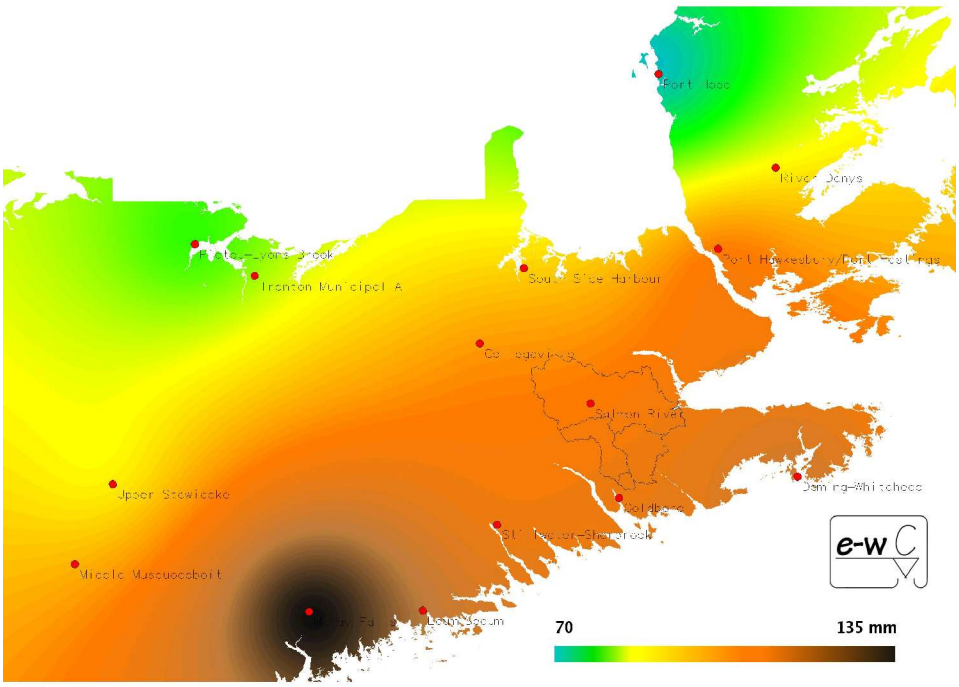


Figure 20 Precipitation distribution – mean June monthly total, 1982-2002.

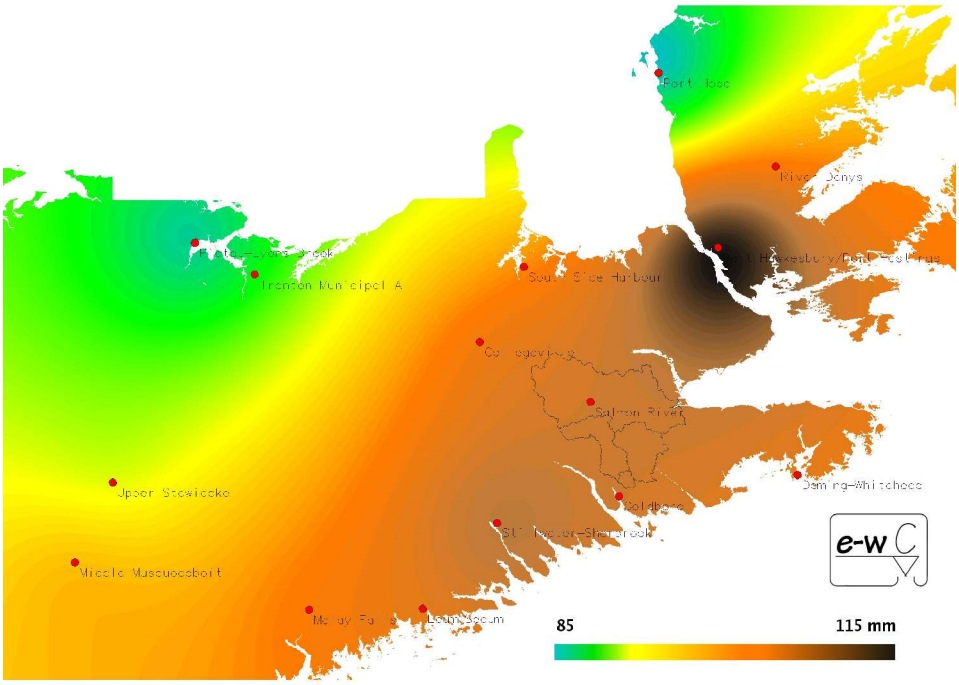


Figure 21 Precipitation distribution – mean July monthly total, 1982-2002.

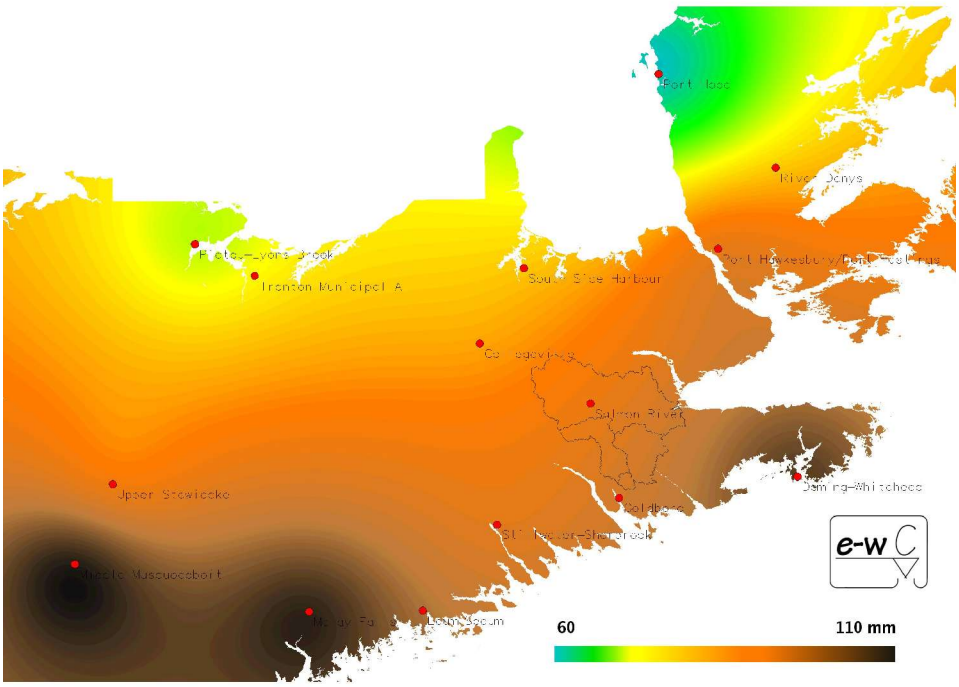


Figure 22 Precipitation distribution – mean August monthly total, 1982-2002.

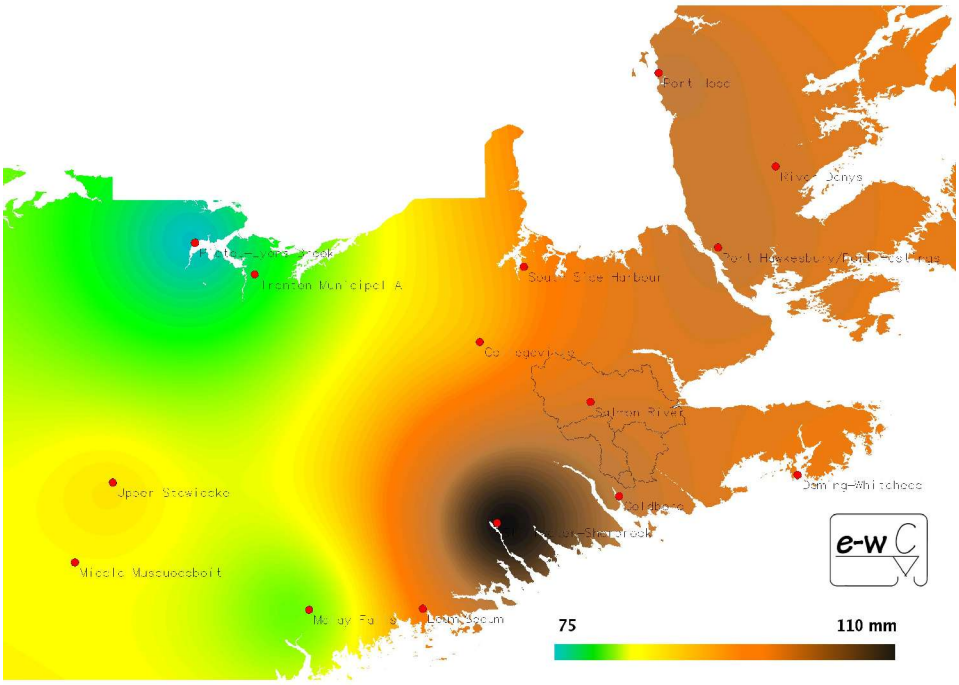


Figure 23 Precipitation distribution – mean September monthly total, 1982-2002.

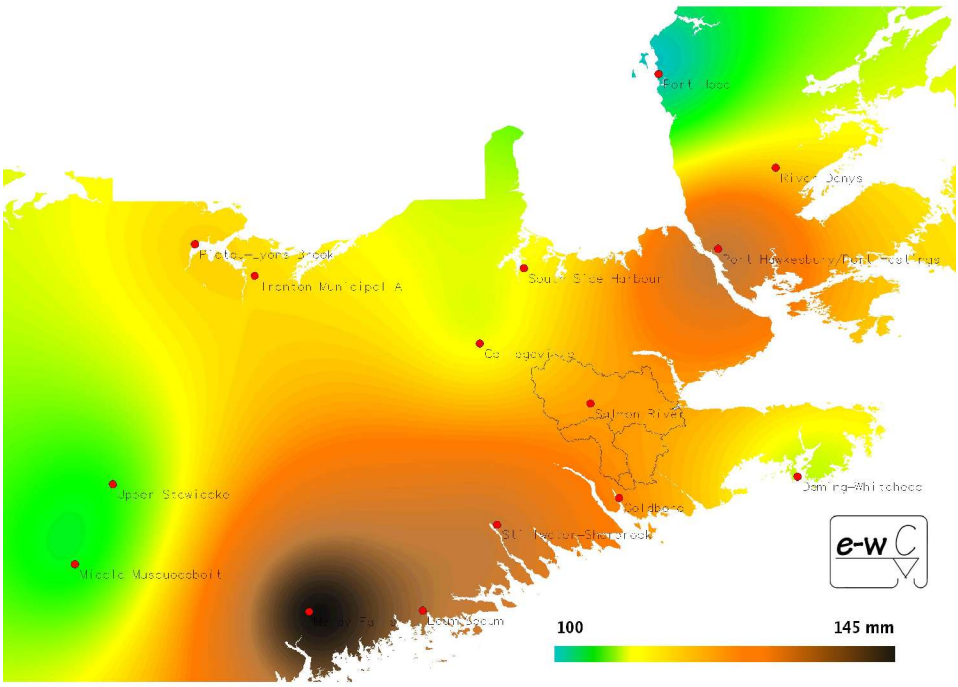


Figure 24 Precipitation distribution – mean October monthly total, 1982-2002.

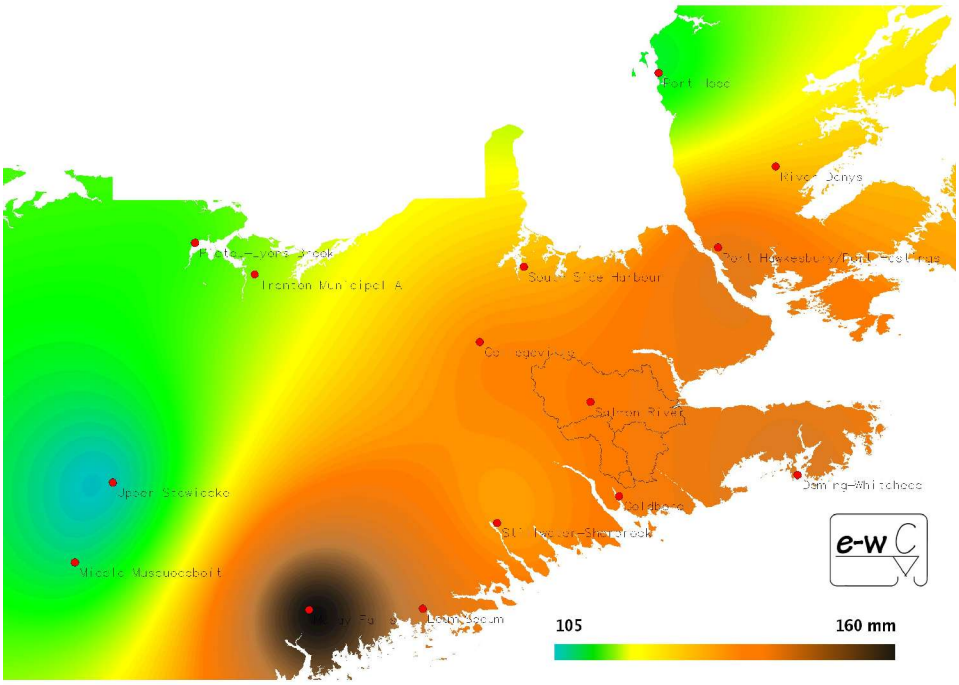


Figure 25 Precipitation distribution – mean November monthly total, 1982-2002.

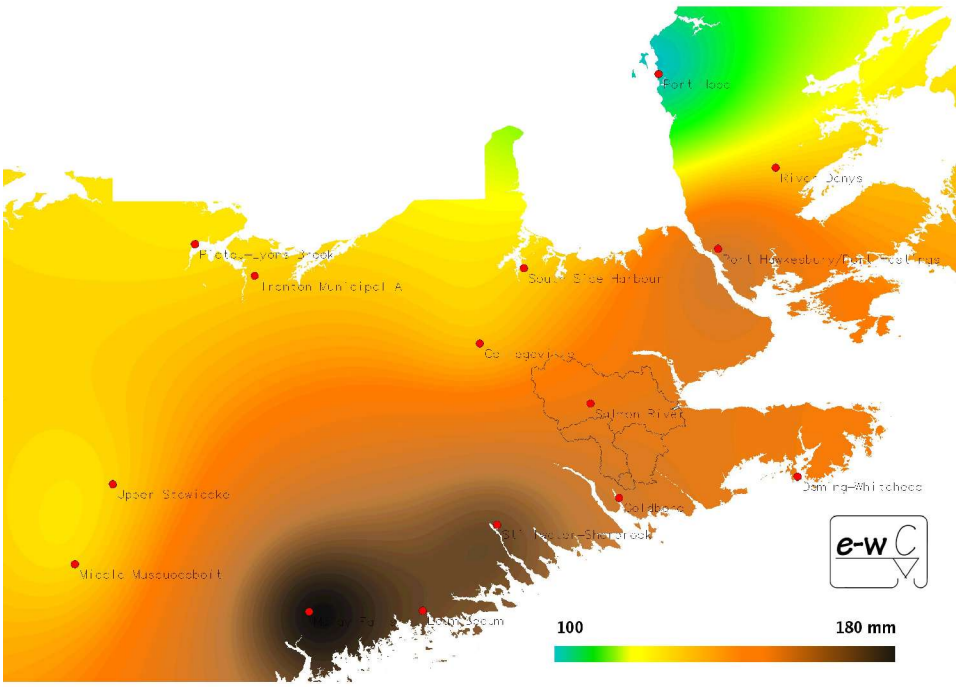
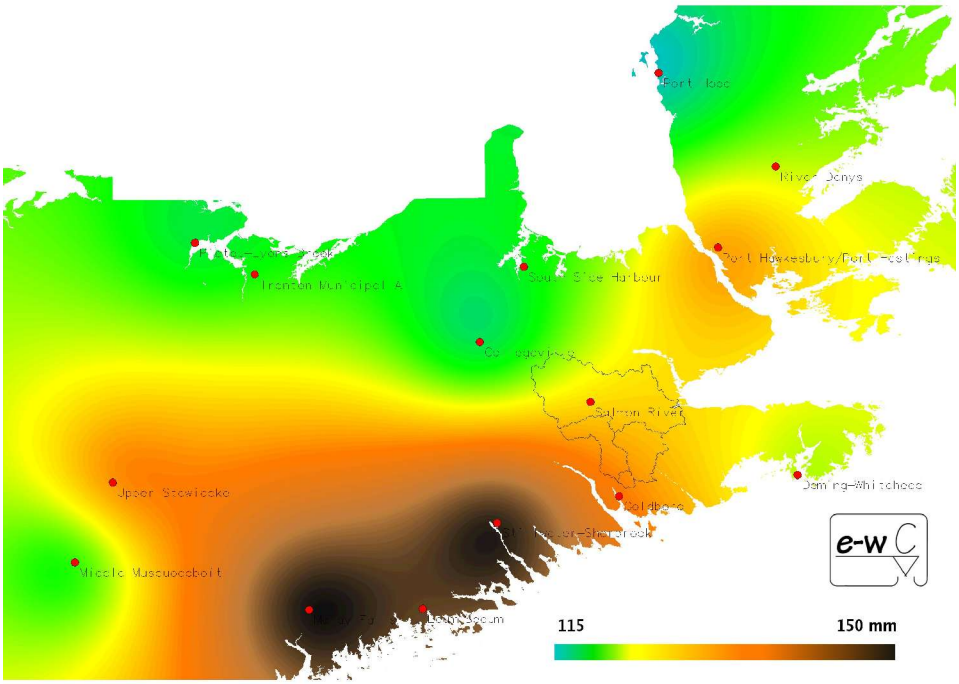


Figure 26 Precipitation distribution – mean December monthly total, 1982-2002.



Drought and flood frequency forecasting

Drought frequency analysis was performed on total summer (June, July plus August) precipitation values for the three nearest Environment Canada stations (Collegeville, Deming-Whitehead and Stillwater-Sherbrooke). For each station, the total summer precipitation was calculated for each year of record. The data was ranked in ascending order and the non-exceedance probability was calculated using:

$$P_{ne} = \frac{m}{(n+1)}$$

where P_{ne} = probability of non-exceedance, m = rank, and n = number of years of record.

The recurrence interval, (return period) was calculated using:

$$T = \frac{1}{P_{ne}}$$

where T = return period in years.

A semi-log graph of the recurrence interval (in years) and precipitation (in mm) was plotted for each climate station. Trend lines were drawn to estimate a range of values for the 50-year, 100-year, 200-year and 500-year summer droughts for each climate station which are presented in Table 10.

Table 10 Summer (June, July, August) drought estimates (in mm).

Station Name	***50-year***	***100-year***	***200-year***	***500-year***
Collegeville	110-115	85-95	65-77	25-55
Deming-Whitehead	100	70-75	37-50	0-15
Stillwater-Sherbrooke	120	85-92	53-70	15-28

Storm frequency analysis was performed on 24-hour, 48-hour and 72-hour precipitation values for the same three climate stations. For the 24-hour events, daily precipitation values were used. The calculations for the 48-hour and 72-hour events required the sum of the daily precipitation values for every two and three consecutive days respectively. For each station, the total event precipitation was calculated for each year of record. The data was then ranked in descending order and the exceedance probability was calculated using:

$$Pe = \frac{m}{(n+1)}$$

The recurrence interval, (return period) was then calculated in days and converted to equivalent years. A semi-log graph of the recurrence interval (in years) and precipitation (in mm) was plotted for each climate station for the 24-hour, the 48-hour and the 72-hour storm events. Trend lines were drawn in order to estimate a range of values for the 100-year, 200-year and 500-year storm events for each climate station and the results are presented in Tables 11, 12 and 13.

Table 11 100-year storm events (in mm)			
Station Name	***24-hour event***	***48-hour event***	***72-hour event***
Collegeville	150-204	176-240	180-250
Deming-Whitehead	135	170	185-188
Stillwater-Sherbrooke	145-150	185-192	208-213

Table 12 200-year storm events (in mm)			
Station Name	***24-hour event***	***48-hour event***	***72-hour event***
Collegeville	164-212	186-258	196-270
Deming-Whitehead	138-142	179-185	194-202
Stillwater-Sherbrooke	155-162	200-210	222-230

Table 13 500-year storm events (in mm)			
Station Name	***24-hour event***	***48-hour event***	***72-hour event***
Collegeville	184-220	204-280	210-300
Deming-Whitehead	144-153	191-204	208-220
Stillwater-Sherbrooke	171-179	220-230	242-251

4. Detailed hydrographic analysis

The rainfall models noted above give a value of 120,400,662 m^3 as total amount of water available from precipitation falling onto the Isaac's Harbour River watershed during the year 2002. When compared to total discharge at ML1 of 118,752,483 m^3 for the same period, this suggests a value of C=0.99 as runoff coefficient for the Isaac's Harbour River watershed – a value that is considered much too large in light that there is perhaps 20 to 30 percent water loss from evapotranspiration and groundwater recharge (little of which would be expected to emanate as base flow at ML1).

One hypothesis to help explain the large value obtained for C involves groundwater contributions from the Salmon River watershed (situated at higher elevation and immediately north of the Isaac's Harbour River watershed); deemed possible in light of the presence of sandstone with relatively high porosity and permeability beneath the Salmon River watershed, and northwest trending faults present within the Isaac's Harbour River watershed and basement rock which are likely to be present under and in hydraulic connection with the Salmon River sandstone aquifer above. Groundwater computer modeling would help to confirm such a hypothesis. However, there is insufficient groundwater data to warrant doing groundwater modeling – the Isaac's Harbour River watershed and parts of the Salmon River watershed of concern are sparsely populated and thus contain too few wells to provide a proper groundwater database. Therefore, it was necessary to further evaluate the watershed by doing detailed analysis of the hydrographs in an effort to separate quick flow (surface rain event flows) from base flow (steadier groundwater contribution to streams).

Two stream-flow hydrographs were created showing stream-flow (m^3/s), instantaneous precipitation (mm) and total precipitation (mm). One hydrograph (at ML1, shown in Figure 27) was used to

describe the Isaacs Harbour River Watershed and the other (combining GB1, GB2 and GB3 onto one chart) to characterize the Gold Brook sub-watershed for comparative purposes. The precipitation used was actual rain gage data collected at Goldboro. Base flow separation was performed manually by corresponding hydrograph response peaks to individual precipitation events, and drawing a straight line to represent the baseline condition beneath each peak. A detailed view from ML1 is presented in Figure 28 to help illustrate this.

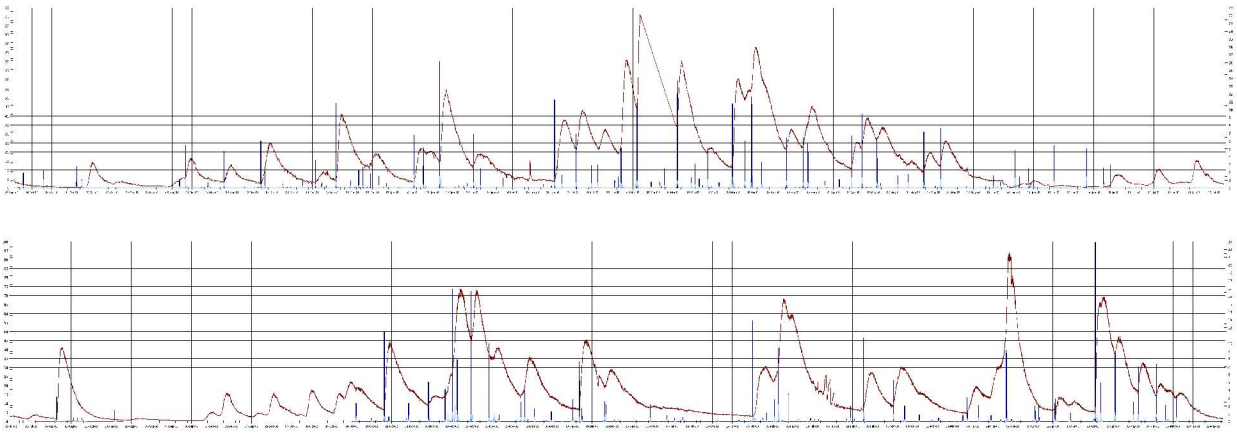


Figure 27 ML1 hydrograph with precipitation from Goldboro rain gage, Oct 2001 to May 2003.

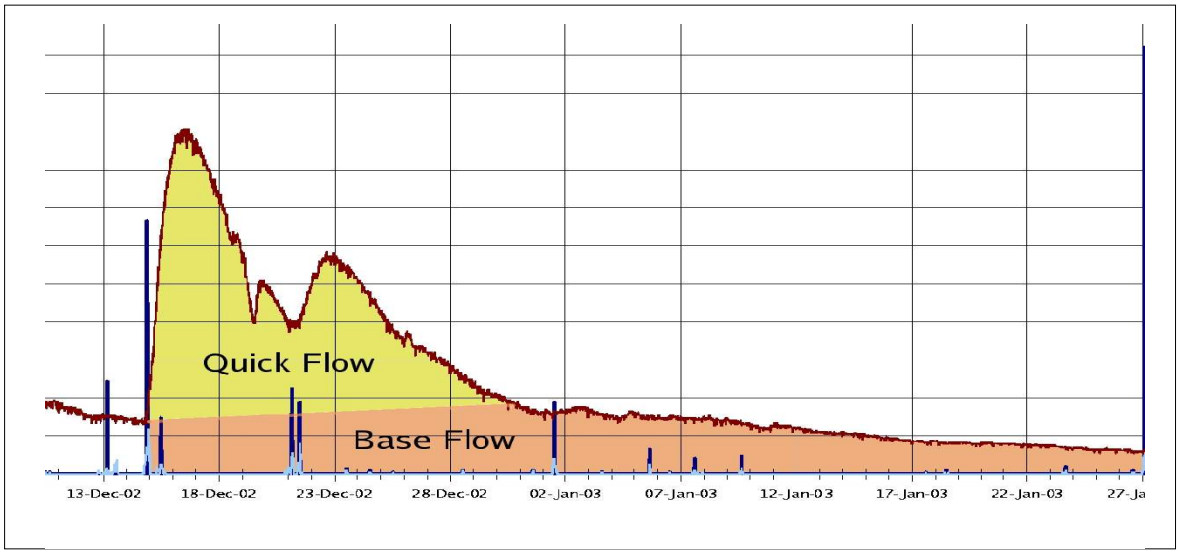


Figure 28. Detail from ML1 hydrograph showing separation into base flow and quick flow

The area beneath all base flow on the ML1 hydrograph was integrated to obtain total monthly base flow for the period October 2001 to May 2003. These values were subtracted from the total flow recorded for the same periods to obtain monthly values for quick flow.

Table 14 shows the average peak delays observed in the hydrographs following individual fall, winter, spring and summer precipitation events in the two watersheds under study. Monthly estimates of total flow, base flow and quick flow (in m^3/s) for October 2001 to May 2003 for Isaacs Harbour River (at ML1) and the Gold Brook sub-watershed system (at GB1, GB2 and GB3) are given in Tables 15, 16, 17 and 18, respectively. Table 15 also shows ratio of total flow to precipitation (TF/P), base flow to precipitation (BF/P) and quick flow to precipitation (QF/P), where the precipitation values (total precipitation falling onto the Isaac's Harbour River watershed) are those defined using GIS.

Table 14 Typical precipitation event to stream-flow peak delay (in hours).

Station Name	Fall	Winter	Spring	Summer
ML1	24 - 36	48	24 - 48	36
GB1	6 – 18	24 - 48	6 – 12	6
GB2	48	48 – 72	24 - 36	36 - 48
GB3	18 - 42	24 - 48	24	-

Table 15 Monthly summary for Isaacs Harbour River (ML1).

Month	*Precip. (m^3)*	*Total Flow (m^3)*	*Base Flow (m^3)*	*Quick Flow (m^3)*	*TF/P*	*BF/P*	*QF/P*
Oct-01	5,634,481	1,516,085	828,433	687,652	0.27	0.15	0.12
Nov-01	7,281,637	5,331,479	2,710,218	2,621,261	0.73	0.37	0.36
Dec-01	8,526,869	6,435,641	3,719,646	2,715,995	0.75	0.44	0.32
Jan-02	9,840,439	10,328,155	5,676,480	4,651,675	1.05	0.58	0.47
Feb-02	9,702,234	14,690,627	7,510,770	7,179,857	1.51	0.77	0.74
Mar-02	14,883,402	27,481,652	15,072,012	12,409,640	1.85	1.01	0.83
Apr-02	13,841,780	20,103,119	10,829,556	9,273,563	1.45	0.78	0.67
May-02	7,801,808	8,820,617	5,788,062	3,032,555	1.13	0.74	0.39
Jun-02	7,806,563	1,479,522	1,044,922	434,600	0.19	0.13	0.06
Jul-02	3,573,861	2,400,045	1,340,118	1,059,927	0.67	0.37	0.30
Aug-02	3,432,845	3,940,844	1,099,726	2,841,118	1.15	0.32	0.83
Sep-02	9,615,633	3,079,701	1,451,062	1,628,638	0.32	0.15	0.17
Oct-02	11,753,728	8,869,048	3,444,291	5,424,757	0.75	0.29	0.46
Nov-02	20,847,237	21,375,682	8,680,356	12,695,326	1.03	0.42	0.61
Dec-02	7,301,132	8,924,936	6,104,988	2,819,948	1.22	0.84	0.39
Jan-03	6,967,033	4,984,243	4,150,660	833,583	0.72	0.60	0.12
Feb-03	6,241,024	14,037,745	8,460,078	5,577,667	2.25	1.36	0.89
Mar-03	9,898,641	15,885,776	6,621,264	9,264,512	1.60	0.67	0.94
Apr-03	11,069,070	10,701,359	4,062,265	6,639,094	0.97	0.37	0.60
May-03	6,436,220	6,008,197	4,329,774	1,678,423	0.93	0.67	0.26

Tables 15 through 18 show that the values TF/P, BF/P and QF/P are clearly variable on a monthly and annual basis. Comparing the values for fall (October to December) 2001 to those for fall 2002, the following is apparent:

- the watersheds received substantially more precipitation (86% more in the Isaacs Harbour River Watershed) during the fall 2002 than during the fall 2001,

- the proportion of precipitation contributing to total flow within the watersheds is significantly higher during the fall 2002.

This is likely due to there having been considerably more precipitation recorded for the year 2002, than is shown for the GIS-modeled annual average for the period 1982-2002. Similarly, comparing the values for January to May 2002 (winter/spring 2002) to those for January to May 2003 (winter/spring 2003), it is noted that the watersheds received 38% more precipitation during the winter 2002 than during the winter 2003. Notwithstanding this variability, due to the absence of any other data, the values in columns 3 to 5 of Table 19 were calculated by simply multiplying those in column 1 (total monthly precipitation obtained from GIS) by the ratios in Table 15 (the mean of two months was used where data was available for more than one year).

Table 16 Monthly summary for GB1

Month	***Total Flow (m^3)***	***Base Flow (m^3)***	***Quick Flow (m^3)***
Oct-01	207,161	172,136	35,024
Nov-01	325,985	257,865	68,120
Dec-01	285,659	229,617	56,042
Jan-02	392,961	296,441	96,520
Feb-02	561,526	267,636	293,891
Mar-02	485,556	276,364	209,192
Apr-02	449,011	305,089	143,923
May-02	246,569	208,899	37,670
Jun-02	181,906	154,509	27,397
Jul-02	198,726	158,240	40,486
Aug-02	124,208	87,608	36,600
Sep-02	128,623	81,320	47,303
Oct-02	245,286	157,589	87,697
Nov-02	460,558	264,112	196,445
Dec-02	237,769	160,704	77,064
Jan-03	177,928	128,199	49,729
Feb-03	440,290	278,395	161,895
Mar-03	365,100	217,374	147,726
Apr-03	107,316	87,294	20,023
May-03	61,928	49,856	12,072

Table 17 Monthly summary for GB2.			
Month	***Total Flow (m^3)***	***Base Flow (m^3)***	***Quick Flow (m^3)***
Oct-01	523,585	385,011	138,573
Nov-01	1,082,771	752,138	330,633
Dec-01	1,088,869	703,522	385,348
Jan-02	1,471,440	1,013,165	458,275
Feb-02	2,004,065	1,407,050	597,015
Mar-02	3,472,990	2,104,274	1,368,716
Apr-02	3,106,891	1,652,639	1,454,252
May-02	1,373,820	988,829	384,991
Jun-02	1,008,405	700,604	307,801
Jul-02	1,430,051	1,170,426	259,625
Aug-02	1,076,998	488,267	588,731
Sep-02	1,202,145	587,262	614,883
Oct-02	1,990,527	1,124,494	866,034
Nov-02	2,986,559	1,247,885	1,738,675
Dec-02	1,833,189	1,287,581	545,608
Jan-03	861,424	772,563	88,860
Feb-03	2,238,444	1,135,055	1,103,388
Mar-03	2,652,792	1,355,042	1,297,750
Apr-03	2,581,073	1,401,831	1,179,242
May-03	1,605,265	1,274,597	330,669

Table 18 Monthly summary for GB3.			
Month	***Total Flow (m^3)***	***Base Flow (m^3)***	***Quick Flow (m^3)***
Oct-01	907,033	685,291	221,742
Nov-01	1,364,898	935,947	428,951
Dec-01	1,266,999	888,754	378,245
Jan-02	1,798,210	1,287,354	510,856
Feb-02	2,864,231	1,906,812	957,418

Table 19 Monthly average values for precipitation (GIS-modeled values) and calculated flow for the years 1982 to 2002 for the Isaacs Harbour River watershed at ML1.				
Month	***Precipitation (m^3)***	***Total Flow (m^3)***	***Base Flow (m^3)***	***Quick Flow (m^3)***
January	9,736,045	8,869,995	5,692,556	3,177,439
February	8,076,487	14,553,131	8,090,463	6462668
March	9,359,327	16,378,389	8,192,806	8,185,584
April	9,033,673	11,170,939	5,400,371	5,770,567
May	8,612,891	8,970,270	6,120,498	2,849,773
June	8,328,281	1,578,400	1,114,755	463,645
July	7,418,206	4,981,735	2,781,661	2,200,073
August	7,950,241	9,126,733	2,546,892	6,579,841
September	9,667,652	3,096,361	1,458,912	1,637,449
October	10,867,227	6,490,466	2,670,353	3,820,113
November	12,009,330	11,402,344	4,863,087	6,539,257
December	10,371,420	10,065,137	6,437,667	3,627,469
Total annual	111,430,780	106,683,900	55,370,021	51,313,878

Hydrologic budget calculations

The hydrologic budget is usually calculated on the basis of the water year (October 1 to September 30) because surface water discharge and groundwater storage are generally at a minimum at the beginning and end of this period. However, this period may vary from place to place. At the study area, the water year for the period of 20 months (October 2001 to May 2003) over which stream and precipitation data were collected appears to have been 01 November to 31 October (see Table 15), whereas for the 1982 to 2002 period represented in Table 19, the end of the water year appears to be somewhere between the start to the middle of September.

When stated as an equation including all items that may be involved, the hydrologic budget is:

$$P_r + SurI + SubI + Imp = R + ET + U + Exp \pm \Delta Soil \pm \Delta Ss \pm \Delta Sg$$

where:
- P_r = precipitation
- SurI = surface inflow
- SubI = subsurface inflow
- Imp = imported water
- R = stream flow (includes surface and groundwater runoff)
- ET = evapotranspiration
- U = subsurface flow
- Exp = exported water
- ΔSoil = change in soil moisture storage
- ΔSs = changed in surface water storage
- ΔSg = change in groundwater storage

Of the many factors that may introduce water into a basin, precipitation and perhaps subsurface inflow are the only contributions of water to the Isaacs Harbour River watershed. On the right side of the equation, runoff, evapotranspiration, and changes in groundwater and perhaps also changes in soil storage (especially for calculations done on a monthly or seasonal basis) are by far the most important. Subsurface outflow is present only in the vicinity of the gaging station. Elsewhere, groundwater would be expected to move toward the Isaacs Harbour River, toward Meadow Lake, or toward tributaries to the river or lake.

Change in soil moisture storage, however, may be an important factor in the water budget, particularly if the budget is calculated on a monthly or season basis. The soil is generally near or above field capacity in the late winter and early spring, and has the greatest soil moisture deficiency in the late summer. On an annual basis, however, the change in soil moisture storage should be small except between wet and dry years. The 2001 water year appears to have been unusually dry and there may be a error in the budget due to the lack of soil moisture data.

About 5.2 percent of the Isaacs Harbour River watershed is covered by surface water, almost all in the form of lakes in the upper reaches of the watershed. Records of uncontrolled lake levels are not available, but this does not introduce serious errors in the water budget because a relative change in lake levels of 0.3 to 0.5 m from one year to the next would amount to less than 2 percent of the total volume of water accounted for on the right side of the hydrologic budget equation.

By eliminating those items of the hydrologic budget which do not apply to the Isaacs Harbour River watershed or which are generally insignificant int eh calculations, the equation for the hydrologic budget reduces to the following form:

$$P_r + SubI = R + ET \pm \Delta Sg$$

Average total annual runoff (R) for the period 1982 to 2002 is known from Table 19 to be 106,683,900 m^3. The change in groundwater storage is not known, but available data suggests that it may have varied from one year to the next over the 20 months of study records (see Table 15). However, without also having a record of groundwater levels for the area (there are no groundwater hydrographic stations nearby – the nearest one which is drilled into similar bedrock is located at Lawrencetown), it is not clear whether this change may represent an overall increase or a decrease in groundwater storage over this period of record.

Values for ET may vary from place to place and over time, but ET is generally expected to be in the range of 20 to 35 percent of total precipitation (a value of 25 percent is suggested for the study site due to its close proximity to the ocean), or perhaps around 27,857,700 m^3 annually (25 percent of precipitation) for the period 1982 to 2002.

Rearranging terms in the hydrologic budget equation so that the unknowns are on one side, we get:

$$P_r - R - ET = \pm \Delta Sg - SubI$$

This suggests that SubI or ΔSg (or both combined) may be equal to approximately 41,193,000 m^3

for the year 2002 during which stream and precipitation measurements were taken, or on average, 23,110,800 m^3 per year (about 2,638 m^3/hr) for the period 1982 to 2002.

Notwithstanding any changes to surface water infiltration and/or groundwater flow regimes, one can expect increases in groundwater storage to equal decreases generally over the long term, suggesting a significant value for SubI for the Isaacs Harbour River watershed of around23,110,800 m^3 per year on average (27 percent of total annual runoff) based on period 1982 to 2002. As noted earlier, this subsurface inflow may originate from the Salmon River watershed to the north. Unfortunately, since the Salmon River is not gaged, similar calculations are not possible for the Salmon River watershed to determine whether it may be experiencing a SubI or ΔSg surplus or deficit to match the values estimated for the Isaacs Harbour River watershed.

APPENDIX 4

TRAFFIC IMPACT STUDY (2007)

GOLDBORO LNG

Atlantic Road & Traffic Management

Traffic Engineering Specialists

Traffic Impact Study

Keltic Petrochemicals Inc. Petrochemical Plant Facilities and MapleLNG Liquified Natural Gas Facilities

Goldboro, NS

Prepared for

Keltic Petrochemicals Inc.

and

MapleLNG

December 2007

0742

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1.0 Introduction

Background

During the past several years, Keltic Petrochemicals Inc. has been preparing plans for construction of an LNG Terminal and Petrochemical Plant at Goldboro, Guysborough County, Nova Scotia (Figure 1.1). An Environmental Impact Assessment Report was prepared and the Environmental Assessment Board released it for public review and comment in the fall of 2006. Following a Public Hearing and further review by the Board, the Minister of Environment & Labour (NSEL) issued the *Terms and Conditions for Environmental Assessment Approval* to Keltic Petrochemicals Inc. on March 14, 2007. In November, 2007, the Minister of Environment & Labour issued an Environmental Assessment Approval with *Terms and Conditions* to MapleLNG.

The *Terms and Conditions for Environmental Assessment Approval* (Item 1.3) require that a Traffic Impact Study, developed in consultation with NSTPW [now NSTIR] and the Municipality of the District of Guysborough, be provided to NSEL for review and approval prior to application for Part V approval under the *Environment Act*.

A Traffic Impact Study Usually Considers Four Questions

A Traffic Impact Study for a proposed project usually consists of four steps to answer the following questions:

1. **What are the existing traffic situations** on roads serving the study site? How have traffic volumes increased historically? What has been the collision experience during the past five years?
2. **What traffic changes are expected** on Study Area roads and intersections? How many vehicle trips will be generated by the proposed project during weekday AM and PM peak hours during both the construction and production phases? How will the traffic be distributed to Study Area roads and intersections?
3. **What traffic impacts will occur** on Study Area roads and intersections? How will level of performance be affected?
4. **What road or intersection improvements are required** to mitigate project impacts on Study Area traffic movements?

Traffic Impact Study Scoping Document

A Traffic Impact Study prepared to meet NSTIR requirements is usually initiated by submission of a Scoping Document to describe study methodology and objectives. After considerable discussions with NSTIR during the summer and early fall of 2007, ARTM submitted a Revised Scoping Document (included as Appendix A) to NSTIR for review and approval on November 23, 2007. NSTIR approval was received on December 14, 2007, and a copy of the approved Scoping Document has been forwarded to the Municipality of the District of Guysborough.

Study Objectives of the Traffic Impact Study

Specific concerns included in the Traffic Impact Study include:

1. Identification of the proposed access route between Highway 104 and the project location in Goldboro, Guysborough County.
2. Evaluation of existing 2007, and projected 2012 and 2017, traffic volumes on Study Area road sections, without addition of site generated trips.
3. Examination of collision experience, including collision numbers by collision severity, and collision rates for Study Area road sections during the last five years.
4. Identification of areas on the access route that may require road upgrades, such as, intersection geometry, horizontal alignment, or grades that require construction of climbing lanes.
5. Estimation of the number of passenger vehicle and large truck trips that will be generated during AM and PM peak hours, for both the construction and operation phases.
6. Evaluation of the impacts of site generated trips for both the construction and operation phases on the safety and level of performance of access route road sections.
7. Identification of areas where pavement and bridge strengthening may be required to handle existing and anticipated truck loadings.
8. Assessment of the proposed Route 316 realignment and access locations to project sites south of Sable Road near Goldboro with regard to sight distances and intersection design characteristics.

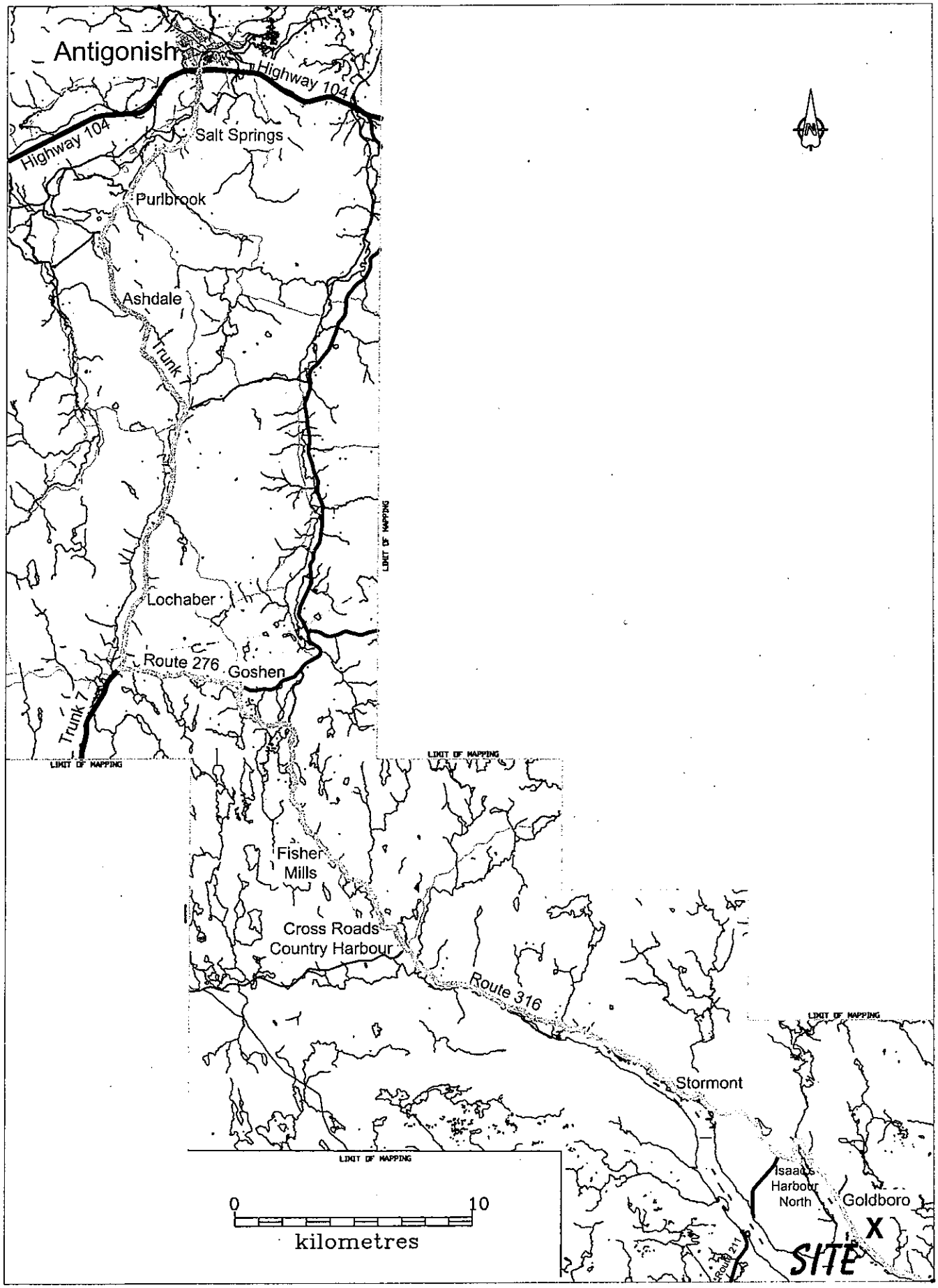


Figure 1.1
Study Area

December 2007

2.0 Description of the Project Access Route

Identification of Proposed Access and Haul Route

The 77.0 kilometre long access route and truck haul route between Highway 104 near Antigonish and the Keltic / MapleLNG Site near Goldboro, illustrated on Figures 1.1, 2.1, and 2.2, includes sections of Trunk 7, and Routes 276 and 316. The route includes the following sections of these roads:

- Trunk 7 (Highway 104 at Antigonish to Route 276) - 29.6 km
- Route 276 (Trunk 7 to Route 316 at Goshen) - 5.3 km
- Route 316 (Route 276 to Sable Road at Goldboro) - 42.1 km.

Description of Road Cross Sections

The first one kilometre section of Trunk 7 has two paved travel lanes (6.6 meters wide) with a 1.2 m wide paved shoulder, concrete curb and gutter, and sidewalk on the west side, and a 1.4 m gravel shoulder on the east side as illustrated in Photo 2.1.

Photo 2.1 - Looking north on Trunk 7 south of Highway 104 at Antigonish.

The remaining 76 kilometres of the access route consists of a typical rural highway with two paved lanes, gravel shoulders, and open ditches. Pavement and shoulder widths at several locations are tabulated in Table 2.1 and are also illustrated in the Photos 2.2 to 2.5.

Table 2.1 - Typical Pavement and Shoulder Widths on the Access Route

Route	Location	Pavement Width	Shoulder Widths	Photo
7	About four km south of Highway 104	6.4 m	1.1 m W & 1.1 m E	-
7	About ten km north of Route 276	6.4 m	1.6 m W & 1.6 m E	-
7	Just north of the Route 276 intersection	6.7 m	1.1 m W & 1.4 m E	2.2
276	Just east of Trunk 7	6.8 m	1.2 m S & 1.2 m N	2.3
276	Just west of Route 316	6.8 m	1.0 m S & 1.2 m N	-
316	About six km south of Route 276	6.6 m	1.3 m W & 1.2 m E	2.4
316	About five km south of Cross Roads Country Harbour	6.4 m	1.0 m W & 1.1 m E	-
316	About four km north of Route 211	6.4 m	1.2 m W & 0.8 m E	-
316	Just north of Sable Road	6.4 m	1.2 m W & 1.3 m E	2.5

NOTE: Shoulder widths are in metres and are indicated for W (west side), E (east side), N (north side) and S (south side)

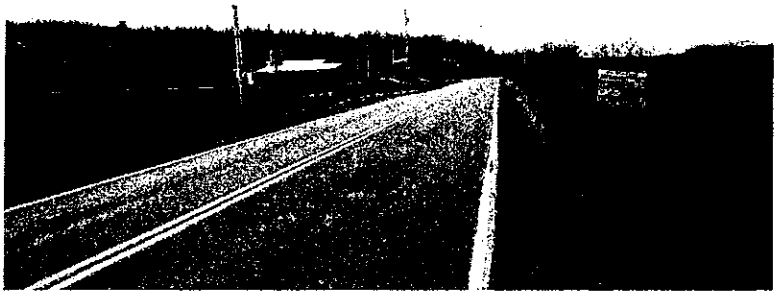


Photo 2.2 - Looking south on Trunk 7 just north of Route 276.

Photo 2.3 - Looking east on Route 276 just east of Trunk 7.

Photo 2.4 - Looking north on Route 316 about six km south of Route 276.

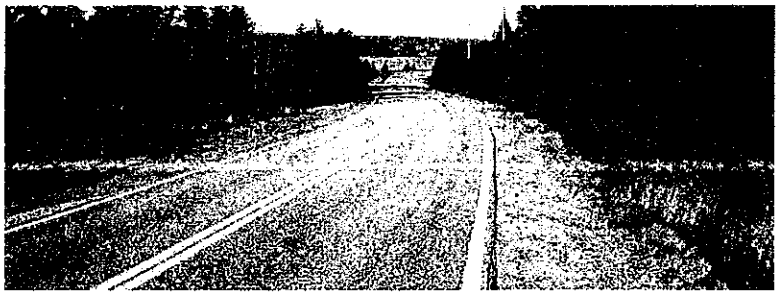
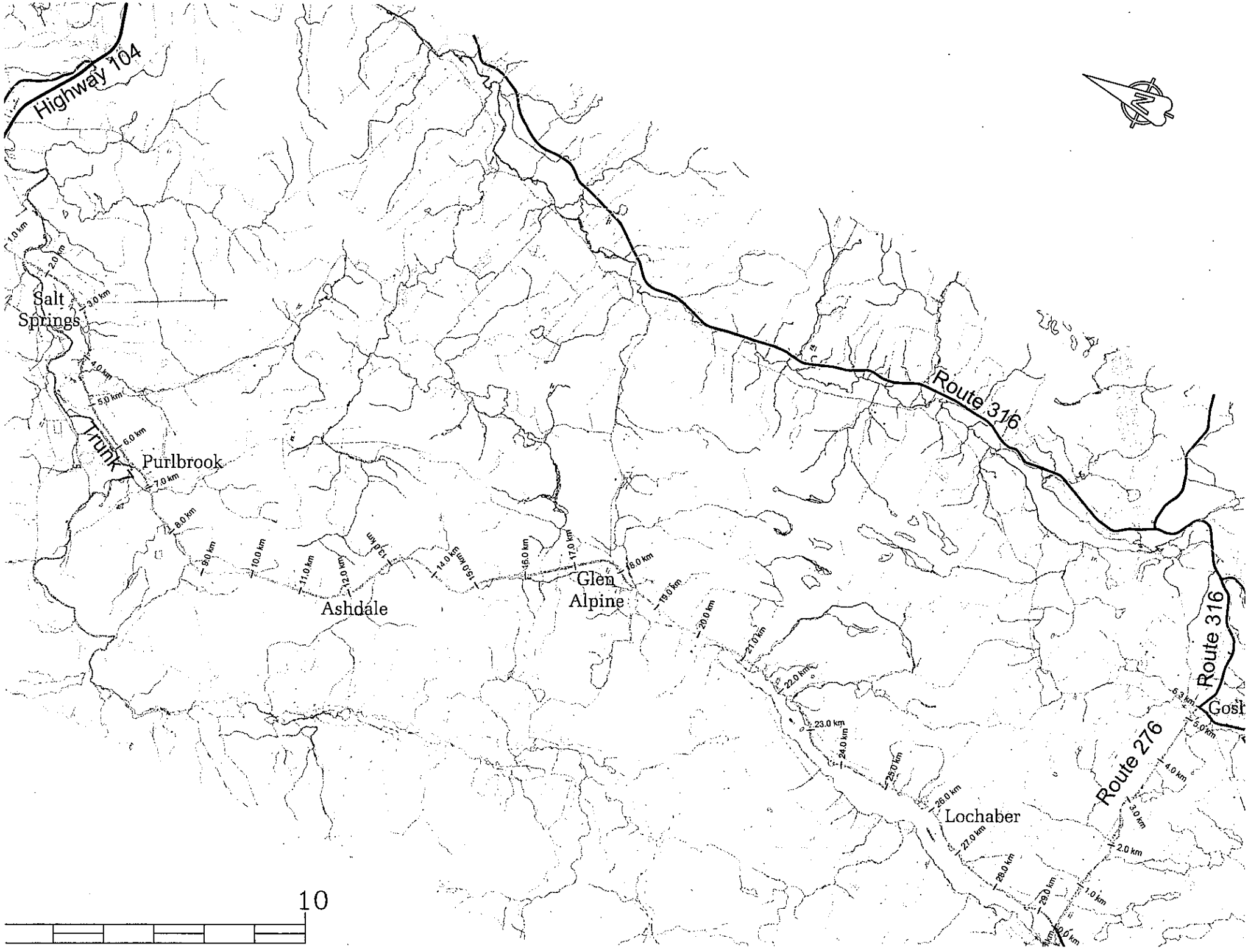


Photo 2.5 - Looking north on Route 316 just north of Sable Road.


Highway 104
Salt Springs
Trunk 7
Purlbrook
Ashdale
Glen Alpine
Route 316
Route 316
Route 276
Lochaber
Gost
1.0 km
2.0 km
3.0 km
4.0 km
5.0 km
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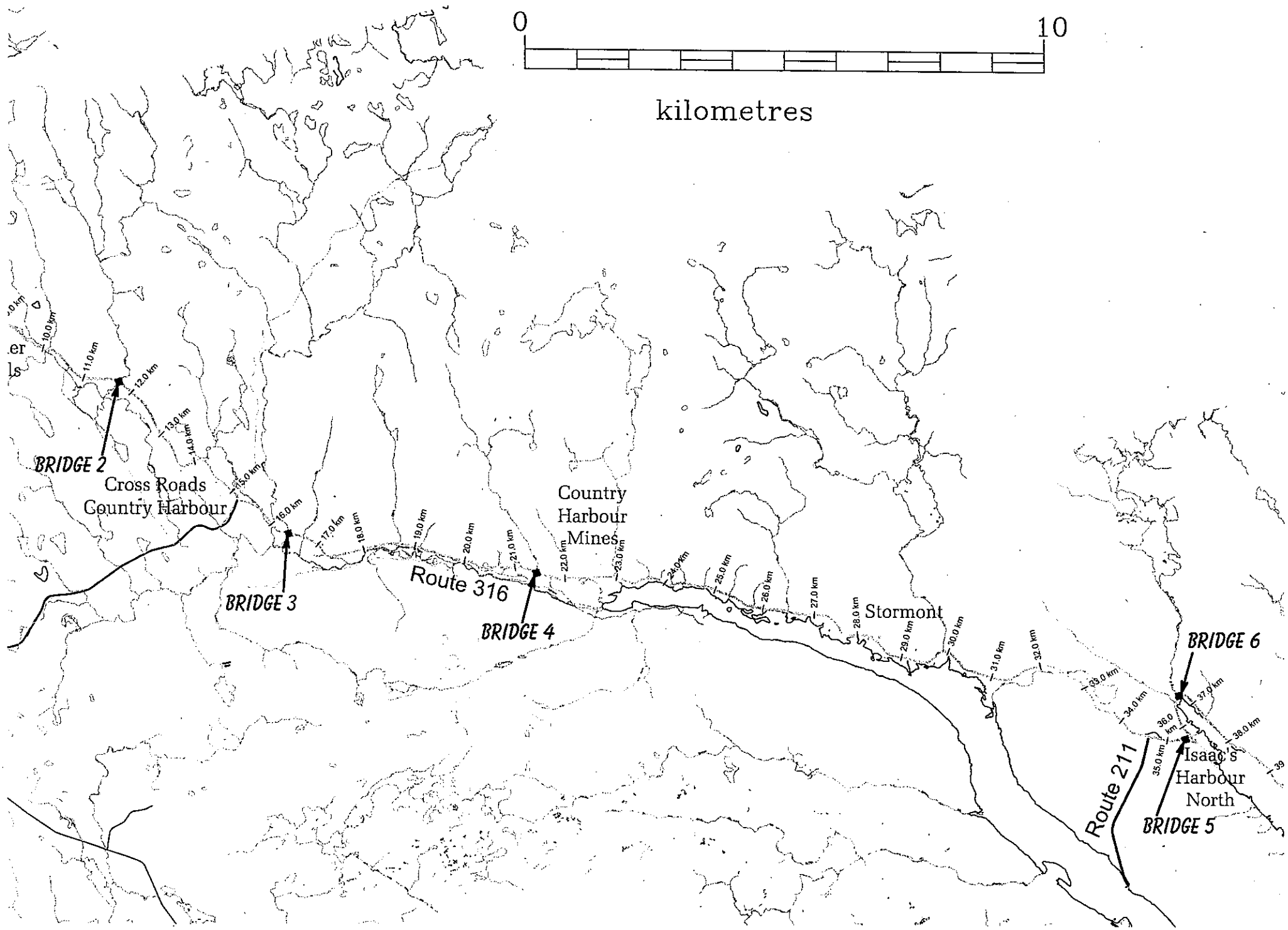

0
10
kilometres
BRIDGE 2
Cross Roads
Country Harbour
BRIDGE 3
Route 316
BRIDGE 4
Country
Harbour
Mines
Stormont
BRIDGE 6
Route 211
Isaac's
Harbour
North
BRIDGE 5

Posted Speed Limits

Most of Trunk 7 in the Study Area has a 90 km/h posted speed limit, and the sections of Routes 276 and 316 have 80 km/h posted speed limits except for short sections where limits are reduced due to roadside development. The following reduced speed zones are included in the 77 kilometre access route:

- Trunk 7 - short 70 km/h and 80 km/h zones just south of Highway 104
- Route 276 - a short 70 km/h zone just west of Route 316
- Route 316 - three 60 km/h and two 70 km/h zones between Route 276 at Goshen and Sable Road in Goldboro.

Speed limit details throughout the 77 kilometre access route are included in Table 2.2. Site visits to the access route indicate that the posted speed limits appear to be suitable for the roadside development, and horizontal and vertical alignments throughout the 77 kilometre route, which is comparable to many roads throughout the Province.

Table 2.2 - Speed Limit Details for the Access Route from Highway 104 to Sable Road

Route Number	Road Section Description (See Figures 2.1 and 2.2)	Km Location Reduced Speed Zones	Lengths (km) of Speed Limits (km/h)			
			90	80	70	60
7	Just south of Highway 104 to Route 276	0.0 - 2.9	26.7	1.6	1.3	-
276	Trunk 7 to Route 316	4.6 - 5.3	-	4.6	0.7	-
316	Route 276 to south of Melrose Country Harbour Rd	14.6 - 15.4	-	14.6	-	0.8
316	South of Melrose Country Harbour Rd to North of Country Harbour Mines	20.3 - 21.8	-	4.9	1.5	-
316	North of Country Harbour Mines to Stormont area	27.2 - 28.6		5.4	1.4	-
316	South of Stormont area to Goldboro	35.4 - 37.2		6.8	-	1.8
316	Goldboro Area	39.0 - 40.6		1.8	-	1.6
316	Goldboro area zone to Sable Road			1.5	-	-
	Totals by Posted Limit (77.0 km Total Length)		26.7	41.2	4.9	4.2

NOTES:
1. The shaded areas indicate sections where the limit is reduced below the normal limit for the specific route.
2. The average posted speed for the 77 km route is 81.7 km/h
2. Travel time for the 77 km route would be about 57 minutes if the posted limit could be maintained in all areas.

Study Area Intersections

Site visits indicated two intersections where improvements are needed:

1. The intersection of Route 276 with Trunk 7 will require construction of a right turn channel to facilitate large vehicle right turns from Route 276 to Trunk 7, as illustrated in Figure 2.3.
2 Route 316 intersects with the Isaac's Harbour Road on a sharp 15 km/h 'switch-back' curve as illustrated in Photos 2.6 and 2.7, and Figure 2.4-A. It is recommended that the intersection be reconstructed so that Route 316 and Isaac's Harbour Road met as a 'T' intersection as illustrated in Figure 2.4-B.

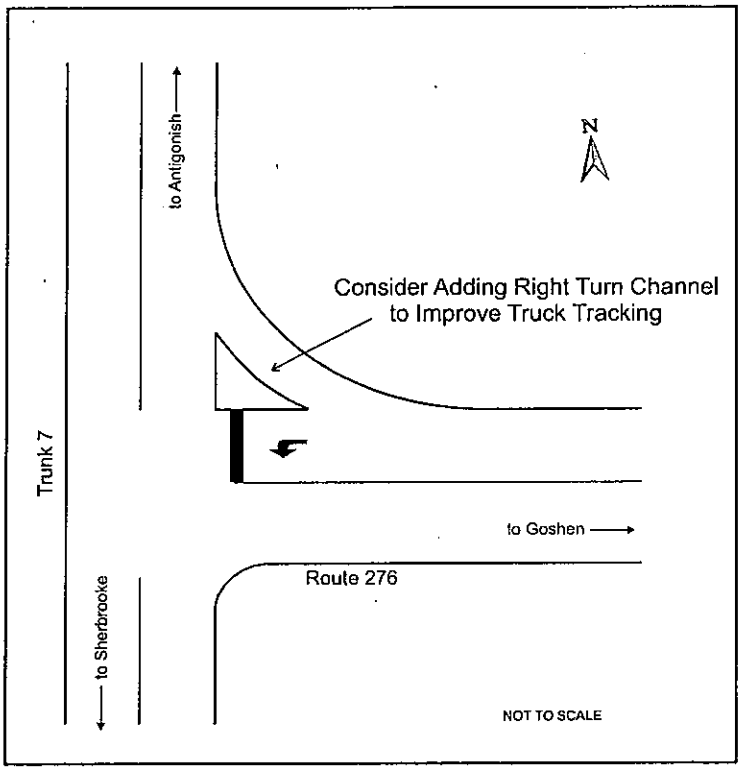


Figure 2.3 - Intersection Improvement - Trunk 7 at Route 276

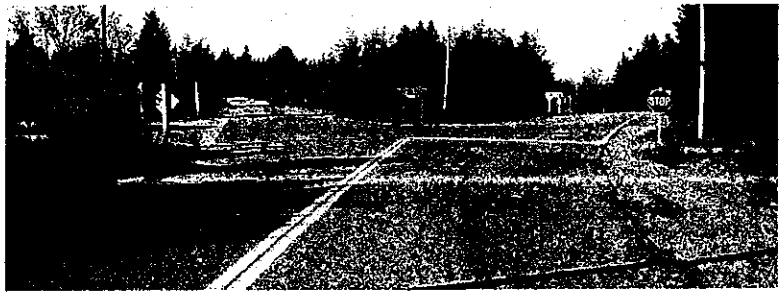


Photo 2.6 - Isaac's Harbour Road northbound approach to Route 316. Route 316 northbound is to the left and southbound is to the right.

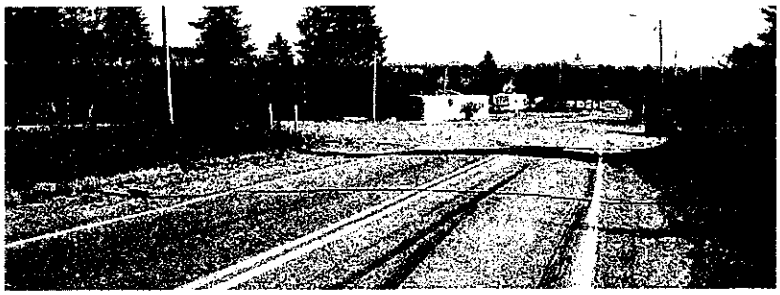
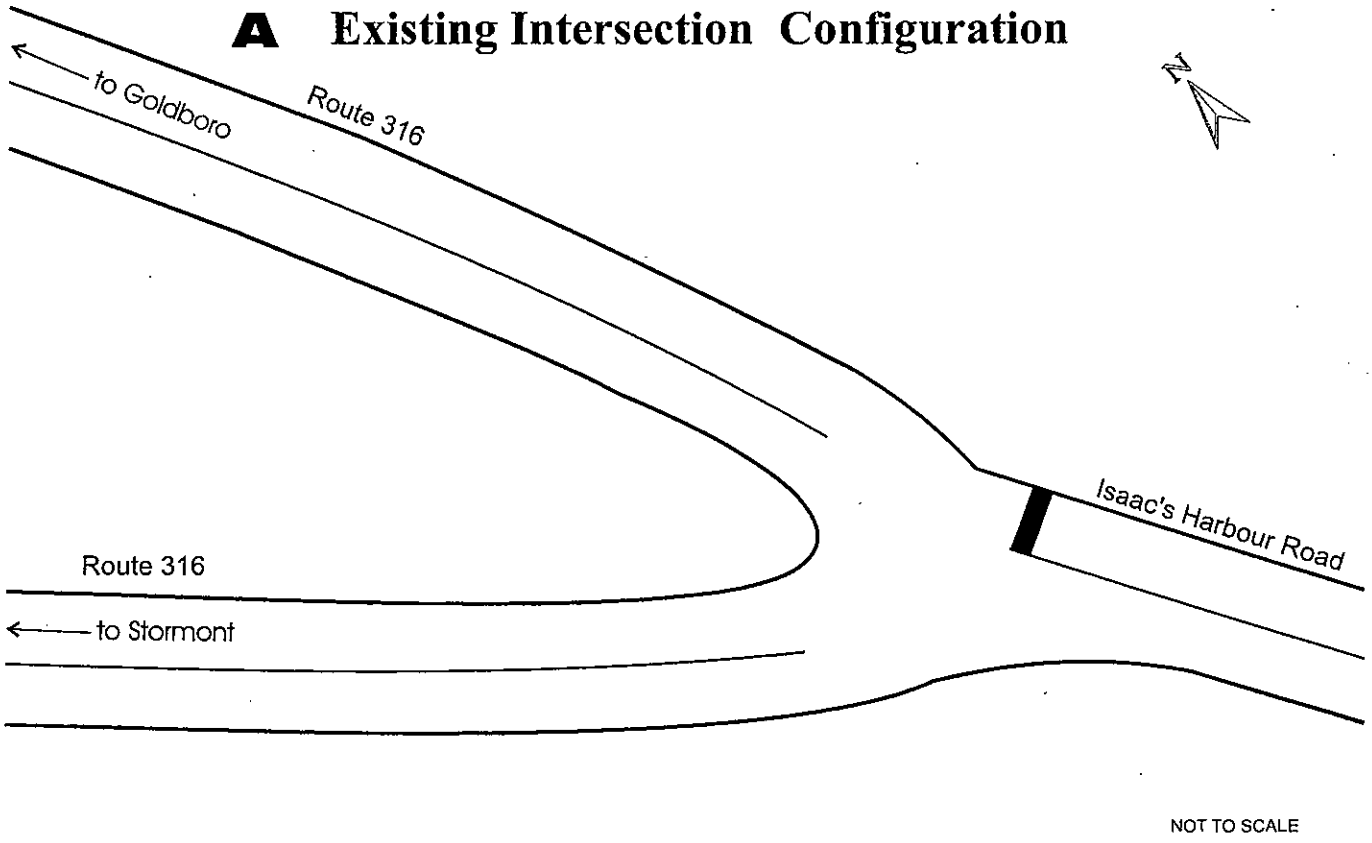
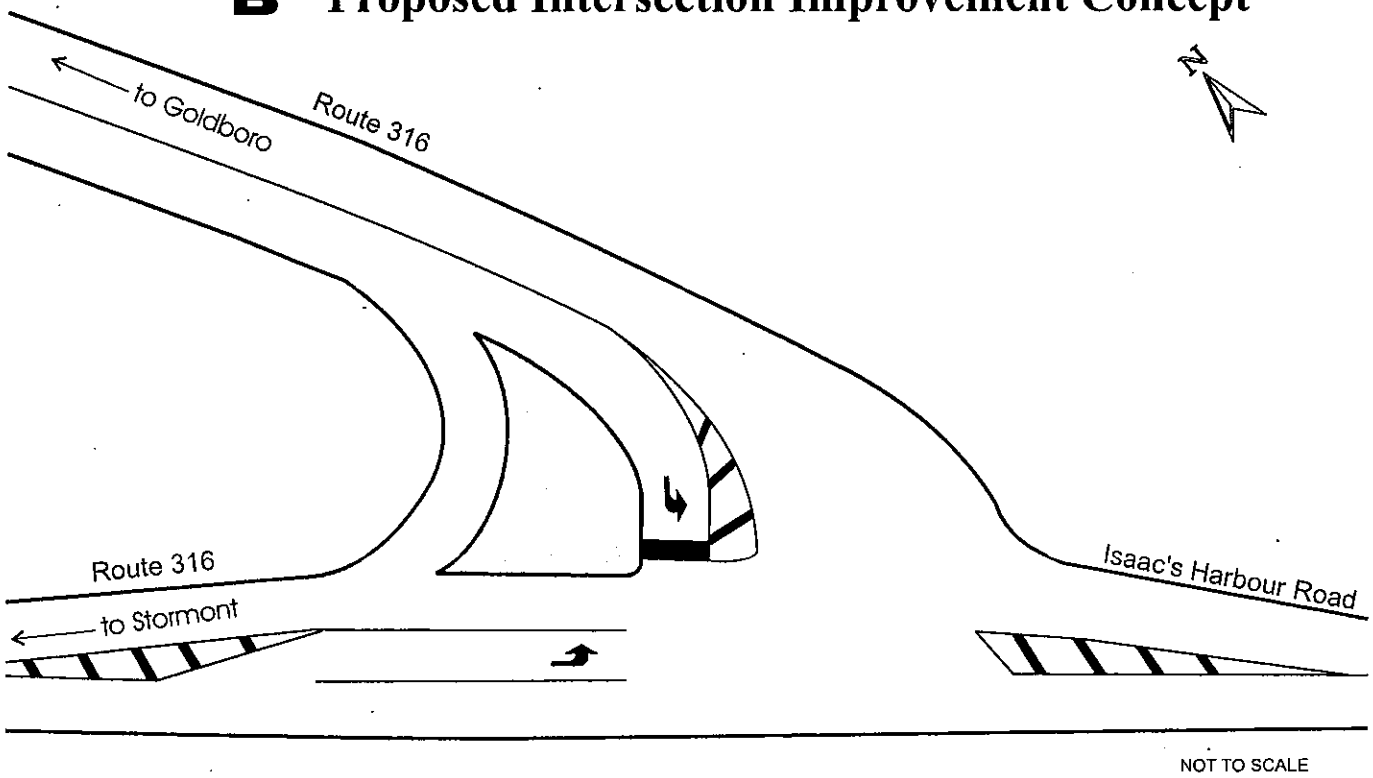


Photo 2.7 - Route 316 southbound approach to Isaac's Harbour Road intersection.

A Existing Intersection Configuration



B Proposed Intersection Improvement Concept



Atlantic Road & Traffic Management *Traffic Engineering Specialists*	**Traffic Impact Study - Keltic Petrochemicals Inc. Petrochemical Plant Facilities and MapleLNG Liquified Natural Gas Facilities, Goldboro, NS**	**Figure 2.4**
	Intersection Improvement Route 316 at Isaac's Harbour Road	**December 2007**

Areas With Significant Numbers of Horizontal Curves

While posted speed limits appear to be suitable for the roadside development, and horizontal and vertical alignments throughout the access route, there are numerous curves with curve warning signs and advisory speed tabs in the order of 60 km/h. Most curves appeared to have appropriate warning signs during site visits in September and November, however, signing should be reviewed each spring to replace warning signs that may have been damaged by snow plows.

It was noted during site visits that the first twelve kilometres of Route 316 south of Route 276 at Goshen have been repaved during the 2006 and 2007 construction seasons. If road improvements were to continue at a similar rate during the 2008 to 2011 construction seasons, the remaining 30 kilometres of Route 316 to Sable Road could be upgraded before the Keltic Petrochemical plant and MapleLNG terminal start operation during 2011.

There are several areas on Trunk 7 and Route 316 where reverse curves are closely spaced requiring posting of warning signs and resultant reduced travel speeds. The following road sections illustrated on Figures 2.1 and 2.2 should be considered for horizontal alignment improvements as the roads are upgraded in future years:

1. Trunk 7 - 6.6 km to 8.0 km (Figure 2.1)
2. Trunk 7 - 13.5 km to 15.6 km (Figure 2.1)
3. Trunk 7 - 21.6 km to 23.4 km (Figure 2.1)
4. Route 316 - various curves 1.6 km to 5.3 km (Figure 2.2)
5. Route 316 - 13.1 km to 16.3 km (Figure 2.2)
6. Route 316 - 16.7 km to 18.2 km (Figure 2.2)
7. Route 316 - 23.0 km to 25.2 km (Figure 2.2)
8. Route 316 - 27.4 km to 28.0 km (Figure 2.2)
9. Route 316 - various curves 29.7 km to 31.9 km (Figure 2.2)
10. Route 316 - 32.8 km to 34.9 km (Figure 2.2)
11. Route 316 - 37.4 km to 38.2 km (Figure 2.2)

Review of Needs for Climbing Lanes

The need for construction of climbing lanes on the access route was considered during site visits which included travelling the access route in both directions between Antigonish and Goldboro. While the route includes sections of rolling terrain in many places, the grades are short and are not expected to have a significant effect on truck travel speeds relative to the posted speed limits. Consequently, climbing lanes are not suggested at any locations on the access route.

Maximum Weight Allowances

The *Weights and Dimensions of Vehicle Regulations* indicates that Trunk 7 from Highway 104 to Route 276 is a designated Schedule C route and that access route sections of Routes 276 and 316 are designated B-Train routes. Therefore, project generated construction and operation traffic will be able to use 8-axle B-Train units and 6-axle semi-trailer units within the

allowable maximum gross vehicle weights for the designated B-Train routes. This will permit the following maximum allowable gross vehicle weights as of January 1, 2008, except during Spring weight restriction periods:

- Schedule C sections of Trunk 7
  - Six-axle tridem semi-trailer 49,500 kg
  - 8-Axle B-Train 62,500 kg
  - Not affected by Spring weight restrictions
- B-Train sections of Routes 276 and 316
  - Six-axle tridem semi-trailer 47,500 kg
  - 8-Axle B-Train 62,500 kg
  - Weights will probably be reduced to about 60% of allowable gross vehicle weight during four to six weeks each Spring.

NSTIR has agreed to complete pavement strength testing of the Route 276 and Route 316 sections of the access route to determine extent of pavement strengthening that may be required to designate these road sections as Schedule C all-year maximum allowable weight roads. Pavement testing will be completed using the DYNAFLECT (Dynamic Deflection Determination System) methodology when pavement and weather conditions permit.

Bridges on the Access Route

Since the Trunk 7 section of the access route is now designated as a Schedule C road, it is assumed that the bridge structures on that road are suitable for current permitted loadings. While Routes 276 and 316 sections of the access route allow B-Train maximum weights and a slightly reduced six-axle tridem weight, NSTIR considers it necessary to evaluate bridge structures to determine suitability for the allowable maximum weights on a Schedule C road. NSTIR has not listed any bridges on Route 276, however, there are several timber bridges, and various timber and corrugated metal culverts, on Route 316 that NSTIR will investigate when weather conditions permit.

The following timber bridges listed by NSTIR bridge numbers, which are also illustrated by Bridge Numbers on Figure 2.2, will be included in the NSTIR investigation:
Bridge 1 - Eight Island Lake Brook (GUY161) - 17 feet
Bridge 2 - Des-Barres Brook Bridge (GUY156) - 24 feet
Bridge 3 - Gunns Brook (GUY152) - 40 feet
Bridge 4 - Doctor Brook (GUY30) - 26 feet
Bridge 5 - Isaac's Harbour North Brook (GUY166) - 14 feet
Bridge 6 - Isaac's Harbour River (GUY48) - 39 feet.

Historical Traffic Volumes and Growth Trends

NSTIR has obtained traffic count data at various locations on the proposed access route for over thirty years. Volumes for six locations where

sufficient data are available have been tabulated (Tables B-1 to B-6, Appendix B) and regression analyses of volume growth trends have been completed (Figures B-1 to B-6). The average annual growth rate for the six locations is about 1.5%. Estimated 2007 Annual Average Daily Traffic (AADT) volumes, growth rates, and projected 2012 and 2017 AADT volumes are included in Table 2.3.

Existing and projected volumes on Trunk 7 are considered to be low to moderate for a primary trunk highway, and those on Routes 276 and 316 are low to very low for a normal collector road.

Table 2.3 - Volume Growth Trends on the Access Route

Location	Table / Figure	Annual Growth Rate (vpd/year)	Estimated 2007 AADT	Annual % Growth	Projected AADT Volumes	
					2012	2017
Trunk 7 - 1 km South of Highway 104	B-1	55	4500	1.2	4800	5050
Trunk 7 - 1 km south of Salt Springs	B-2	50	2900	1.7	3150	3400
Trunk 7 - Ant. / Guy. County Line	B-3	12	1100	1.0	1160	1220
Route 276 - Halfway Trunk 7 and Route 316	B-4	10	550	1.8	600	650
Route 316 - 1.0 km south of Route 276	B-5	5	430	1.2	480	530
Route 316 - 1.5 km north of Isaac's Harbour Rd.	B-6	5	470	1.0	530	570

NOTES:
1. Complete volume and regression details are available in Appendix B, Tables and Figures B-1 to B-6.
2. Projected 2012 and 2017 AADT volumes are based on estimated 2007 AADT with addition of the appropriate Annual Growth Rate of vpd/year.

Determination of 2007 Design Hourly Volumes (DHVs)

Tabulated hourly volumes for machine traffic counts obtained by NSTIR at seven locations along the access route during 1999, 2002, and 2005 are tabulated in Tables B-7 to B-27, Appendix B. Average weekday hourly volumes for each location are also illustrated diagrammatically in Figures B-7 to B-13.

The 2005 AM and PM peak hourly volumes have been increased by 10% to provide estimates of 2005 AM and PM Design Hourly Volumes (DHVs). Estimated 2005 DHVs have been increased by the 1.5% annual volume growth rate to provide estimated 2007 DHVs. Traffic volume data, including estimated 2007 AM and PM DHVs, are summarized in Table 2.4.

Table 2.4 - Summary of Machine Traffic Count Data

Count Location	2005 Count Dates	Table / Figure [1]	2005 Weekday Volume	2005 DHVs [2]		2007 DHVs [3]	
				AM	PM	AM	PM
Trunk 7 - 1 km South of Highway 104	June	B-9 / B-7	5,340	435	490	450	505
Trunk 7 - 1 km south of Salt Springs	June	B-12 / B-8	3,340	260	315	270	325
Trunk 7 - Ant. / Guy. County Line	May	B-15 / B-9	1,160	95	110	100	115
Route 276 - Halfway Trunk 7 and Route 316	May	B-18 / B-10	580	50	55	50	55
Route 316 - 1.0 km south of Route 276	May	B-21 / B-11	440	30	40	30	40
Route 316 - 1.5 km north of Isaac's Hbr. Rd.	May	B-24 / B-12	470	30	40	30	40
Route 316 - Goldboro Area	Oct [4]	B-26 / B-13	460 [4]	30	40	30	40

Notes:
1. Tabulated volumes and diagrammatical hourly volumes figures are in Appendix B.
2. 2005 DHVs have been estimated using 2005 average weekday peak hour volumes plus 10%
3. 2007 DHVs have been estimated using 2005 DHVs plus 1.5% per annual growth rate.
4. 2005 values are not available; 2000 volumes have been increased by 1.5% per year to estimate 2005 values.

Roadside Development - Number of Driveways

Roadside development throughout the 77 kilometre access road was observed during a site visit in September 2007. The numbers of driveways per kilometre are included in Tables C-1 to C-3, Appendix C. The locations of various one kilometre roadside study sections along the access route can be approximated by referring to the one kilometre sections marked on Figure 2.1 and 2.2. While seven of the one kilometre sections of the 77 kilometre access route have a total more than 15 driveways per kilometre for both sides of the road, many sections have fewer than five driveways per kilometre, with most sections having five to ten driveways per kilometre. It should also be noted that many driveway locations on Trunk 7 and Route 316 to properties with water frontage involve seasonal driveways to cottage lots. Roadside development information is summarized in Table 2.5.

Table 2.5 - Summary of Roadside Development Information

Road Section	Length, km	Average Number of Driveways / km (Both Sides)	Table
Trunk 7 (Highway 104 to Route 276)	29.6	8.6	C-1
Route 276 (Trunk 7 to Route 316)	5.3	4.2	C-2
Route 316 (Route 276 to Sable Road)	42.1	8.6	C-3

NOTE: Driveway density by kilometre is shown in detail in Tables C-1 to C-3, Appendix C.

Summary - Collision History (2000 to 2004)

NSTIR maintains a collision data base of all reported motor vehicle collisions in the Province. Collision data is sorted by Highway Section for all numbered roadways. For a number of years NSTIR published *Motor Vehicle Collision Rates for Number Highways and Sections*, a bound publication that included collision statistics by Highway Section for a five year period. While NSTIR has redefined Highway Sections throughout the Province during 2007, the most recent edition of *Motor Vehicle Collision Rates for Number Highways and Sections - 2000 to 2004* is based on the previous highway section identification system.

Available NSTIR published collision statistics for Trunk 7 Highway Sections that include the access route are tabulated in Table 2.6, and those for appropriate Highway Sections on Routes 276 and 316 are tabulated in Table 2.7.

Table 2.6 - Collision Statistics for Trunk 7 (2000 to 2004)

Year	AADT	HMVK[1]	Number of Collisions by Severity				Collision Rates[2]			
			PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Section 7-100 (Highway 104 at Antigonish to Ashdale West [South] Line) - Length 16.80 km										
2000	4290	0.2638	6	6	0	12	22.7	22.7	0.0	45.5
2001	4290	0.2631	7	3	0	10	26.6	11.4	0.0	38.0
2002	2680	0.1643	4	1	1	6	24.3	6.1	6.1	36.5
2003	2680	0.1643	3	2	0	5	18.3	12.2	0.0	30.4
2004	2680	0.1648	3	0	0	3	18.2	0.0	0.0	18.2
Collision Totals and Five Year Average Collision Rates		1.0203	23	12	1	36	22.5	11.8	1.0	35.3
Section 7-90 (Ashdale West [South] Line to Melrose - Country Harbour Road) - Length 27.56 km[3]										
2000	1460	0.1473	13	1	0	14	88.3	6.8	0.0	95.1
2001	1460	0.1469	6	4	0	10	40.9	27.2	0.0	68.1
2002	1100	0.1107	7	4	0	11	63.3	36.1	0.0	99.4
2003	1100	0.1107	7	3	0	10	63.3	27.1	0.0	90.4
2004	1100	0.1110	3	3	0	6	27.0	27.0	0.0	54.1
Collision Totals and Five Year Average Collision Rates		0.6264	36	15	0	51	57.5	23.9	0.0	81.4
Five Year Average Collision Rates for Both Trunk 7 Highway Sections[4]							**35.8**	**16.4**	**0.6**	**52.8**

NOTES:
1. HMVK means 'Hundred Million Vehicle Kilometres'
2. Collision rates are 'Number of collisions per HMVK of vehicle travel.
3. Only the northern 12.8 km of this Highway Section are included in the Access Route, however, it is not practical to attempt to 'split' the section.
4. These are the average collision rates for the combined sections of Trunk 7 - Trunk Highways.

Table 2.7 - Collision Statistics for Routes 276 and 316 (2000 to 2004)

Year	AADT	HMVK[1]	Number of Collisions by Severity				Collision Rates [2]			
			PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Route 276 - Section 276-10 (Trunk 7 to Route 316) - Length 5.33 km										
2000	1080	0.0211	2	0	0	2	94.9	0.0	0.0	94.9
2001	1080	0.0210	0	0	0	0	0.0	0.0	0.0	0.0
2002	600	0.0117	0	1	0	1	0.0	85.7	0.0	85.7
2003	600	0.0117	1	0	0	1	85.7	0.0	0.0	85.7
2004	600	0.0117	1	0	0	1	85.4	0.0	0.0	85.4
Collision Totals and Five Year Average Collision Rates		0.0771	4	1	0	5	51.9	13.0	0.0	64.8
Route 316 - Section 316-20 (Ant. / Guy. Co. Line to Country Harbour Cross Roads) - Length 18.51 km [3]										
2000	530	0.0359	3	3	0	6	83.6	83.6	0.0	167.1
2001	530	0.0358	3	1	0	4	83.8	27.6	0.0	111.7
2002	420	0.0284	2	1	0	3	70.5	35.2	0.0	105.7
2003	420	0.0284	3	1	0	4	105.7	35.2	0.0	141.0
2004	420	0.0285	3	1	0	4	105.4	35.1	0.0	140.6
Collision Totals and Five Year Average Collision Rates		0.1569	14	7	0	21	89.2	44.6	0.0	133.8
Route 316 - Section 316-30 (Country Harbour Cross Roads to Drumhead) - Length 30.69 km										
2000	480	0.0539	2	4	0	6	37.1	74.2	0.0	111.3
2001	480	0.0538	2	5	1	8	37.2	93.0	18.6	148.8
2002	460	0.0515	2	0	0	2	38.8	0.0	0.0	38.8
2003	460	0.0515	0	0	0	0	0.0	0.0	0.0	0.0
2004	460	0.0517	0	1	0	1	0.0	19.4	0.0	19.4
Collision Totals and Five Year Average Collision Rates		0.2624	6	10	1	17	22.9	38.1	3.8	64.8
Five Year Average Collision Rates for the three Collector Highway Sections [4]							**48.3**	**36.3**	**2.0**	**86.6**

NOTES:
1. HMVK means 'Hundred Million Vehicle Kilometres'
2. Collision rates are 'Number of collisions per HMVK of vehicle travel.
3. Only the southern 15.2 km of this Highway Section are included in the Access Route, however, it is not practical to attempt to 'split' the section.
4. These are the average collision rates for the combined sections of Routes 276 and 316 - Collector Roads

Conclusion - Collision History

The Trunk Highway sections of the access route (Trunk 7) have a five year average collision rate of 52.8 collisions per 100 million vehicle kilometres compared to the Provincial average rate of 75.0 for all rural Trunk Highway sections. The Collector Route sections of the access route (Routes 276 and 316) have a five year collision rate of 86.6 compared to the Provincial average of 88.7 for all Collector Road sections.

Since the collision rates on the access route sections are lower than the Provincial average rates, there is no indication of abnormal collision experience for the Study Area road sections.

3.0 Trip Generation, Trip Distribution and Assignment

Construction will Begin during 2008 and Extend to Mid-2011

Construction of a Route 316 diversion, marginal wharf, MapleLNG unloading and storage facilities, and preparation of the Keltic Petrochemical Complex site will begin during spring 2008, with more labour intensive construction occurring during 2009 and 2010.

Estimates of Construction Related Employee Trips

During peak construction periods in 2009 and 2010, the project is expected to have about 2000 to 2500 employees at the Keltic Petrochemical Complex site, working two shifts with 1000 to 1250 employees in each shift. There will also be about 200 to 250 employees at the MapleLNG terminal site, probably working in two shifts with about 100 to 125 employees per shift. The combined peak work force is expected to include about 1100 to 1375 employees per shift.

While it is planned that the majority of the work force will be housed in a construction camp on-site with transportation provided by the contractor, it is also expected that up to 35% of employees will be from the local area, or may choose to get their own accommodations in the Guysborough - Antigonish and surrounding local areas. The work force traveling to and from the site from local areas will include about 400 to 500 employees arriving at the site, as well as equal numbers leaving the site during shift changes. Assuming 2.5 persons per vehicle, the local area employees will generate about 160 to 200 vehicle trips entering, and another 160 to 200 vehicle trips exiting, the project area during each shift change.

Distribution of Local Area Construction Employee Trips

After a study of the local road network and locations of communities in the Guysborough - Antigonish area, the following trip distribution has been assumed for the local area construction employee trips:

- 30% - south on Route 316 to travel to Canso and Guysborough areas;
- 10% - Isaac's Harbour area;
- 10% - Country Harbour Ferry to reach areas around Sherbrooke;
- 10% - connecting roads at Cross Road Country Harbour
- 10% - connecting roads in the Goshen area; and
- 30% - Antigonish area.

Transportation of Construction Materials

Although large prefabricated equipment units and sections of construction material are expected to be delivered to the site by ship or barge, significant construction materials will also be transported by truck.

Keltic / MapleLNG have estimated that construction will require about 47,000 tonnes of steel and up to 200,000 cubic meters of concrete, plus piping, lumber and other building materials. If it is assumed that about one-half of the steel is delivered by truck over a 24 month period, there will be an average of about 32 loads per month, or one to two loads per day.

While stone for concrete will be crushed on site, it is estimated that about 64,000 tonnes of cement will be required over a 30 month period. If cement is transported by B-Train units hauling 42,000 kg per load, then there will be about 50 B-Train units per month, or about two per day.

There are also expected to be 30 to 35 other trucks making site deliveries each day. Steel and cement transport trucks, plus other trucks, will generate about 40 loaded trucks arriving at the site, and forty empty trucks leaving the site each day during the peak construction period. Since trucks will arrive at various times during a 24 hour day, truck traffic is not expected to have any significant impact on traffic volumes during AM and PM peak travel periods. Trucks are expected to use the Trunk 7 - Route 276 - Route 316 access route between Highway 104 and Goldboro.

Projected DHVs that Include Construction Trips

Construction generated trips, distributed to access route road sections based on the assumed trip distributions discussed above, have been added to projected 2010 background DHVs to provide estimated 2010 DHVs that include site generated construction trips which are shown in Table 3.1.

Since existing access route volumes are low to moderate, and since the estimated volumes that include construction trips are similar to those experienced in 1999 during construction of the Sable Gas Project as illustrated in Figures B-9 to B-13, Appendix B, it is expected that the access route road sections will provide satisfactory performance during the construction period.

Table 3.1 - Estimated 2010 Two-Way Design Hourly Volumes during the Construction Phase

Count Location	Background 2010 DHVs [1]		Construction Vehicle Trips [2]		Estimated 2010 DHVs with Construction Trips	
	AM	PM	AM	PM	AM	PM
Trunk 7 - 1 km South of Highway 104	470	530	90	90	560	620
Trunk 7 - 1 km south of Salt Springs	280	340	90	90	370	430
Trunk 7 - Ant. / Guy. County Line	105	120	90	90	195	210
Route 276 - Halfway Trunk 7 and Route 316	50	60	90	90	140	150
Route 316 - 1.0 km south of Route 276	30	40	120	120	150	160
Route 316 - 1.5 km north of Isaac's Hbr. Rd.	30	40	150	150	180	190
Route 316 - Goldboro Area (north of Site)	30	40	210	210	240	250
Route 316 - south of Site	30	40	90	90	120	130

Notes:
1. 2010 DHVs have been estimated using 2007 DHVs from Table 2.4 plus 1.5% per annual growth rate.
2. Construction generated trips have been distributed to road sections based on the trip distribution assumptions included above. Volumes included in this table are two-way hourly volumes for a peak hour during a shift change. Since entering and exiting trips will probably be spread over a two hour period, peak hour construction generated trips have been assumed to be 75% of the total two-way volumes generated by a shift change.

Estimation of Passenger Vehicle Trips Generated by Production Activities

TheMapleLNG terminal, which is expected to begin operation by early 2011, will have about 40 permanent employees, working two shifts per day. The Keltic Petrochemical Complex is expected to begin operation in the fall of 2011 with about 550 employees. The plant will operate 24 hours per day with two shifts of about 275 employees working from 7:00 AM to 7:00 PM and 7:00 PM to 7:00 AM.

The combined employee movements for the Keltic Petrochemical Complex and MapleLNG facilities will include about 300 employees arriving and 300 employees leaving the industrial area during AM and PM peak travel periods. Assuming an average of two people per vehicle, operational employees at the two facilities are expected to generate about 150 entering and 150 exiting vehicles during peak periods.

Distribution of Employee Vehicle Trips

While permanent employees may have a greater tendency than construction employees to live reasonably close to the industrial area, employee trips will be distributed throughout the Guysborough - Antigonish areas. Operation employee trips have been assumed to be distributed in the same manner as local area construction employee trips.

Estimation of Truck Traffic during the Operational Phase

Information contained in the EA Report indicated that there would be about 100 two-way truck trips per day transporting finished products from the Petrochemical Complex. However, since the Report was prepared, Keltic Petrochemical officials have been refining the proposed delivery methods for finished products. It is now expected that about 90% of the finished product will be shipped by sea to the Eastern United States. The remaining 10% of the polyethylene and polypropylene (PE & PP) pellets will be shipped by truck to customers in Atlantic Canada and Eastern Quebec.

PE & PP pellets weigh between 30 and 35 pounds per cubic foot. Information from a trucking firm now transporting pellets in Nova Scotia indicates that a B-Train can carry 2200 cu. ft. Using a weight of 35 pcf, a B-Train will carry about a 35,000 kg payload. Keltic expects that when fully operational, the Petrochemical Complex at Goldboro could be shipping 100,000 to 150,000 metric tonnes of PE & PP product per year to customers in the Maritimes and Eastern Quebec. Keltic expects to use B-train trucks to move this product to customers. Assuming a maximum load of 35 tonnes per B-Train and shipping product for 350 out of 365 days per year, would produce about 12 to 13 B-Train loads per day plus 12 to 13 empty trucks returning to the plant each day.

It is expected that the Keltic Petrochemical Complex will generate some truck traffic in addition to those required for shipping products. Also, there will be infrequent local truck traffic generated by the MapleLNG

operational phase. It is assumed that the operational phases of the Keltic Petrochemical Complex and MapleLNG will generate a total of about 25 trucks entering and 25 trucks exiting the site each day. Since trucks will arrive at various times during a 24 hour day, truck traffic is not expected to have any significant impact on traffic volumes during AM and PM peak travel periods. Trucks are expected to use the Trunk 7 - Route 276 - Route 316 access route between Highway 104 and Goldboro.

Projected DHVs that Include Production Trips

Keltic Petrochemical Complex and MapleLNG operation generated trips, distributed to access route road sections based on the assumed trip distributions discussed above, have been added to projected 2017 background DHVs to provide estimated 2017 DHVs that include site generated operational trips which are shown in Table 3.2.

Since existing access route volumes are low to moderate, and volume growth rates are very low, projected 2017 background volumes are not significantly different from existing volumes for many road sections. Since the estimated 2017 volumes that include production phase trips are similar to those experienced in 1999 during construction of the Sable Gas Project as illustrated in Figures B-9 to B-13, Appendix B, it is expected that the access route road sections will provide satisfactory performance while accommodating site generated trips from operation of the Keltic Petrochemical Complex and MapleLNG facilities.

Table 3.2 - Estimated 2017 Two-Way Design Hourly Volumes during the Production Phase

Count Location	Background 2017 DHVs [1]		Construction Vehicle Trips [2]		Estimated 2010 DHVs with Construction Trips	
	AM	PM	AM	PM	AM	PM
Trunk 7 - 1 km South of Highway 104	520	580	70	70	590	650
Trunk 7 - 1 km south of Salt Springs	310	375	70	70	380	445
Trunk 7 - Ant. / Guy. County Line	125	115	70	70	195	185
Route 276 - Halfway Trunk 7 and Route 316	65	60	70	70	135	130
Route 316 - 1.0 km south of Route 276	45	35	90	90	135	125
Route 316 - 1.5 km north of Isaac's Hbr. Rd.	45	35	110	110	155	145
Route 316 - Goldboro Area (north of Site)	45	35	160	160	205	195
Route 316 - south of Site	45	35	70	70	115	105

Notes:
1. 2017 DHVs have been estimated using 2007 DHVs from Table 2.4 plus 1.5% per annual growth rate.
2. Production generated trips have been distributed to road sections based on the trip distribution assumptions included above. Volumes included in this table are two-way hourly volumes for a peak hour during a shift change. Since entering and exiting trips will probably be spread over a two hour period, peak hour construction generated trips have been assumed to be 75% of the total two-way volumes generated by a shift change. Numbers have been rounded.

4.0 Review of Proposed Route 316 Realignment at Goldboro

Route 316 Realignment

Route 316 will be realigned south of Sable Road to facilitate construction of the MapleLNG storage tanks between the road and the ocean terminal. The proposed realignment (illustrated in Figure 4.1) will include construction of about 1.2 kilometres of new roadway about 40 meters north of the existing roadway. The realigned road will be designed to NSTIR standards and requires NSTIR approval before construction. After the new road is completed, the existing section of Route 316 will be absorbed into the MapleLNG storage tank area.

Intersections on the Realigned Section of Route 316

Since the proposed realignment of Route 316 will occur within an area abutted by MapleLNG terminal and Keltic Petrochemical Complex site property on both sides of the road, there will not be any noticeable impact to public use of Route 316. However, three driveway intersections are proposed, one on the south side near Sable Road, one on the north side near the mid-point of the new road section, and a third at the south end of the realignment. All driveways will be designed to satisfy NSTIR design and sight distance requirements.

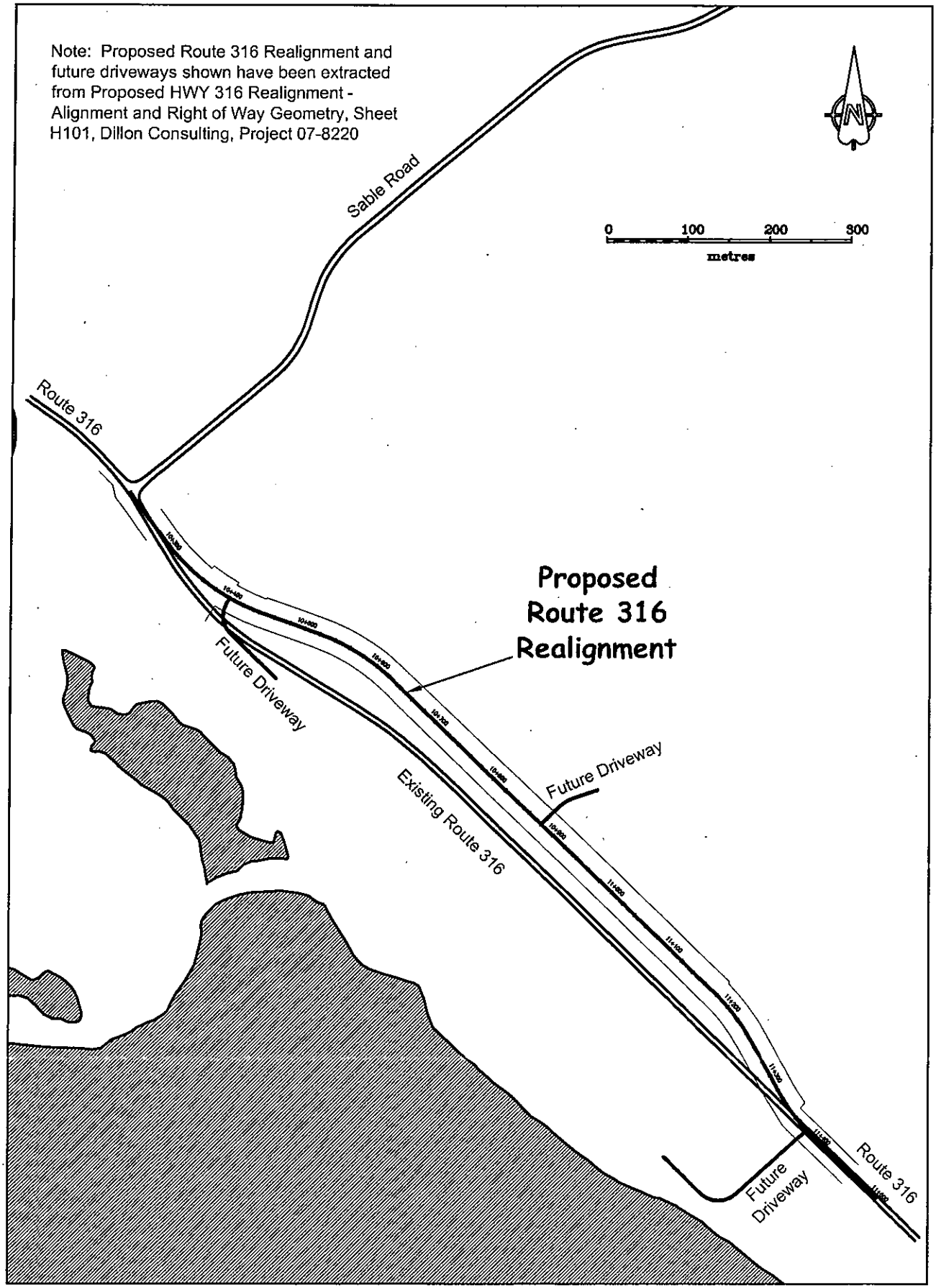


Figure 4.1
Route 316 Realignment at Goldboro

December 2007

6.0 Summary and Conclusions

Description of the Proposed Project

1. During the past several years, Keltic Petrochemicals Inc. has been preparing plans for construction of an LNG Terminal and Petrochemical Plant at Goldboro, Guysborough County. An Environmental Impact Assessment Report was prepared and the Environmental Assessment Board released it for public review and comment in the fall of 2006. Following a Public Hearing and further review by the Board, the Minister of Environment & Labour (NSEL) issued the *Terms and Conditions for Environmental Assessment Approval* to Keltic Petrochemicals Inc. on March 14, 2007. In November, 2007, the Minister of Environment & Labour issued an Environmental Assessment Approval with *Terms and Conditions* to MapleLNG.

   The *Terms and Conditions for Environmental Assessment Approval* (Item 1.3) require that a Traffic Impact Study, developed in consultation with NSTPW [now NSTIR] and the Municipality of the District of Guysborough, be provided to NSEL for review and approval prior to application for Part V approval under the *Environment Act.*

Study Objectives

2. Specific concerns included in the Traffic Impact Study include:
   - Identification of the proposed access route between Highway 104 and the project location in Goldboro, Guysborough County.
   - Evaluation of existing 2007, and projected 2012 and 2017, traffic volumes on Study Area road sections, without addition of site generated trips.
   - Examination of collision experience, including collision numbers by collision severity, and collision rates for Study Area road sections during the last five years.
   - Identification of areas on the access route that may require road upgrades, such as, intersection geometry, horizontal alignment, or grades that require construction of climbing lanes.
   - Estimation of the number of passenger vehicle and large truck trips that will be generated during AM and PM peak hours, for both the construction and production phases.
   - Evaluation of the impacts of site generated trips for both the construction and operation phases on the safety and level of performance of access route road sections.
   - Identification of areas where pavement and bridge strengthening may be required to handle existing and anticipated truck loadings.
   - Assessment of the proposed Route 316 realignment and access locations to project sites south of Sable Road near Goldboro

with regard to sight distances and intersection design characteristics.

Identification of Proposed Access and Haul Route

3. The 77.0 kilometre long access route and truck haul route between Highway 104 near Antigonish and the Keltic / MapleLNG site near Goldboro, includes sections of Trunk 7, and Routes 276 and 316. The route includes the following sections of these roads:
   - Trunk 7 (Highway 104 at Antigonish to Route 276) - 29.6 km
   - Route 276 (Trunk 7 to Route 316 at Goshen) - 5.3 km
   - Route 316 (Route 276 to Sable Road at Goldboro) - 42.1 km.

Evaluation of Existing and Projected Background Volumes

4. Existing 2007 Design Hourly Volumes (DHVs) on Trunk 7 are considered to be low to moderate for a primary trunk highway, and those on Routes 276 and 316 are low to very low for a normal collector road. Two-way DHVs on Trunk 7 vary from about 500 vehicles per hour (vph) near Antigonish to about 100 vph near the Route 276 intersection. DHVs for Route 276 and Route 316 sections are generally about 50 vph. Since volumes are low, a 1.5% annual growth rate will not cause significant changes to 2012 or 2017 background volumes.

Examination of Collision History

5. The Trunk Highway sections of the access route (Trunk 7) have a five year average collision rate of 52.8 collisions per 100 million vehicle kilometres compared to the Provincial average rate of 75.0 for all rural Trunk Highway sections. The Collector Route sections of the access route (Routes 276 and 316) have a five year collision rate of 86.6 compared to the Provincial average of 88.7 for all Collector Road sections.

   Since the collision rates on the access route sections are lower than the Provincial average rates for similar road types, there is no indication of abnormal collision experience for the Study Area road sections.

Roadway Cross Section

6. The first one kilometre section of Trunk 7 has two paved travel lanes (6.6 meters wide) with a 1.2 m wide paved shoulder, concrete curb and gutter, and sidewalk on the west side; and a 1.4 m gravel shoulder. The remaining 76 kilometres of the access route consists of a typical rural highway with two paved lanes, gravel shoulders, and open ditches. Pavement widths are generally about 6.4 meters, with about 1.2 meter wide gravel shoulders.

Posted Speed Limits

7. Most of Trunk 7 in the Study Area has a 90 km/h posted speed limit, and the sections of Routes 276 and 316 have 80 km/h posted speed limits except for short sections where limits are reduced due

to roadside development. The following reduced speed zones are included in the 77 kilometre access route:

- Trunk 7 - short 70 km/h and 80 km/h zones just south of Highway 104
- Route 276 - a short 70 km/h zone just west of Route 316
- Route 316 - three 60 km/h and two 70 km/h zones between Route 276 at Goshen and Sable Road in Goldboro.

Examination of Horizontal Alignment

8. While posted speed limits appear to be suitable for the roadside development, and horizontal and vertical alignments throughout the access route, there are numerous curves with curve warning signs and advisory speed tabs in the order of 60 km/h. Most curves appeared to have appropriate warning signs during site visits in September and November, however, signing should be reviewed each spring to replace warning signs that may have been damaged by snow plows.

   There are several areas on Trunk 7 and Route 316 where reverse curves are closely spaced requiring posting of warning signs and resultant reduced travel speeds. Improved horizontal alignment should be considered when planning future road upgrades.

Roadside Development - Number of Driveways

9. Roadside development throughout the 77 kilometre access road was observed during a site visit in September 2007. While seven of the one kilometre sections of the 77 kilometre access route have a total more than 15 driveways per kilometre for both sides of the road, many sections have fewer than five driveways per kilometre, with most sections having five to ten driveways per kilometre. It was also noted that many driveway locations on Trunk 7 and Route 316 for properties with water frontage involve seasonal driveways to cottage lots.

Review of Needs for Climbing Lanes

10. The need for construction of climbing lanes on the access route was considered during site visits which included travelling the access route in both directions between Antigonish and Goldboro. While the route includes sections of rolling terrain in many places, the grades are short and are not expected to have a significant effect on truck travel speeds relative to the posted speed limits. Consequently, climbing lanes are not suggested at any locations on the access route.

Study Area Intersections

11. Site visits indicated two intersections where improvements are needed:

    - The intersection of Route 276 with Trunk 7 will require construction of a right turn channel to facilitate large vehicle

right turns from Route 276 to Trunk 7, as illustrated in Figure 2.3.

- Route 316 intersects with the Isaac's Harbour Road on a sharp 15 km/h 'switch-back' curve as illustrated in Photos 2.6 and 2.7, and Figure 2.4-A. It is recommended that the intersection be reconstructed so that Route 316 and Isaac's Harbour Road met as a 'T' intersection as illustrated in Figure 2.4-B.

Maximum Weight Allowances

12. The *Weights and Dimensions of Vehicle Regulations* indicates that Trunk 7 from Highway 104 to Route 276 is a designated Schedule C route and that access route sections of Routes 276 and 316 are designated B-Train routes. Therefore, project generated construction and operation traffic will be able to use 8-axle B-Train units and 6-axle semi-trailer units within the allowable maximum gross vehicle weights for the designated B-Train routes.

    NSTIR has agreed to complete pavement strength testing of the Route 276 and Route 316 sections of the access route to determine extent of pavement strengthening that may be required to designate these road sections as Schedule C all-year maximum allowable weight roads. Pavement testing will be completed using the DYNAFLECT (Dynamic Deflection Determination System) methodology when pavement and weather conditions permit.

    Keltic Petrochemical and MapleLNG officials have indicated that they will adhere to all vehicle weights and dimensions regulations, including reduced allowable maximum gross vehicle weights during the annual Spring weight restriction period.

Bridges on the Access Route

13. Since the Trunk 7 section of access route is now designated as a Schedule C road, it is assumed that the bridge structures on that road are suitable for current permitted loadings. While Routes 276 and 316 sections of the access route allow B-Train maximum weights and a slightly reduced six-axle tridem weight, NSTIR considers it necessary to evaluate bridge structures to determine suitability for the allowable maximum weights on a Schedule C road. NSTIR has not listed any bridges on Route 276, however, there are several timber bridges, and various timber and corrugated metal culverts, on Route 316 that NSTIR will investigate when weather conditions permit.

Estimation of Construction Related Employee Trips

14. During peak construction periods in 2009 and 2010, the project is expected to have about 2000 to 2500 employees at the Petrochemical Complex site, working two shifts with 1000 to 1250 employees in each shift. There will also be about 200 to 250

employees at the MapleLNG site, probably working in two shifts with about 100 to 125 employees per shift. The combined peak work force is expected to have 1100 to 1375 employees per shift.

While it is planned that the majority of the work force will be housed in a construction camp on-site with transportation provided by the contractor, it is also expected that up to 35% of employees will be from the local area, or may choose to get their own accommodations in the Guysborough - Antigonish and surrounding local areas. The work force traveling to and from the site from local areas will include about 400 to 500 employees arriving at the site, as well as equal numbers leaving the site during shift changes. Assuming 2.5 persons per vehicle, the local area employees will generate about 160 to 200 vehicle trips entering, and another 160 to 200 vehicle trips exiting, the project area during each shift change.

Transportation of Construction Materials

15. Although large prefabricated equipment units and sections of construction material are expected to be delivered to the site by ship or barge, significant construction materials will also be transported by truck. It is estimated that steel and cement transport trucks, plus other trucks, will generate about 40 loaded trucks arriving at the site, and forty empty trucks leaving the site each day during the peak construction period. Since trucks will arrive at various times during a 24 hour day, truck traffic is not expected to have any significant impact on traffic volumes during AM and PM peak travel periods. Trucks are expected to use the Trunk 7 - Route 276 - Route 316 access route between Highway 104 and Goldboro.

Distribution of Local Area Construction Employee Trips

16. After a study of the local road network and locations of communities in the Guysborough - Antigonish area, the following trip distribution has been assumed for the local area construction employee trips:
    - 30% - south on Route 316 to travel to Canso and Guysborough areas;
    - 10% - Isaac's Harbour area;
    - 10% - Country Harbour Ferry to reach areas around Sherbrooke;
    - 10% - connecting roads at Cross Road Country Harbour
    - 10% - connecting roads in the Goshen area; and
    - 30% - Antigonish area.

Estimation of Passenger Vehicle Trips Generated by Production Activities

17. The MapleLNG terminal, which is expected to begin operation early in 2011, will have about 40 permanent employees, working two shifts per day. The Keltic Petrochemical Complex is expected to begin operation in the fall of 2011 with about 550 employees.

The plant will operate 24 hours per day with two shifts of about 275 employees working from 7:00 AM to 7:00 PM and 7:00 PM to 7:00 AM.

The combined employee movements for the Keltic Petrochemical Complex and MapleLNG facilities will include about 300 employees arriving and 300 employees leaving the industrial area during AM and PM peak travel periods. Assuming an average of two people per vehicle, the Keltic Petrochemical Complex and MapleLNG operational employees are expected to generate about 150 entering and 150 exiting vehicles during peak periods. While permanent employees may have a greater tendency than construction employees to live reasonably close to the industrial area, employee trips will be distributed throughout the Guysborough - Antigonish areas. Operational phase employee trips have been assumed to be distributed in the same manner as local area construction employee trips.

Estimation of Truck Traffic during the Operational Phase

18. It is now expected that about 90% of the finished product from the Keltic Petrochemical Complex will be shipped by sea to the Eastern United States, with the remaining 10% being shipped by truck to customers in Atlantic Canada and Eastern Quebec. It is estimated that the Complex will produce about 12 to 13 B-Train loads per day. Since other trucks can also be expected to travel to and from the site, and there will also be infrequent local truck traffic generated by MapleLNG, it is assumed that the operational phases of the Keltic Petrochemical Complex and MapleLNG will generate a total of about 25 trucks entering and 25 trucks exiting the site each day. Since trucks will arrive at various times during a 24 hour day, truck traffic is not expected to have any significant impact on traffic volumes during AM and PM peak travel periods. Trucks are expected to use the Trunk 7 - Route 276 - Route 316 access route between Highway 104 and Goldboro.

Review of Proposed Route 316 Realignment

19. Route 316 will be realigned south of Sable Road to facilitate construction of the MapleLNG storage tanks between the road and the ocean terminal. The proposed realignment will include construction of about 1.2 kilometres of new roadway about 40 meters north of the existing roadway. The realigned road will include three driveway intersections, one on the south side near Sable Road, one on the north side near the mid-point of the new road section, and a third at the south end of the realignment. The realigned road and all driveways will be designed to satisfy NSTIR design and sight distance requirements, and will require NSTIR approval before construction.

Evaluation of Impacts of Construction and Operation Phase Vehicle Trips

20. Since existing access route volumes are low to moderate, and volume growth rates are very low, projected background volumes are not significantly different from existing volumes for many road sections of the access route. Since the estimated 2010 DHVs that include construction traffic, and the estimated 2017 DHVs that include operational phase trips, are similar to those experienced in 1999 during construction of the Sable Gas Project, it is expected that the access route road sections will provide satisfactory performance while accommodating site generated trips from both the construction and operation of the Keltic Petrochemical Complex and MapleLNG facilities.

Appendix A

Project Scoping Document

Atlantic Road & Traffic Management

Traffic Engineering Specialists

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Halifax, NS B3M 4H4

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November 23, 2007

Mr. Paul Colton, P. Eng. Via Email 'coltonpv@gov.ns.ca '
Area Manager Antigonish
Department of Transportation and Infrastructure Renewal
ANTIGONISH NS

Re: Revised Scoping Document for a Traffic Impact Study,
Keltic Petrochemicals Inc. LNG and Petrochemical Plant Facilities, Goldbro, NS

Dear Mr. Colton:

Further to your comments of October 25, 2007, with regards to the Scoping Document dated October 15, 2007, I am providing this Revised Scoping Document to describe the Traffic Impact Study (TIS) that we are preparing for the proposed Keltic Petrochemicals Inc. LNG and Petrochemical Plant Facilities. The TIS is required by the *Terms and Conditions for Environmental Assessment Approval* approved by the Minister of Environment & Labour on March 14, 2007. The TIS will be completed in accordance with TIR *Guidelines for Completion of Traffic Impact Studies*.

The following methodology will be used to complete the TIS:

1. Project initiation will include [or has included] the following work tasks:
   - Meeting with TIR officials to discuss the Traffic Impact Study.
   - Trunk 7, and Routes 276 and 316 historical traffic count data for road sections between the Trunk 7 / Highway 104 intersection at Antigonish and the proposed project location adjacent to Route 316 in Goldboro have been obtained from TIR. AADT data for the past 30 years will be used to establish the annual volume growth rate for background traffic. Hourly machine count data from 2005 and 2006 will be used to establish peak hour volumes and estimated design hourly volumes for various road sections.
   - Available collision data for 2001 to 2006 for appropriate sections of Trunk 7, Route 276, and Route 316 have been obtained from the TIR collision data base.
   - Photo inventories of Trunk 7, Route 276, and Route 316 collected by TIR during 2005 and 2006 have been provided by Technical Services Group in Miller Lake.

2. The TIS will identify the proposed truck haul route between Highway 104 and Goldboro and will describe the anticipated travel demands associated with the development. The classification of each road section between Highway 104 at Antigonish and Goldboro with regards to load carrying capabilities will be determined. While Trunk 7 is known to be rated as a Schedule C Maximum Weight Road, Route 276 and Route 316 sections are designated B-Train routes that are subject to weight reduction of up to 40% during several weeks each spring when Spring Weight Restrictions are enforced.

3. The TIS will identify the type of trucks that will be accessing the Goldboro site during both the construction and operational phases of the project including anticipated loadings and truck operational characteristics. The heavy truck trips, as well as number of passenger vehicle trips, that will be generated by the construction and operation phases of the projects will be estimated based on information provided by Keltic Petrochemicals Inc. Trip generation estimates for the projects will be prepared for weekday daily volumes, as well as for weekday AM and PM peak hourly volumes. Site generated trips for construction and production phases of the projects will be distributed and assigned to the road sections. Site generated construction and operation trips will be added to the projected future horizon year volumes for the Study Area road sections to provide projected future year DHVs that include traffic that will be generated by the proposed development.

4. Pavement and bridge strength will be considered for the identified haul route based on anticipated gross vehicle weights and the truck configurations that will be used during construction and operational phases of the project. It is understood that TIR will complete dynaflex testing of pavement and initial structural assessment of bridges on Route 276 from Trunk 7 to Route 316, and Route 316 from Route 276 to Gas Plant Road. Pavement and bridge analyses results will be used in the preparation of the TIS Report.

5. Existing posted speed limits, pavement widths, housing densities, collision records, traffic volume data, photo inventories, and field visits of the road sections, will assist in identification of areas that may require upgrading to accommodate the existing traffic volumes using the road sections. Areas to be considered during site visits and evaluation of collision data include intersection geometry, climbing lane requirements, and safety of the identified haul route.

6. Level of service analyses will be completed for 2007 peak hour volumes and projected future horizon year volumes, in accordance to methodologies included in the *Highway Capacity Manual*.

7. The TIS will include an assessment of the proposed Route 316 realignment and access locations south of Gas Plant Road in Goldboro. Intersection design characteristics and sight distances will be considered.

8. Mitigation measures will be recommended to accommodate road deficiencies identified during preparation of the TIS, including the following:
   - Areas where pavement and bridge strengthening may be required to handle existing and anticipated truck loadings;
   - Intersection geometry improvements required to accommodate vehicles that will use the haul route. Functional sketches (1:10,000 scale) will be provided for identified intersection improvements.
   - Areas where roadway improvements may be required to correct existing poor roadway geometry will be identified. However, the TIS will not include survey and design of possible corrective measures.
   - Areas where bypass alignments may need to be considered due to roadside density will identified. However, the TIS will not include survey and design of possible bypass routes.

9. A Traffic Impact Study Report will be prepared to include review of study methodology, evaluation of 2007 peak hour volumes, trip generation estimates for both construction and operational phases of the project, distribution of site generated traffic, evaluation of projected future horizon year DHVs effects on the performance of Study Area road sections, identification of areas where road improvements may be required, and recommendation of appropriate mitigation measures.

If there are questions or comments, please contact me by Email at ***traffic@ns.sympatico.ca***.

Sincerely:

Ken O'Brien, P. Eng.

cc:

Appendix B

Traffic Volume Data

Table B-1 - Traffic Growth Trend on Trunk 7 (Section 105) - 1 Km South of Highway 104

Year	AADT
1979	3370
1980	2710
1981	2750
1983	3110
1984	3170
1985	2690
1987	2680
1988	3850
1991	3070
1993	2990
1995	4020
1996	3660
1999	3750
2002	2680
2005	4510

Shaded values were obtained from July and August counts

Source: AADTs were obtained from NSTIR for 1979 to 2005.
Since the Group C seasonal adjustment factors used for the summer season counts (shaded areas) are considered to underestimate AADTs for this short suburban section of Trunk 7, these counts have been omitted from the regression analysis.

Figure B-1 - Background Volume Growth Trend 1979 to 2022 (Trunk 7 - 1 km south of Highway 104)

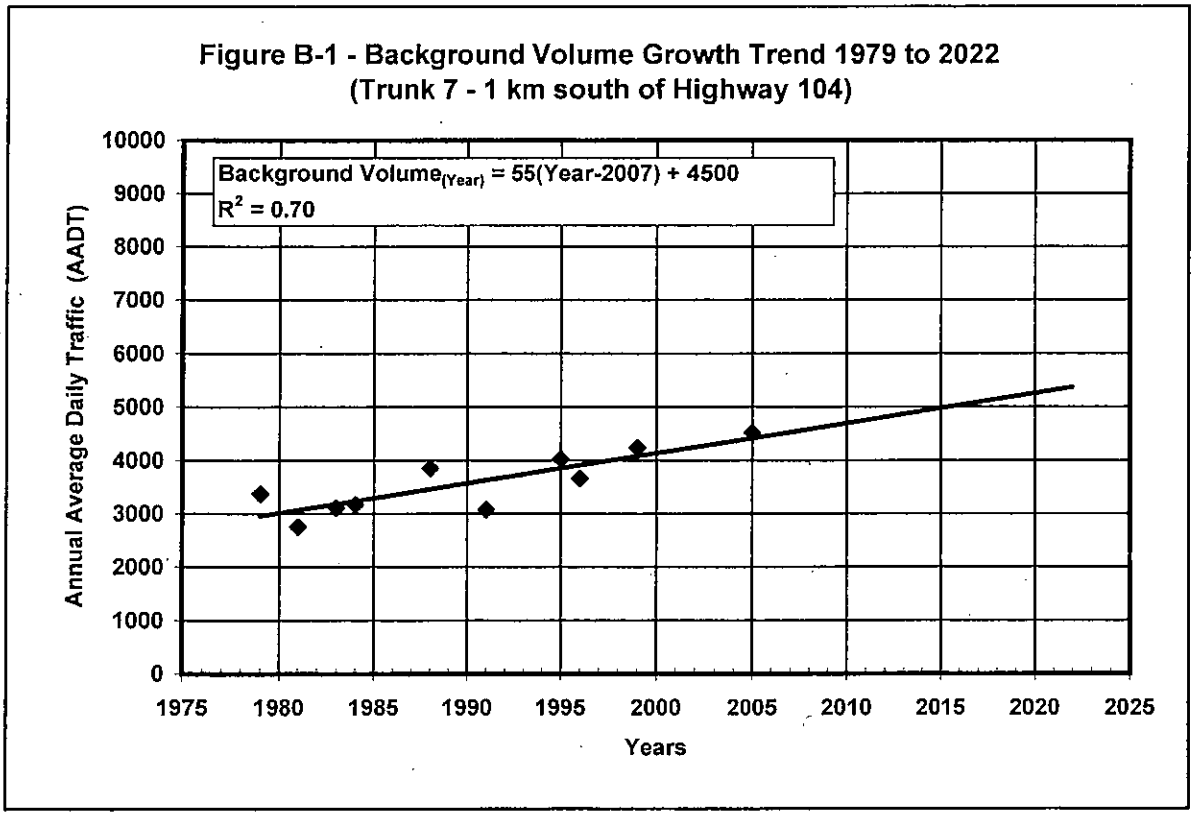


Table B-2 - Traffic Growth Trend on Trunk 7(Section 100) - 1 km South of Salt Springs

Year	AADT
1972	1070
1973	1090
1974	1010
1975	1410
1976	1660
1977	1560
1978	1830
1980	1510
1981	1410
1983	1270
1991	1970
1993	1960
1995	2480
1996	2370
1999	2490
2005	2830

Source: AADTs were obtained from NSTIR for 1972 to 2005.

Figure B-2 - Background Volume Growth Trend 1972 to 2022 (Trunk 7 - 1 km south of Salt Springs)

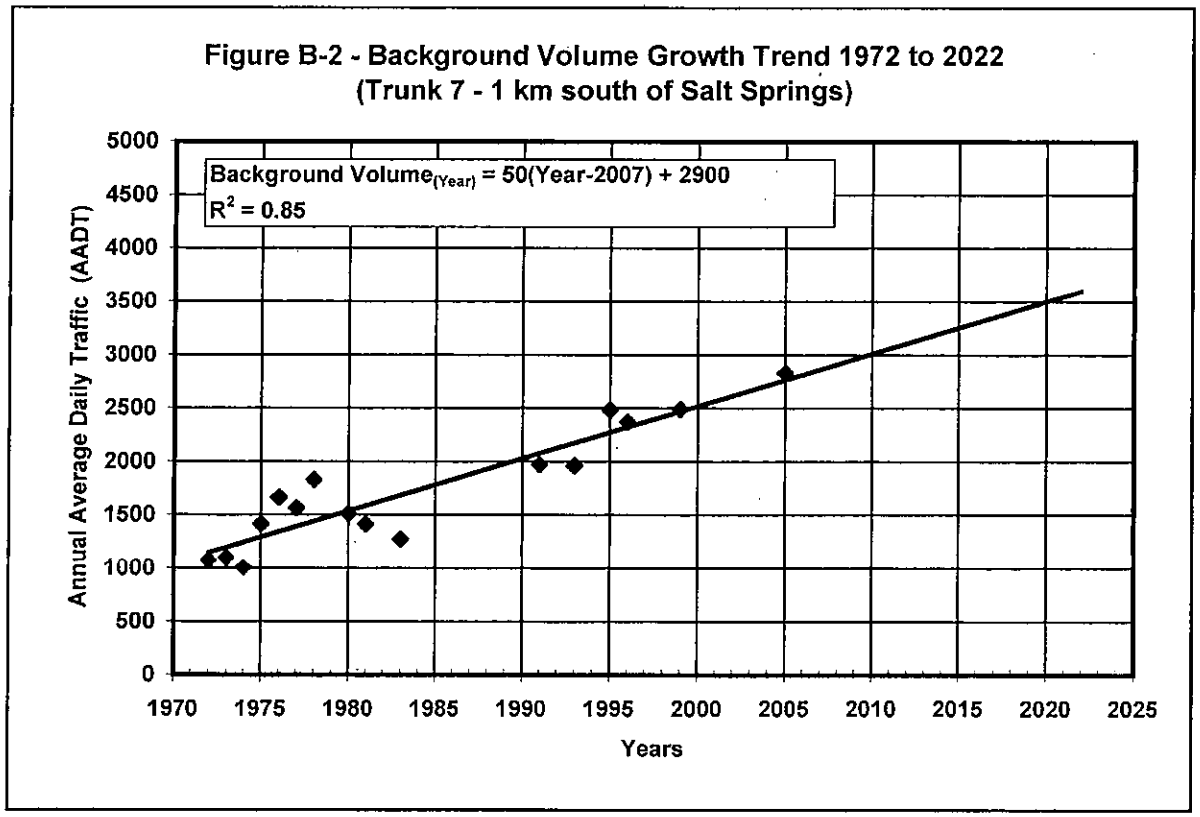


Table B-3 - Traffic Growth Trend on Trunk 7 (Section 098) - Ant. / Guy. Co. Line

Year	AADT
1980	820
1981	790
1983	770
1984	820
1988	880
1991	920
1993	810
1995	1290
1996	1110
1999	1440
2002	1100
2005	1020

Source: AADTs were obtained from NSTIR for 1980 to 2005.
The 1995 AADT was not used in the regression analysis since it appears to be an 'outlier'
The 1999 AADT was not used in the regression analysis since it is suspected that Sable Gas traffic may have inflated the count.

Figure B-3 - Background Volume Growth Trend 1980 to 2022 (Trunk 7 - Ant. / Guy. County Line)

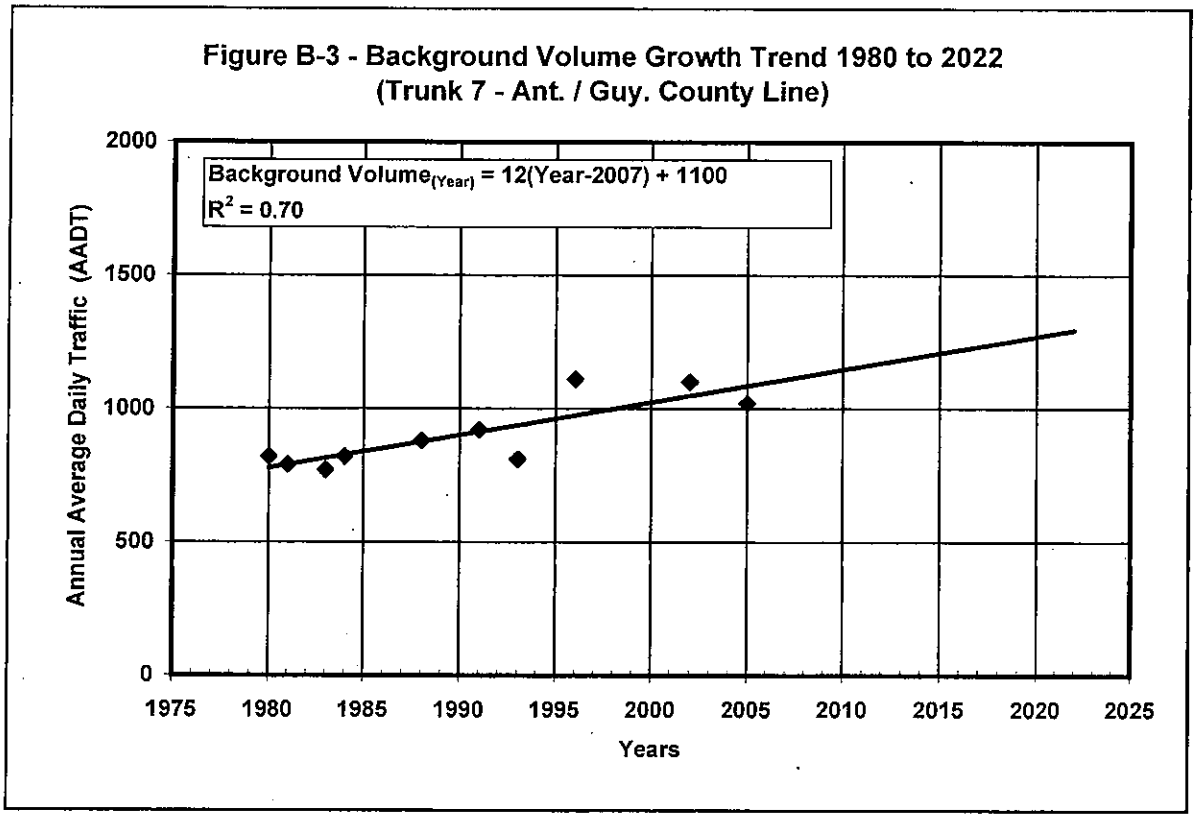


Table B-4 - Traffic Growth Trend on Route 276 (Section 010) - Halfway Trunk 7 to Route 316

Year	AADT
1971	320
1972	320
1974	470
1975	520
1976	470
1978	440
1980	510
1981	510
1983	390
1984	450
1988	640
1993	780
1995	800
1998	830
1999	1080
2002	600
2005	530

Source: AADTs were obtained from NSTIR for 1971 to 2005.
The 1999 AADT was not used in the regression analysis since it is suspected that Sable Gas traffic may have inflated the count.

Figure B-4 - Background Volume Growth Trend 1971 to 2022 (Route 276 (Section 010) - Halfway Trunk 7 to Route 316)

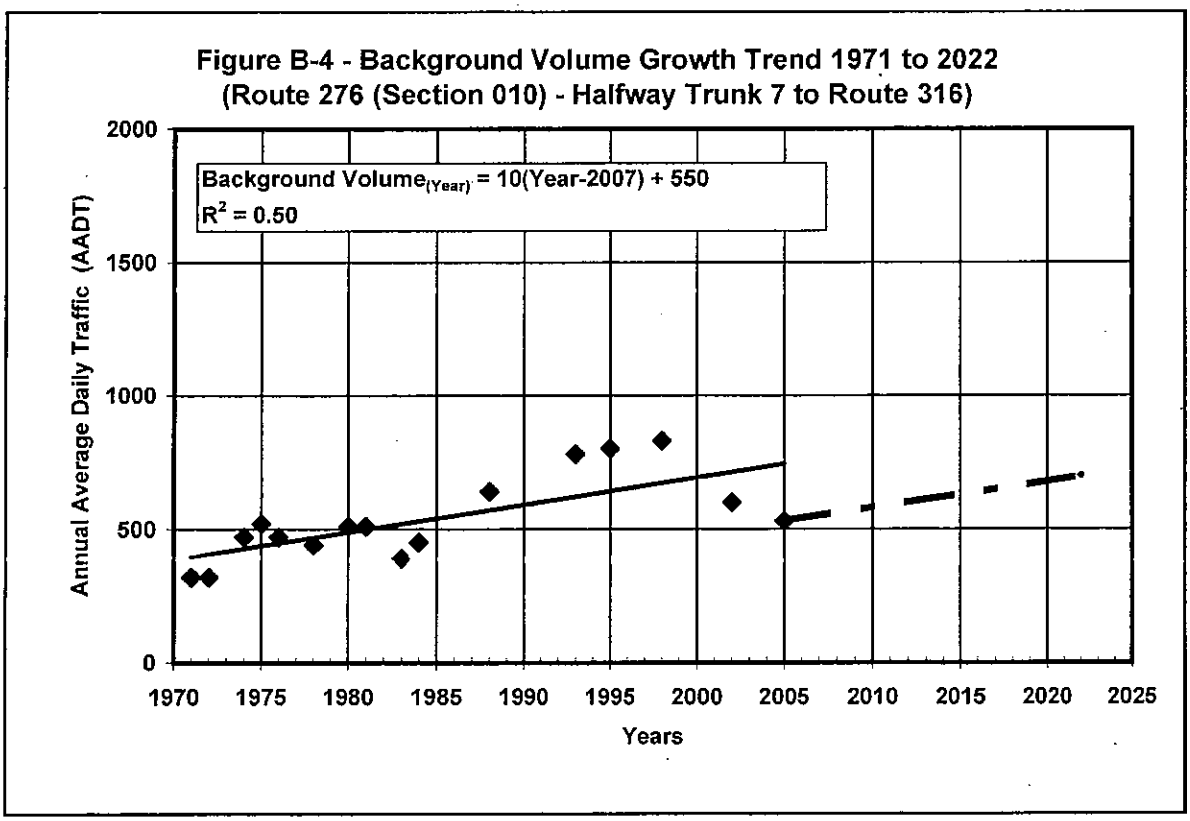


Table B-5 - Traffic Growth Trend on Route 316 (Section 025) - 1.0 km south of Route 276

Year	AADT
1971	420
1972	280
1974	500
1975	400
1976	360
1978	390
1980	360
1981	540
1984	510
1986	610
1988	690
1991	590
1995	660
1998	670
1999	790
2000	530
2002	420
2005	420

Source: AADTs were obtained from NSTIR for 1971 to 2005.
The 1999 AADT was not used in the regression analysis since it is suspected that Sable Gas traffic may have inflated the count.

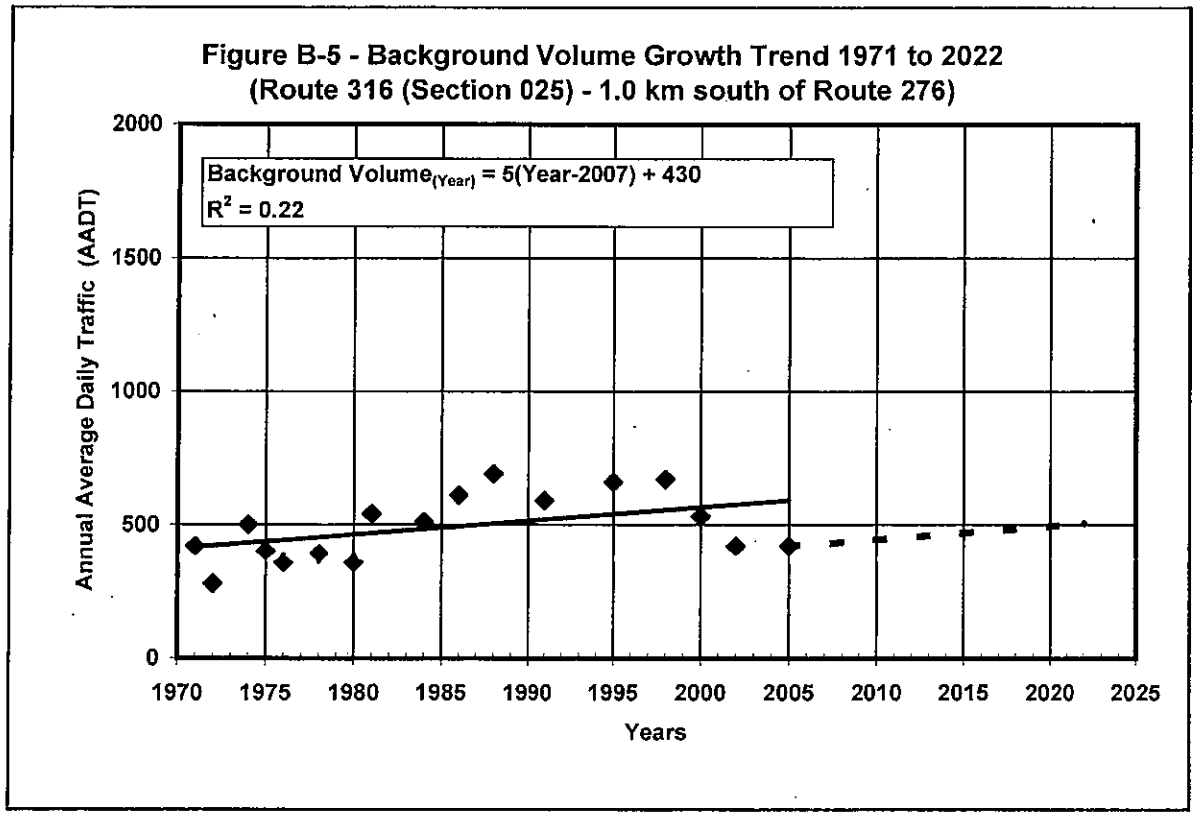


Table B-6 - Traffic Growth Trend on Route 316 (Section 035) - 1.5 km north of Isaacs Harbour Road

Year	AADT
1970	250
1972	220
1975	280
1976	300
1977	290
1980	290
1981	370
1983	380
1984	410
1988	400
1991	350
2002	460
2005	400

Source: AADTs were obtained from NSTIR for 1970 to 2005.
The 1999 AADT was not used in the regression analysis since it is suspected that Sable Gas traffic may have inflated the count.

Figure B-6 - Background Volume Growth Trend 1970 to 2022 (Route 316 (Section 035) - 1.5 km north of Isaacs Harbour Rd)

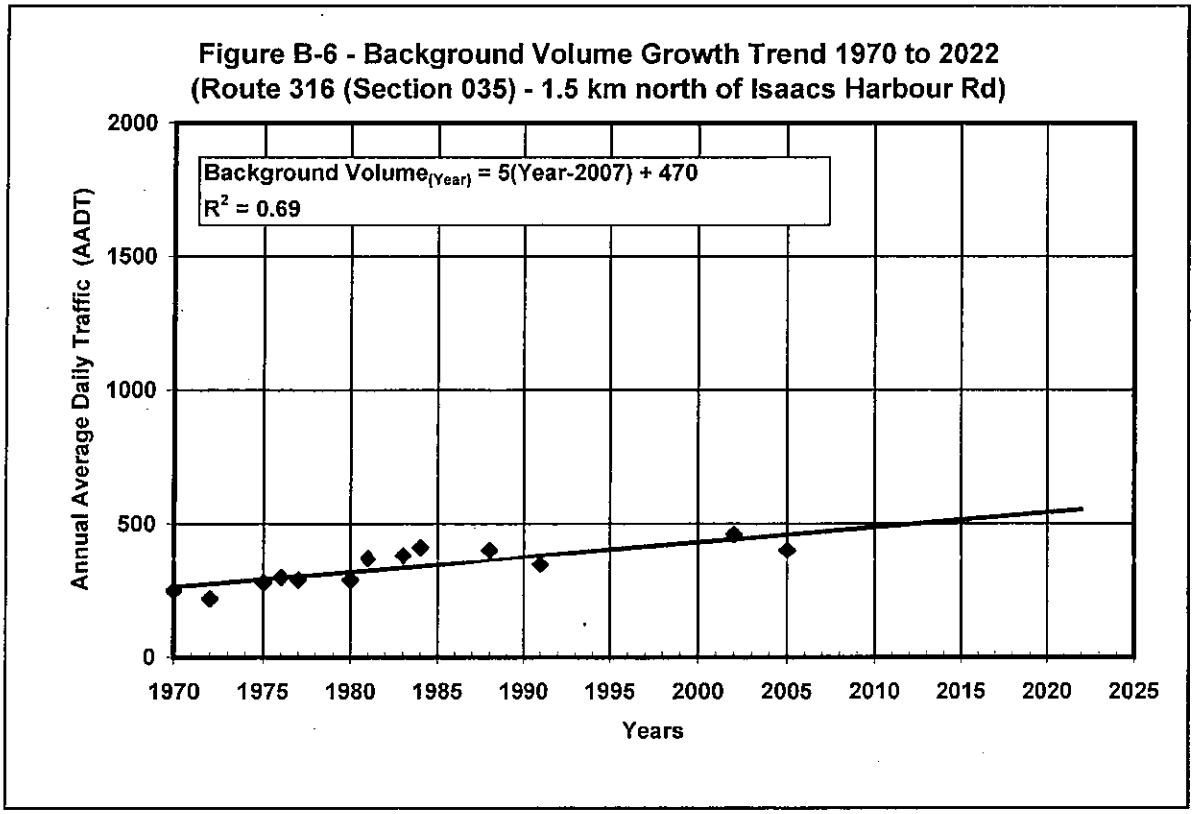


Table B-7 - Two-Way Volumes Trunk 7 Section 105 - June 9 to 16, 1999
(1 km south of Highway 104)

Hour	Days of the Week							Average
	Mon-14	Tue-15	Wed-16/09	Thu-10	Fri-11	Sat-12	Sun-13	Weekday
0								
1	22	15	17	18	19	50	52	18
2	11	7	16	9	6	48	30	10
3	9	6	7	6	2	17	19	6
4	6	15	11	12	5	12	6	10
5	22	16	18	24	16	7	5	19
6	63	56	66	50	65	52	15	60
7	192	191	205	179	193	84	26	192
8	309	331	304	305	299	144	64	310
9	315	322	350	302	310	203	99	320
10	230	243	207	237	233	270	160	230
11	265	254	237	240	216	337	187	242
12	278	249	252	228	252	324	233	252
13	266	278	255	226	251	281	268	255
14	264	276	254	274	278	312	292	269
15	267	252	225	259	282	296	243	257
16	311	305	307	293	324	287	203	308
17	379	376	371	367	357	309	251	370
18	409	389	400	437	422	297	216	411
19	286	326	260	328	305	270	255	301
20	270	274	265	263	305	270	286	275
21	276	190	196	257	286	245	202	241
22	173	185	167	191	235	220	131	190
23	102	97	119	137	119	146	91	115
24	46	52	35	39	115	88	47	57
TOTALS	4771	4705	4544	4681	4895	4560	3381	4719

Data Source: NSTIR road tube count. Estimated 1999 AADT is 3260 vpd.

Table B-8 - Two-Way Volumes Trunk 7 Section 105 - August 13 to 19, 2002
(1 km south of Highway 104)

Hour	Days of the Week							Average
	Mon-19	Tue-13	Wed-14	Thu-15	Fri-16	Sat-17	Sun-18	Weekday
0								
1	23	28	32	19	34	37	51	27
2	12	14	11	11	6	32	28	11
3	8	3	12	9	5	21	24	7
4	6	4	3	13	14	12	18	8
5	19	20	17	22	23	10	6	20
6	41	43	44	47	44	17	20	44
7	120	120	105	122	110	42	22	115
8	206	200	216	210	173	105	66	201
9	206	233	243	262	221	152	83	233
10	241	213	232	259	218	243	117	233
11	217	196	214	225	210	238	141	212
12	259	226	239	258	256	261	222	248
13	251	288	272	262	282	299	235	271
14	265	255	288	308	273	275	238	278
15	307	253	258	257	298	246	210	275
16	273	221	271	280	270	223	210	263
17	307	330	298	310	308	217	238	311
18	312	324	291	308	339	249	219	315
19	233	235	220	238	265	234	194	238
20	208	236	186	227	212	182	212	214
21	180	197	194	215	225	176	177	202
22	153	145	180	144	159	143	141	156
23	50	93	81	93	110	122	75	85
24	41	58	55	55	57	100	43	53
TOTALS	3938	3935	3962	4154	4112	3636	2990	4020

Data Source: NSTIR road tube coune. Estimated 2002 AADT is 2680 vpd.

Table B-9 - Two-Way Volumes Trunk 7 Section 105 - June 13 to 20, 2005
(1 km south of Highway 104)

Hour Ending	Days of the Week							Average
	Mon-20/13	Tue-14	Wed-15	Thu-16	Fri-17	Sat-18	Sun-19	Weekday
0								
1	18	24	28	20	30	56	62	24
2	16	12	4	9	9	32	49	10
3	8	10	14	16	12	31	26	12
4	13	17	16	14	11	18	24	14
5	22	20	22	18	21	13	14	21
6	65	62	62	73	66	31	26	66
7	137	132	162	159	112	52	38	140
8	304	318	310	311	267	136	59	302
9	390	399	380	378	426	251	99	395
10	290	293	266	287	283	377	182	284
11	273	278	251	279	284	349	204	273
12	301	295	269	313	326	383	237	301
13	331	338	331	354	386	366	285	348
14	319	303	318	336	352	359	313	326
15	355	291	306	323	354	368	285	326
16	337	366	355	366	383	327	285	361
17	412	437	411	431	416	349	287	421
18	421	441	444	456	461	316	259	445
19	284	354	342	347	332	287	233	332
20	265	276	327	322	297	249	247	297
21	251	240	250	284	263	256	255	258
22	157	188	221	244	220	211	147	206
23	98	120	137	108	162	130	101	125
24	27	61	52	57	88	92	46	57
TOTALS	5094	5275	5278	5505	5561	5039	3763	5343

Data Source: NSTIR vehicle classification count. Estimated 2005 AADT is 4510.

Figure B-7 - Trunk 7 - 1.0 km South of Highway 104
Average Weekday Hourly Volumes

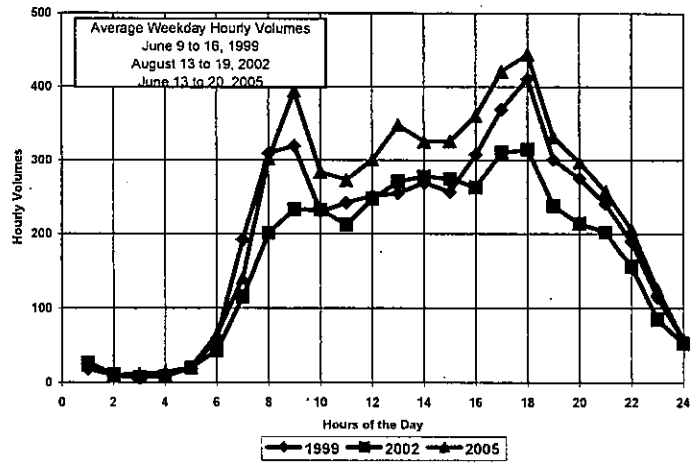


Table B-10 - Two-Way Volumes Trunk 7 Section 100 - June 16 to 23, 1999
(1 km south of Salt Springs)

Hour	Days of the Week							Average
	Mon-21	Tue-22	Wed-23/16	Thu-17	Fri-18	Sat-19	Sun-20	Weekday
0								
1	9	9	13	17	15	25	58	13
2	8	4	7	8	9	20	33	7
3	4	9	11	3	6	11	11	7
4	3	8	8	7	1	7	13	5
5	11	13	13	8	8	4	4	11
6	52	44	41	45	49	32	9	46
7	148	142	146	136	151	51	17	145
8	234	211	229	182	172	81	28	206
9	177	205	181	163	162	85	39	178
10	159	139	171	130	121	127	70	144
11	137	170	180	168	150	168	121	161
12	127	144	150	167	167	174	137	151
13	138	151	148	149	160	161	143	149
14	145	196	176	193	153	186	191	173
15	140	156	151	168	203	220	175	164
16	202	180	158	198	249	159	137	197
17	191	210	200	199	232	213	151	206
18	290	269	298	197	260	205	161	263
19	204	189	144	158	187	160	170	176
20	154	148	149	161	162	151	124	155
21	121	119	131	101	160	158	116	126
22	84	77	88	89	138	154	90	95
23	56	60	67	54	95	89	58	66
24	30	26	21	27	54	60	24	32
TOTALS	2824	2879	2881	2728	3064	2701	2080	2875

Data Source: NSTIR road tube count. Estimated 1999 AADT is 2490 vpd.

Table B-11 - Two-Way Volumes Trunk 7 Section 100 - August 13 to 19, 2002
(1 km south of Salt Springs)

Hour	Days of the Week							Average
	Mon-19	Tue-13	Wed-14	Thu-15	Fri-16	Sat-17	Sun-18	Weekday
0								
1	19	21	25	11	25	30	39	20
2	11	12	5	9	2	18	22	8
3	5	4	8	6	6	13	20	6
4	6	5	7	13	11	9	9	8
5	14	13	11	14	15	10	3	14
6	35	35	37	42	37	8	13	37
7	94	92	85	94	80	33	15	89
8	155	145	168	153	130	76	52	150
9	151	166	165	193	149	116	59	165
10	180	147	169	191	169	164	76	171
11	162	149	132	171	159	176	112	155
12	178	168	187	184	194	200	171	182
13	167	210	183	188	213	219	176	192
14	199	201	205	218	185	194	203	202
15	241	196	200	169	214	187	173	204
16	203	175	190	210	216	171	163	199
17	242	210	221	215	206	159	197	219
18	228	220	217	218	248	180	161	226
19	163	174	156	174	172	176	127	168
20	126	145	113	168	156	138	142	142
21	129	137	113	154	155	119	123	138
22	103	96	126	99	112	98	92	107
23	37	66	49	67	81	85	59	60
24	26	37	41	39	46	97	30	38
TOTALS	2874	2824	2813	3000	2982	2676	2237	2899

Data Source: NSTIR road tube count. Estimated 2002 AADT is 1940 vpd

Table B-12 - Two-Way Volumes Trunk 7 Section 100 - June 13 to 20, 2005
(1 km south of Salt Springs)

Hour Ending	Days of the Week							Average
	Mon-20/13	Tue-14	Wed-15	Thu-16	Fri-17	Sat-18	Sun-19	Weekday
0								
1	19	16	10	13	15	34	36	15
2	8	3	3	3	2	17	13	4
3	8	13	13	10	14	13	26	12
4	7	11	8	5	2	10	8	7
5	24	11	14	18	13	7	8	16
6	51	45	42	53	41	21	14	46
7	107	100	110	107	81	29	23	101
8	192	235	197	221	166	79	37	202
9	245	236	241	224	246	152	65	238
10	194	178	174	212	174	214	117	186
11	165	172	142	172	172	218	133	165
12	184	190	159	181	204	249	161	184
13	192	187	181	213	198	256	190	194
14	226	186	208	199	226	227	201	209
15	203	166	190	218	223	229	209	200
16	211	244	215	211	249	215	218	226
17	247	261	272	283	278	215	216	268
18	272	314	298	282	278	203	179	289
19	178	206	215	241	221	159	159	212
20	166	170	189	177	207	161	157	182
21	140	170	161	158	173	150	157	160
22	102	108	116	147	135	107	79	122
23	50	85	59	64	90	76	51	70
24	11	26	27	35	60	47	32	32
TOTALS	3202	3333	3244	3447	3468	3088	2489	3339

Data Source: NSTIR road tube count. Estimated 2005 AADT is 2830 vpd.

Figure B-8 - Trunk 7 - 1.0 km South of Salt Springs
Average Weekday Hourly Volumes

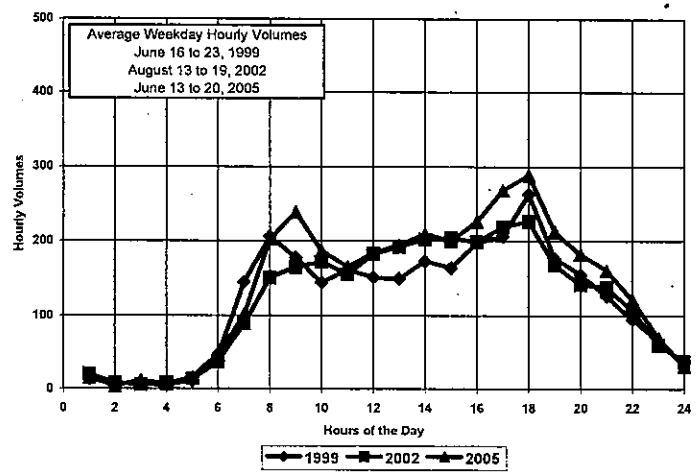


Table B-13 - Two-Way Volumes Trunk 7 Section 100 - May 26 to June 2, 1999
(Antigonish / Guysborough County Line)

Hour	Days of the Week							Average
	Mon-31	Tue-01	Wed-02/26	Thu-27	Fri-28	Sat-29	Sun-30	Weekday
0								
1	3	9	6	1	7	3	11	5
2	2	17	3	7	7	18	12	7
3	5	6	6	9	6	3	10	6
4	4	3	1	4	2	1	4	3
5	8	8	12	11	7	6	3	9
6	42	24	23	33	22	16	2	29
7	109	95	98	91	94	47	8	97
8	151	135	120	150	152	71	17	142
9	97	79	82	92	95	67	36	89
10	82	65	86	90	105	88	57	86
11	91	66	83	99	76	117	59	83
12	68	90	87	88	102	84	92	87
13	88	71	67	91	84	73	85	80
14	78	98	86	97	102	99	105	92
15	103	83	95	94	116	91	85	98
16	123	112	104	110	146	110	96	119
17	120	116	104	140	160	122	83	128
18	162	170	170	210	182	112	91	179
19	109	94	95	101	115	76	86	103
20	62	50	64	81	93	56	73	70
21	48	36	36	42	66	32	56	46
22	26	34	52	44	64	52	48	44
23	24	30	26	45	32	45	28	31
24	14	11	10	15	25	11	4	15
TOTALS	1619	1502	1516	1745	1860	1400	1151	1648

Data Source: NSTIR road tube count. Estimated 1999 AADT is 1440 vpd.

Table B-14 - Two-Way Volumes Trunk 7 Section 100 - July 22 to 28, 2002
(Antigonish / Guysborough County Line)

Hour	Days of the Week							Average
	Mon-29/22	Tue-23	Wed-24	Thu-25	Fri-26	Sat-27	Sun-28	Weekday
0								
1	3	5	7	6	10	12	12	6
2	3	5	4	4	7	4	4	5
3	4	8	7	6	8	2	10	7
4	8	4	5	9	9	1	4	7
5	12	15	10	11	8	4	2	11
6	27	19	15	30	19	6	3	22
7	41	78	73	67	57	11	4	63
8	87	74	80	85	85	26	25	82
9	105	128	109	119	90	63	42	110
10	127	107	115	105	100	73	60	111
11	147	134	134	141	124	107	79	136
12	119	125	137	106	130	111	94	123
13	150	131	145	124	121	121	95	134
14	145	156	132	110	160	111	119	141
15	128	151	179	129	146	106	117	147
16	144	142	144	122	106	125	100	132
17	148	146	138	155	130	105	116	143
18	125	125	131	143	141	77	119	133
19	82	105	80	118	113	105	82	100
20	66	61	62	73	73	61	74	67
21	49	63	63	54	70	39	60	60
22	24	46	29	36	43	42	23	36
23	25	24	31	25	39	85	18	29
24	11	11	15	25	17	35	14	16
TOTALS	1780	1863	1845	1803	1806	1432	1276	1819

Data Source: NSTIR road tube count. Estimated 2002 AADT is 1100 vpd.

Table B-15 - Two-Way Volumes Trunk 7 Section 100 - May 17 to 23, 2005
(Antigonish / Guysborough County Line)

Hour Ending	Days of the Week							Average
	Mon-23	Tue-17	Wed-18	Thu-19	Fri-20	Sat-21	Sun-22	Weekday
0								
1	4	0	1	2	2	5	12	1
2	3	2	2	5	5	7	3	3
3	2	1	5	2	5	2	2	3
4	3	4	0	5	0	1	3	3
5	2	12	10	3	5	0	0	8
6	6	10	18	24	11	5	4	15
7	26	32	40	45	31	20	5	36
8	24	70	69	71	64	27	12	69
9	35	80	91	79	101	61	24	86
10	43	75	57	64	83	66	29	71
11	64	45	72	67	71	77	37	60
12	75	57	53	70	80	84	51	63
13	73	74	59	70	72	77	55	70
14	83	85	80	66	97	80	63	83
15	77	77	60	100	99	71	66	83
16	84	95	95	76	109	82	60	94
17	66	92	75	91	134	88	65	97
18	55	99	91	102	111	68	63	100
19	43	59	63	72	95	51	47	70
20	30	37	43	42	85	52	42	49
21	18	36	37	32	60	42	33	40
22	19	24	32	36	44	17	18	32
23	10	14	8	16	35	15	11	17
24	12	7	12	10	18	16	7	11
TOTALS	857	1087	1073	1150	1417	1014	712	1163

Note: Monday was Victoria Day Holiday; Average weekday was calculated using 2 x Tuesday volumes
Source Data: NSTIR road tube count. Estimated 2005 AADT is 1020 vpd.

Figure B-9 - Trunk 7 - Antigonish / Guysborough County LineAverage Weekday Hourly Volumes

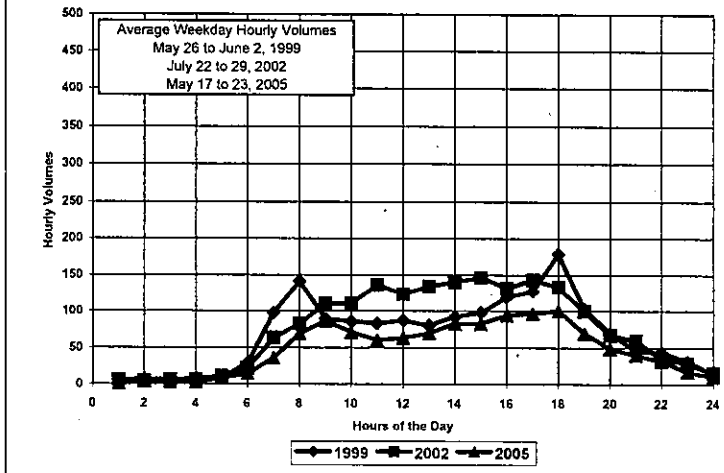


Table B-13 - Two-Way Volumes Trunk 7 Section 100 - May 26 to June 2, 1999
(Antigonish / Guysborough County Line)

Hour	Days of the Week							Average
	Mon-31	Tue-01	Wed-02/26	Thu-27	Fri-28	Sat-29	Sun-30	Weekday
0								
1	3	9	6	1	7	3	11	5
2	2	17	3	7	7	18	12	7
3	5	6	6	9	6	3	10	6
4	4	3	1	4	2	1	4	3
5	8	8	12	11	7	6	3	9
6	42	24	23	33	22	16	2	29
7	109	95	98	91	94	47	8	97
8	151	135	120	150	152	71	17	142
9	97	79	82	92	95	67	36	89
10	82	65	86	90	105	88	57	86
11	91	66	83	99	76	117	59	83
12	68	90	87	88	102	84	92	87
13	88	71	67	91	84	73	85	80
14	78	98	86	97	102	99	105	92
15	103	83	95	94	116	91	85	98
16	123	112	104	110	146	110	96	119
17	120	116	104	140	160	122	83	128
18	162	170	170	210	182	112	91	179
19	109	94	95	101	115	76	86	103
20	62	50	64	81	93	56	73	70
21	48	36	36	42	66	32	56	46
22	26	34	52	44	64	52	48	44
23	24	30	26	45	32	45	28	31
24	14	11	10	15	25	11	4	15
TOTALS	1619	1502	1516	1745	1860	1400	1151	1648

Data Source: NSTIR road tube count. Estimated 1999 AADT is 1440 vpd.

Table B-14 - Two-Way Volumes Trunk 7 Section 100 - July 22 to 28, 2002
(Antigonish / Guysborough County Line)

Hour	Days of the Week							Average
	Mon-29/22	Tue-23	Wed-24	Thu-25	Fri-26	Sat-27	Sun-28	Weekday
0								
1	3	5	7	6	10	12	12	6
2	3	5	4	4	7	4	4	5
3	4	8	7	6	8	2	10	7
4	8	4	5	9	9	1	4	7
5	12	15	10	11	8	4	2	11
6	27	19	15	30	19	6	3	22
7	41	78	73	67	57	11	4	63
8	87	74	80	85	85	26	25	82
9	105	128	109	119	90	63	42	110
10	127	107	115	105	100	73	60	111
11	147	134	134	141	124	107	79	136
12	119	125	137	106	130	111	94	123
13	150	131	145	124	121	121	95	134
14	145	156	132	110	160	111	119	141
15	128	151	179	129	146	106	117	147
16	144	142	144	122	106	125	100	132
17	148	146	138	155	130	105	116	143
18	125	125	131	143	141	77	119	133
19	82	105	80	118	113	105	82	100
20	66	61	62	73	73	61	74	67
21	49	63	63	54	70	39	60	60
22	24	46	29	36	43	42	23	36
23	25	24	31	25	39	85	18	29
24	11	11	15	25	17	35	14	16
TOTALS	1780	1863	1845	1803	1806	1432	1276	1819

Data Source: NSTIR road tube count. Estimated 2002 AADT is 1100 vpd.

Table B-15 - Two-Way Volumes Trunk 7 Section 100 - May 17 to 23, 2005
(Antigonish / Guysborough County Line)

Hour Ending	Days of the Week							Average
	Mon-23	Tue-17	Wed-18	Thu-19	Fri-20	Sat-21	Sun-22	Weekday
0								
1	4	0	1	2	2	5	12	1
2	3	2	2	5	5	7	3	3
3	2	1	5	2	5	2	2	3
4	3	4	0	5	0	1	3	3
5	2	12	10	3	5	0	0	8
6	6	10	18	24	11	5	4	15
7	26	32	40	45	31	20	5	36
8	24	70	69	71	64	27	12	69
9	35	80	91	79	101	61	24	86
10	43	75	57	64	83	66	29	71
11	64	45	72	67	71	77	37	60
12	75	57	53	70	80	84	51	63
13	73	74	59	70	72	77	55	70
14	83	85	80	66	97	80	63	83
15	77	77	60	100	99	71	66	83
16	84	95	95	76	109	82	60	94
17	66	92	75	91	134	88	65	97
18	55	99	91	102	111	68	63	100
19	43	59	63	72	95	51	47	70
20	30	37	43	42	85	52	42	49
21	18	36	37	32	60	42	33	40
22	19	24	32	36	44	17	18	32
23	10	14	8	16	35	15	11	17
24	12	7	12	10	18	16	7	11
TOTALS	857	1087	1073	1150	1417	1014	712	1163

Note: Monday was Victoria Day Holiday; Average weekday was calculated using 2 x Tuesday volumes
Source Data: NSTIR road tube count. Estimated 2005 AADT is 1020 vpd.

Figure B-9 - Trunk 7 - Antigonish / Guysborough County LineAverage Weekday Hourly Volumes

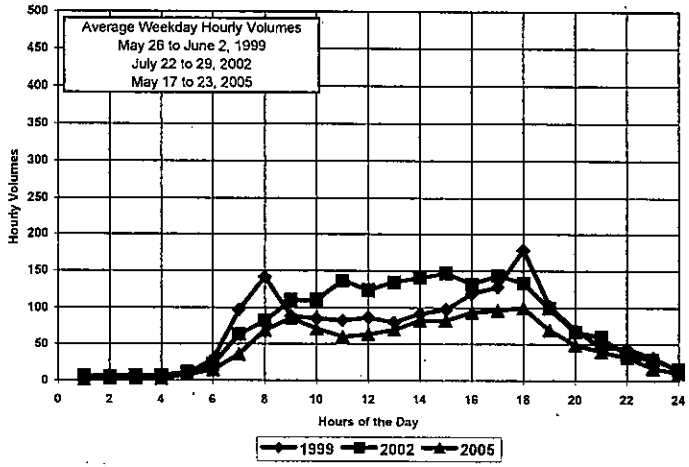


Table B-16 - Two-Way Volumes Route 276 - May 25 to June 1, 1999
(1 km west of Route 316)

Hour	Days of the Week							Average
	Mon-31	Tue-01	Wed-02/26	Thu-27	Fri-28	Sat-29	Sun-30	Weekday
0								
1	2	5	5	3	3	5	8	4
2	0	16	3	6	4	15	12	6
3	4	3	3	6	6	5	9	4
4	4	4	6	4	3	2	1	4
5	3	3	3	13	2	5	3	5
6	25	24	17	20	16	13	4	20
7	98	77	104	62	83	40	6	85
8	124	109	103	117	119	60	8	114
9	56	58	63	58	69	49	27	61
10	42	51	26	54	50	64	45	45
11	45	57	28	55	56	65	55	48
12	47	38	38	45	49	51	64	43
13	51	64	51	48	59	49	77	55
14	56	57	50	50	63	57	70	55
15	69	52	43	67	64	59	57	59
16	77	67	56	58	95	73	60	71
17	90	96	91	107	138	83	59	104
18	130	130	106	129	119	79	51	123
19	74	87	81	84	83	84	66	82
20	47	46	52	71	57	51	54	55
21	40	32	53	47	49	44	36	44
22	21	21	39	35	46	60	41	32
23	18	20	25	27	15	38	15	21
24	9	8	10	12	16	12	4	11
TOTALS	1132	1125	1056	1178	1264	1063	832	1151

Data Source: .NSTIR road tube count. Estimated 1999 AADT is 1080 vpd.

Table B-17 - Two-Way Volumes Route 276 - July 22 to 29, 2002
(Halfway between Trunk 7 and Route 316)

Hour	Days of the Week							Average
	Mon-29/22	Tue-23	Wed-24	Thu-25	Fri-26	Sat-27	Sun-28	Weekday
0								
1	3	5	2	3	2	8	6	3
2	3	1	2	1	6	3	6	3
3	1	3	5	2	5	1	7	3
4	2	2	5	4	2	1	2	3
5	6	9	6	5	6	1	1	6
6	14	14	6	13	9	3	0	11
7	44	21	30	26	49	9	8	34
8	40	51	38	49	68	34	18	49
9	49	37	35	41	57	32	23	44
10	49	49	49	52	62	39	40	52
11	54	44	53	59	77	52	62	57
12	55	46	42	53	69	54	42	53
13	58	63	44	61	74	51	59	60
14	38	58	46	61	87	48	63	58
15	44	53	67	67	53	65	64	57
16	53	59	67	59	58	70	45	59
17	75	68	65	104	69	51	67	76
18	59	46	54	80	72	53	74	62
19	55	53	39	76	68	61	61	58
20	42	29	40	40	55	34	60	41
21	41	36	40	33	40	36	56	38
22	18	36	28	35	43	19	17	32
23	17	17	21	14	34	33	7	21
24	8	6	8	10	13	13	7	9
TOTALS	828	806	792	948	1078	771	795	890

Data Source: NSTIR road tube count. Estimated 2002 AADT is 600 vpd

Table B-18 - Two-Way Volumes Route 276 - May 17 to 23, 2005
(Halfway between Trunk 7 and Route 316)

Hour Ending	Days of the Week							Average
	Mon-23	Tue-17	Wed-18	Thu-19	Fri-20	Sat-21	Sun-22	Weekday
0								
1	0	0	1	0	8	12	3	2
2	2	0	1	2	2	4	3	1
3	2	1	2	1	1	1	1	1
4	1	1	0	1	0	1	3	1
5	2	4	4	3	3	1	0	4
6	3	9	8	9	6	2	2	8
7	7	20	21	23	15	11	3	20
8	14	41	36	43	42	15	9	41
9	20	43	51	36	40	29	14	43
10	25	44	32	29	35	33	21	37
11	36	29	30	35	29	39	30	30
12	37	24	24	37	27	32	39	27
13	39	25	32	35	35	43	39	30
14	37	36	37	37	40	44	40	37
15	48	32	32	30	43	39	50	34
16	58	36	47	42	39	44	39	40
17	35	44	47	52	58	46	46	49
18	40	51	46	43	58	44	33	50
19	33	29	36	35	52	30	30	36
20	27	31	14	25	48	38	32	30
21	14	24	24	14	37	25	22	25
22	9	14	22	13	17	20	17	16
23	6	9	8	8	19	14	6	11
24	8	5	4	9	14	10	0	7
TOTALS	503	552	559	562	668	577	482	579

Note: Monday was Victoria Day Holiday; Average weekday was calculated using 2 x Tuesday volumes
Source Data: NSTIR vehicle classification count. Estimated 2005 AADT is 530 vpd.

Figure B-10 - Route 276 - Halfway between Trunk 7 and Route 316
Average Weekday Hourly Volumes

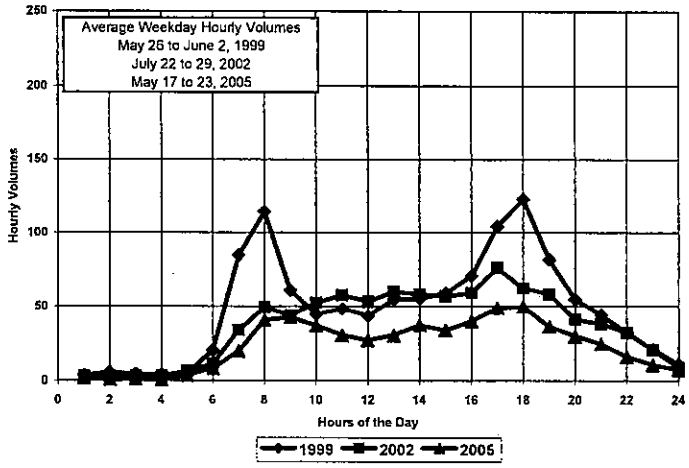


Table B-19 - Two-Way Volumes Route 316 - Section 025 - May 19 to 26, 1999
(1 km south of Route 276)

Hour	Days of the Week							Average
	Mon-24	Tue-25	Wed-24/19	Thu-29	Fri-21	Sat-22	Sun-23	Weekday
0								
1	4	2	3	3	2	9	6	2
2	0	1	8	5	8	15	15	5
3	2	2	3	0	3	2	6	2
4	2	1	1	1	1	0	0	1
5	2	2	4	4	4	3	1	3
6	8	12	15	10	13	4	0	12
7	12	54	41	39	40	8	2	46
8	22	95	87	86	89	24	13	90
9	21	51	51	57	53	28	31	53
10	31	27	33	36	39	31	36	32
11	45	42	19	33	42	47	33	36
12	43	31	16	28	37	51	42	29
13	44	43	25	50	51	58	58	42
14	41	45	26	34	70	53	70	44
15	73	37	61	33	55	35	46	45
16	45	53	62	49	101	55	58	64
17	48	85	76	75	113	61	53	87
18	45	66	85	112	75	46	45	81
19	38	61	76	61	55	50	64	63
20	38	33	64	40	53	42	48	45
21	33	27	60	30	76	31	63	44
22	24	16	35	15	54	20	29	27
23	14	5	17	14	18	33	13	12
24	6	6	9	8	17	8	14	9
TOTALS	641	797	877	823	1069	714	746	873

Note: Monday was Victoria Day Holiday; Average weekday was calculated using 2 x Tuesday volumes
Source Data: NSTIR road tube count. Estimated 1999 AADT is 790 vpd.

Table B-20 - Two-Way Volumes Route 316 - Section 025 - July 22 to 29, 2002
(1 km south of Route 276)

Hour	Days of the Week							Average
	Mon-29/22	Tue-23	Wed-24	Thu-25	Fri-26	Sat-27	Sun-28	Weekday
0								
1	3	2	6	2	2	2	6	3
2	2	0	1	3	1	0	8	1
3	0	4	5	3	1	4	0	3
4	2	1	4	4	1	1	1	2
5	4	3	3	3	3	1	0	3
6	12	7	5	4	10	3	1	8
7	18	11	19	20	35	7	1	21
8	42	29	22	32	48	19	9	35
9	44	24	25	27	58	29	13	36
10	23	25	30	29	47	24	18	31
11	44	28	27	53	50	35	35	40
12	47	33	29	40	52	40	36	40
13	50	46	35	53	66	42	50	50
14	52	37	34	41	52	30	43	43
15	42	32	34	63	47	45	40	44
16	58	39	36	48	50	63	42	46
17	47	49	36	64	49	32	45	49
18	30	33	32	63	49	43	35	41
19	25	42	27	37	46	43	37	35
20	32	23	32	26	34	33	36	29
21	18	35	24	27	36	20	29	28
22	17	20	16	20	29	11	15	20
23	12	9	12	11	22	24	7	13
24	5	6	3	7	11	9	6	6
TOTALS	629	538	497	680	799	560	513	629

Data Source: NSTIR road tube count Estimated 2002 AADT is 420 vpd.

Table B-21 - Two-Way Volumes Route 316 - Section 025 - May 17 to 23, 2005
(1 km south of Route 276)

Hour Ending	Days of the Week							Average
	Mon-23	Tue-17	Wed-18	Thu-19	Fri-20	Sat-21	Sun-22	Weekday
0								
1	2	1	2	4	0	4	6	2
2	1	0	1	1	2	4	1	1
3	3	0	2	0	1	2	3	1
4	0	1	0	0	0	0	1	0
5	3	1	1	2	1	1	0	1
6	5	8	7	6	5	0	3	7
7	9	8	9	11	6	7	1	8
8	10	28	25	34	27	14	5	28
9	15	25	35	25	37	27	14	29
10	25	23	18	24	33	27	14	24
11	31	27	19	26	28	30	22	25
12	27	11	23	30	26	30	36	20
13	29	31	19	26	27	45	33	27
14	32	29	25	24	35	32	43	28
15	40	29	17	22	34	34	31	26
16	41	27	32	31	29	35	35	29
17	27	40	33	40	39	47	45	38
18	20	37	33	38	38	26	22	37
19	33	27	27	33	46	24	25	32
20	16	27	24	17	47	33	36	28
21	7	19	17	17	38	19	16	22
22	13	13	15	10	14	22	14	13
23	3	6	1	4	14	10	5	6
24	5	4	3	6	14	6	0	6
TOTALS	397	422	388	431	541	479	411	441

Note: Monday was Victoria Day Holiday; Average weekday was calculated using 2 x Tuesday volumes
Source Data: NSTIR vehicle classification count. Estimated 2005 AADT is 420 vpd.

Figure B-11 - Route 316 - 025 - 1 km South of Route 276
Average Weekday Hourly Volumes

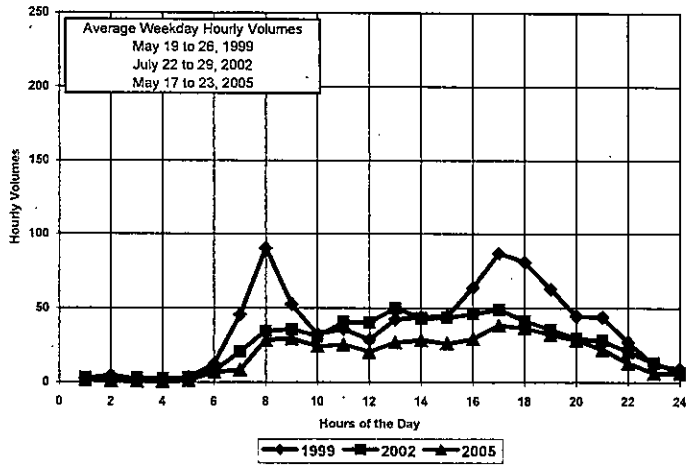


Table B-22 - Two-Way Volumes Route 316 - Section 035 - May 12 to 19, 1999
(Stormont Area)

Hour	Days of the Week							Average
	Mon-17	Tue-18	Wed-19/12	Thu-13	Fri-14	Sat-15	Sun-16	Weekday
0								
1	6	2	4	13	12	14	8	7
2	2	17	15	11	14	20	7	12
3	0	0	0	2	2	1	4	1
4	0	2	4	2	4	0	5	2
5	3	2	3	1	2	1	0	2
6	8	11	9	11	9	6	1	10
7	72	64	64	60	58	19	2	64
8	197	193	192	192	216	74	12	198
9	100	76	83	85	55	48	13	80
10	55	57	55	44	52	58	12	53
11	58	31	48	54	59	75	27	50
12	51	48	58	49	50	64	40	51
13	54	48	56	59	64	54	67	56
14	44	38	56	64	48	60	59	50
15	54	59	48	63	76	49	54	60
16	79	79	76	81	98	73	72	83
17	183	198	171	210	227	71	49	198
18	100	103	108	108	80	42	52	100
19	70	81	68	70	67	50	49	71
20	30	38	60	59	36	43	44	45
21	45	35	27	35	39	53	42	36
22	28	31	19	22	17	12	27	23
23	13	10	23	14	12	12	12	14
24	5	13	4	11	13	5	3	9
TOTALS	1257	1236	1251	1320	1310	904	661	1275

Source Data: NSTIR vehicle classification count. Estimated 1999 AADT is 1120 vpd.

Table B-23 - Two-Way Volumes Route 316 - Section 035 - July 15 to 22, 2002
(1.5 km North of Isaacs Harbour Road)

Hour	Days of the Week							Average
	Mon-29/22	Tue-23	Wed-24	Thu-25	Fri-26	Sat-27	Sun-28	Weekday
0								
1	2	3	3	1	3	5	2	2
2	0	1	1	0	0	0	9	0
3	3	0	2	1	10	1	3	3
4	3	2	3	2	1	0	0	2
5	7	1	6	4	3	1	3	4
6	20	12	19	11	14	0	2	15
7	31	24	28	29	22	13	15	27
8	26	42	40	27	34	6	2	34
9	34	24	31	35	26	4	22	30
10	22	38	40	32	49	22	26	36
11	28	44	27	31	38	24	36	34
12	39	42	29	46	48	36	46	41
13	43	40	42	44	43	45	31	42
14	45	51	45	43	60	42	44	49
15	59	69	52	50	47	44	50	55
16	50	48	51	45	57	48	42	50
17	57	50	62	45	55	34	57	54
18	37	41	60	31	42	34	51	42
19	46	53	48	35	49	38	64	46
20	30	30	27	28	44	21	46	32
21	20	22	43	29	39	34	56	31
22	24	20	15	31	24	11	35	23
23	3	4	7	9	14	15	13	7
24	6	4	5	3	8	9	2	5
TOTALS	635	665	686	612	730	487	657	666

Data Source: NSTIR road tube count. Estimated 2002 AADT is 460 vpd.

Table B-24 - Two-Way Volumes Route 316 - Section 035 - May 17 to 23, 2005
(1.5 km North of Isaacs Harbour Road)

Hour Ending	Days of the Week							Average
	Mon-23	Tue-17	Wed-18	Thu-19	Fri-20	Sat-21	Sun-22	Weekday
0								
1	3	0	1	0	1	5	3	0
2	2	0	0	0	0	1	3	0
3	0	1	0	0	1	2	1	1
4	0	2	0	3	1	0	1	2
5	2	1	2	1	3	1	0	2
6	3	8	3	10	6	3	1	7
7	15	15	26	27	25	22	4	22
8	10	27	41	21	26	7	0	28
9	4	26	23	13	18	27	3	21
10	25	23	16	29	41	16	12	26
11	31	20	23	19	20	21	18	20
12	32	28	17	23	28	31	14	25
13	32	33	35	32	26	25	22	32
14	27	35	27	35	14	43	27	29
15	41	36	35	30	34	32	24	34
16	20	54	28	31	50	44	32	43
17	17	38	36	32	32	46	27	35
18	24	23	28	30	42	19	26	29
19	25	23	23	31	25	16	21	25
20	16	18	28	21	33	16	31	24
21	11	23	16	32	28	13	18	24
22	2	16	16	16	22	13	5	17
23	6	8	6	17	8	4	6	9
24	1	14	16	7	21	6	3	14
TOTALS	336	472	446	460	505	413	302	471

Note: Monday was Victoria Day Holiday; Average weekday was calculated using 2 x Tuesday volumes
Source Data: NSTIR road tube count. Estimated 2005 AADT is 400 vpd.

Figure B-12 - Route 316 - 035 - (1.5 km North of Isaacs Harbour Road)
Average Weekday Hourly Volumes

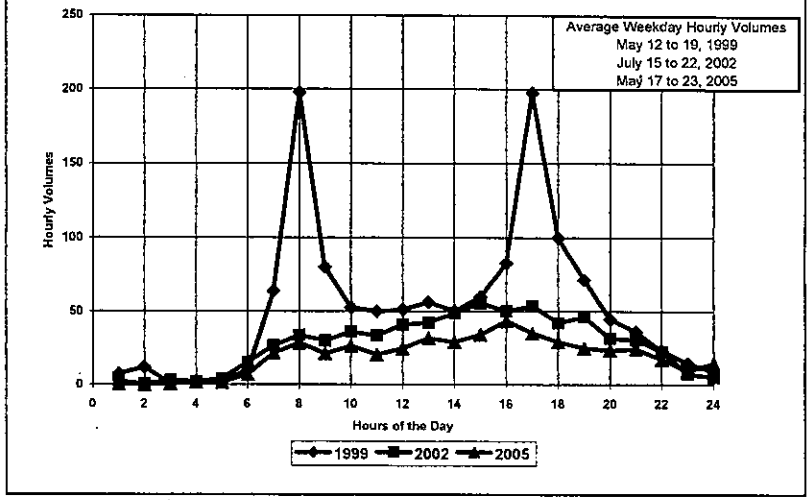


Table B-25 - Two-Way Volumes Route 316 - Section 037 - May 12 to 19, 1999
(Isaacs Harbour - Goldboro Area)

Hour	Days of the Week							Average
	Mon-17	Tue-18	Wed-19/12	Thu-13	Fri-14	Sat-15	Sun-16	Weekday
0								
1	3	23	21	26	29	33	3	21
2	2	7	2	5	6	3	1	4
3	0	0	0	3	0	0	3	1
4	2	1	2	6	5	2	6	3
5	5	5	4	4	4	3	2	4
6	3	8	9	8	9	6	4	7
7	66	60	66	65	67	17	4	65
8	221	219	207	209	231	28	15	217
9	105	104	100	130	119	70	15	112
10	74	53	42	94	85	52	7	70
11	63	43	47	95	80	73	32	66
12	88	73	94	110	106	68	30	94
13	112	65	103	117	116	61	65	103
14	83	61	88	101	98	42	58	86
15	90	79	87	112	119	62	76	97
16	108	88	97	142	140	70	63	115
17	228	232	260	275	227	67	45	244
18	96	97	103	98	73	34	51	93
19	74	81	55	53	62	22	52	65
20	48	42	37	40	38	31	41	41
21	29	23	29	35	26	19	29	28
22	14	25	11	15	15	12	17	16
23	7	7	11	11	7	7	10	9
24	6	6	8	7	11	4	2	8
TOTALS	1527	1402	1483	1763	1673	786	631	1570

Source Data: NSTIR vehicle classification count. Estimated 1999 AADT is 1300 vpd.

Table B-26 - Two-Way Volumes Route 316 - Section 037 - October 2 to 3, 2000
(Isaacs Harbour / Goldboro Line)

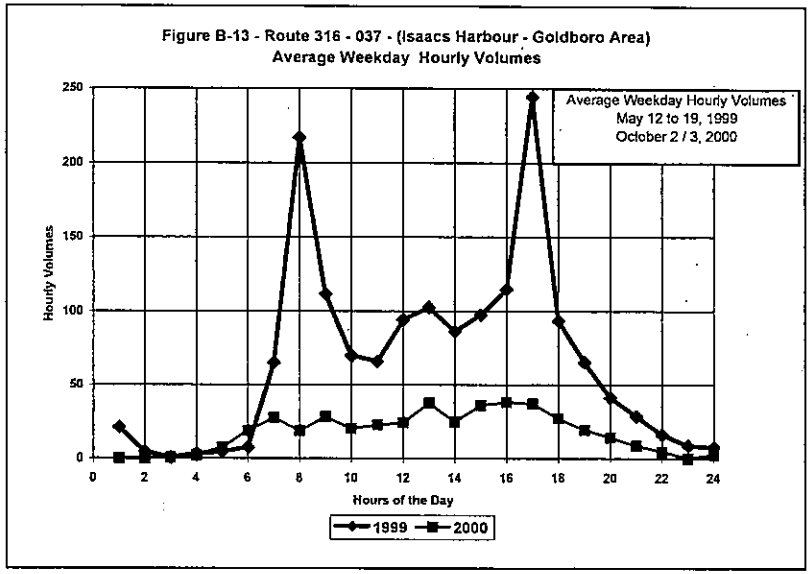
Hour	Days of the Week							Average
	Mon-02	Tue-03	Wed-24	Thu-25	Fri-26	Sat-27	Sun-28	Weekday
0								
1	0	0						0
2	0	0						0
3	0	1						1
4	3	1						2
5	7	8						8
6	15	22						19
7	24	31						28
8	15	22						19
9	27	29						28
10	22	18						20
11	18	27						23
12	29	19						24
13	43	32						38
14	25	24						25
15	34	38						36
16	39	37						38
17	36	38						37
18	22	32						27
19	19	19						19
20	14	14						14
21	10	7						9
22	3	6						5
23	0	0						0
24	4	1						3
TOTALS	409	426	0	0	0	0	0	418

Source Data: NSTIR vehicle classification count. Estimated 2000 AADT is 380 vpd

Table B-27 - Two-Way Volumes

Hour Ending	Days of the Week							Average
	Mon-23	Tue-17	Wed-18	Thu-19	Fri-20	Sat-21	Sun-22	Weekday
0								
1								0
2								0
3								0
4								0
5								0
6								0
7								0
8								0
9								0
10								0
11								0
12								0
13								0
14								0
15								0
16								0
17								0
18								0
19								0
20								0
21								0
22								0
23								0
24								0
TOTALS	0	0	0	0	0	0	0	0

Figure B-13 - Route 316 - 037 - (Isaacs Harbour - Goldboro Area)
Average Weekday Hourly Volumes



Appendix C

Roadside Development Details

Table C-1 - Trunk 7 from Highway 104 at Antiginish

KM	North to South	Driveways		
		Left	Right	Both Sides
1	0-1	5	9	14
2	1-2	6	11	17
3	2-3	10	5	15
4	3-4	7	3	10
5	4-5	7	8	15
6	5-6	5	7	12
7	6-7	6	4	10
8	7-8	3	4	7
9	8-9	1	3	4
10	9-10	1	7	8
11	10-11	5	9	14
12	11-12	4	3	7
13	12-13	3	3	6
14	13-14	3	2	5
15	14-15	5	8	13
16	15-16	0	0	0
17	16-17	0	3	3
18	17-18	0	2	2
19	18-19	4	2	6
20	19-20	7	2	9
21	20-21	4	4	8
22	21-22	7	4	11
23	22-23	3	3	6
24	23-24	7	1	8
25	24-25	7	2	9
26	25-26	10	4	14
27	26-27	8	0	8
28	27-28	5	1	6
29	28-29	5	1	6
30	29-29.6	0	1	1
Average Driveways per km:		8.6		

Table C-2 - Route 276 from Trunk 7

KM	West to East	Driveways		
		Left	Right	Both Sides
1	0-1	2	1	3
2	1-2	1	1	2
3	2-3	0	0	0
4	3-4	0	5	5
5	4-5	5	2	7
6	5-5.3	3	2	5
Average Driveways per km:		4.2		

Table C-3 - Route 316 from Route 276

KM	North to South	Driveways		
		Left	Right	Both Sides
1	0-1	9	2	11
2	1-2	9	2	11
3	2-3	3	1	4
4	3-4	1	2	3
5	4-5	4	5	9
6	5-6	6	3	9
7	6-7	3	0	3
8	7-8	1	0	1
9	8-9	0	0	0
10	9-10	1	5	6
11	10-11	3	2	5
12	11-12	6	3	9
13	12-13	1	3	4
14	13-14	9	6	15
15	14-15	9	9	18
16	15-16	3	6	9
17	16-17	10	7	17
18	17-18	7	1	8
19	18-19	11	1	12
20	19-20	10	0	10
21	20-21	11	7	18
22	21-22	7	8	15
23	22-23	7	9	16
24	23-24	4	2	6
25	24-25	0	0	0
26	25-26	3	2	5
27	26-27	7	5	12
28	27-28	11	9	20
29	28-29	5	3	8
30	29-30	8	7	15
31	30-31	1	3	4
32	31-32	0	0	0
33	32-33	0	1	1
34	33-34	1	1	2
35	34-35	3	0	3
36	35-36	5	4	9
37	36-37	11	10	21
38	37-38	4	2	6
39	38-39	10	0	10
40	39-40	9	1	10
41	40-41	6	3	9
42	41-42	7	0	7
Average Driveways per km:		8.6		