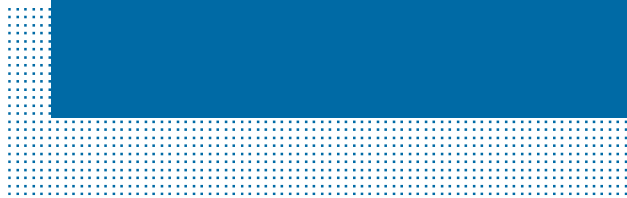
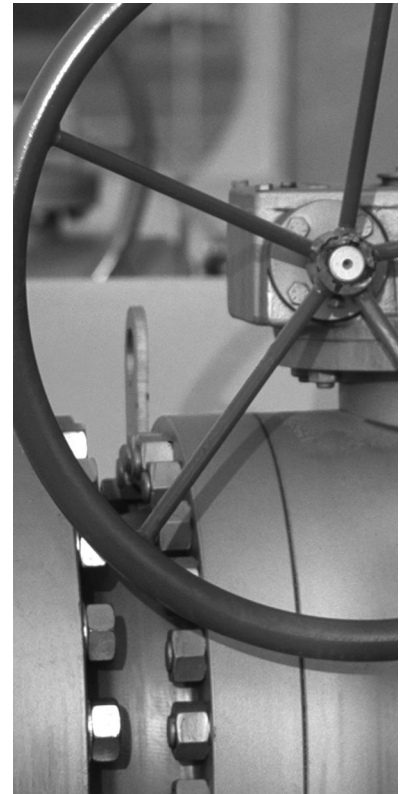


H NOISE ASSESSMENT STUDY



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 **Bear Head**
LNG
A subsidiary company of Liquefied Natural Gas Limited

BEAR HEAD LNG

NOISE ASSESSMENT STUDY

Bear Head LNG Corporation



01 | 04 | 2015

FINAL REPORT

622560-0001-T-4E-REP-000-0001

EXECUTIVE SUMMARY

SNC-Lavalin Inc. was selected by Bear Head LNG Corporation to carry out environmental studies for the Bear Head LNG project in Richmond County, Nova Scotia.

The site is located on the shoreline of the Strait of Canso at the end of Bear Island Road, which was constructed to access the subject site. The subject site underwent approved development in 2005 for the construction of an LNG import facility. Site work was suspended in 2007. Bear Head LNG has recognized the potential of the site for continued development, and proposes to construct an LNG export facility with an annual production capacity of eight (8) million tonnes per annum (mtpa). Development of the site is being resumed following acquisition of the site and assets of Bear Head LNG by Bear Head LNG Corporation on August 27th, 2014.

The noise assessment of the Bear Head LNG project included a site visit to measure the existing baseline noise and modelling of the 8 mtpa LNG project noise to predict off-site noise impacts.

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Appendix A: Ambient Noise Monitoring, October 2014

1 BACKGROUND

Bear Head LNG Corporation (Bear Head LNG) intends to resume development of a Liquefied Natural Gas (LNG) facility at the Bear Head LNG site in Point Tupper, Nova Scotia (the subject site), to export LNG. Development of the site is being resumed following acquisition of the site and assets of Bear Head LNG by Bear Head LNG Corporation on August 27th, 2014, from Anadarko Petroleum Corporation.

Bear Head LNG proposes to construct an LNG export facility that will include four (4) LNG liquefaction trains with a total annual production capacity of eight (8) million tonnes per annum (mtpa). The facility will include four LNG liquefaction trains, two LNG storage tanks, a marine terminal and associated infrastructure.

2 BASIS OF DESIGN

The Basis of Design (BoD) provides data to be used for the design of the Bear Head LNG Plant. It includes a detailed description of the process and facilities, selection of equipment and preferred suppliers, construction philosophy and operations and maintenance methodology.

The following noise assessment is based on the BoD (Bear Head LNG, Rev C, December 2014).

3 NOISE REGULATORY ENVIRONMENT

The site is located on the shoreline of the Strait of Canso at the end of Bear Island Road in the County of Richmond. The area across the Strait of Canso is in the County of Guysborough.

The provincial and municipal governments provide noise assessment criteria which are applicable to the project. In addition to the regulatory framework, Health Canada provides information on the assessment of noise. This information is summarized in Table 1.

Nova Scotia Environment (NSE) has established the following noise criteria to approve the construction of a project, as presented in the Guideline for Environmental Noise Measurement and Assessment” (NSE 1989). The sound levels shall not exceed the following equivalent levels (Leq). The monitoring locations may include point(s) beyond the property boundary.

- ◆ 07:00 to 19:00 65 dBA
- ◆ 19:00 to 23:00 60 dBA
- ◆ 23:00 to 07:00 55 dBA

Richmond County By-Law # 8, Mischiefs and Nuisances, prohibits disturbing noise in the vicinity of any public place or way. With the exception between 12:00 and 24:00 on any week day, no loud speaker, amplifier or other sound transmitting apparatus shall be operated in the

Municipality such that the sound is projected beyond a distance of 300 feet.

Guysborough County Noise Control By-Law prohibits acts that disturb the peace and tranquillity, the operation of a sound system at such a level that the sound is heard in other dwellings, and the making of noise that exceeds the following continuous noise levels, when measured on any property on which the noise is heard:

- ◆ 06:00 to 23:00 65 dBA
- ◆ 23:00 to 06:00 55 dBA

Construction noise is permitted between 07:00 and 21:00. If NSE noise criteria are met, the Noise Control By-Laws from Guysborough County will also be met.

Health Canada's approach to noise assessment is to consider a variety of recognized standards from the U.S. Environmental Protection Agency and the International Organization for Standardization. They have published Useful Information for Environmental Assessments (HC 2010) in which the following noise effects on health are considered: hearing loss, sleep disturbance, interference with speech, complaints, and change in percent highly annoyed of the community.

The assessment of noise exposure on human receptors located near the project site should consider:

- ◆ The distance from the receptor to the project site and the expectation of "peace and quiet" in quiet areas.
- ◆ The characterization of ambient baseline sound levels for both daytime (07:00 to 22:00) and night time (22:00 to 07:00).
- ◆ The identification of potential noise sources during construction, operation and decommissioning, as well as the identification of tonal, low frequency and impulsive types of noise.
- ◆ The prediction of the project sound levels.
- ◆ A comparison of the baseline and projected sound levels.
- ◆ The expected duration of the noise.
- ◆ An evaluation of the severity of predicted change in sound levels.

Daytime and night time sound levels are energy averaged with a bias of +10 dB applied to the night time period to calculate the day-night (24 hours) sound level (L_{dn}). The day-night sound level reflects the greater sensitivity of the community during the night. The annoyance is

calculated from the Schultz curve [ISO1996-2 2003] to give the percent highly annoyed (%HA) in the community. The %HA should be calculated for the ambient baseline and for the projected conditions (ambient + project). When the Ldn sound levels are in the range of 45-75 dBA, the effect should be evaluated on the change in the %HA. Mitigation should be proposed if the predicted change in %HA is greater than 6.5 %, or when the project Ldn is in excess of 75 dBA.

A summary of the Health Canada approach to noise assessment is presented in Table 1.

Table 1: Health Canada Approach to Noise Assessment

Duration	Criterion	Limit
Temporary (<2 months) Construction noise lasts less than two months at receptors	Community consultation is advised	--
Short-term (2 - 12 months) Construction noise lasts less than twelve months at receptors	Mitigation should be proposed if the sound levels are predicted to result in widespread complaints based on U.S. EPA [U.S. EPA 1974, Michaud et al. 2008]	--
Long-term (> 1 year) Construction noise lasts more than one year, and operational noise sound levels are in the range of Ldn: 45 – 75 dBA.	% HA	Predicted change in %HA is greater than 6.5 %
Long-term (> 1 year) Construction noise lasts more than one year, and operational noise project-related sound level is in excess of Ldn: 75 dBA.	Ldn	75 dBA

4 BASELINE NOISE

The site is located on the shoreline of the Strait of Canso at the end of Bear Island Road, in a remote area of the Point Tupper Industrial Park. It was partially developed as a Liquefied Natural Gas (LNG) import facility. The site is graded and developed with drainage ditches, culverts, sedimentation ponds, and fences/gates limiting access to the site. In 2007, construction was halted. Areas surrounding the site contain native and relatively undisturbed habitat including dense woods and wetlands. The properties directly adjacent to the site are occupied by a wind farm (Renewable Energy Services Limited) west and northwest of the site, an ash disposal site and a dam (Nova Scotia Power Inc) west of the site. The nearest residential receptors are located across the Strait of Canso, along the Marine Drive (Road 344). The width of the Strait is 1.85 km in front of the proposed LNG site.

Zoning in the project area is determined by the planning department of Richmond County. The subject site is zoned for Port Industrial (I-2) use, which includes bulk terminals, marine terminals, and fuel bunkering facilities.

Ambient noise monitoring was conducted in October 2014 at the proposed site and across the Strait at residential receptors (Figure 1.0). The ambient noise was monitored over a period of 24 hours (October 01-02, 2014) at one location on the Bear Head LNG site and at three residential receptors across the Strait. It was also monitored between 18:00 and 19:00, over periods of two minutes (October 01, 2014) at four locations at the site boundary. Given the limited noise sources in the area, the samples are considered representative of the ambient noise levels before the construction of the LNG facility. The winds were generally from the north with velocities under 20 km/h except for October 02 where velocities up to 26 km/h were observed.

The results of the ambient noise monitoring are presented in Appendix A and they are summarized in Tables 2 and 3. The monitored sound levels hereafter were rounded to the nearest integer and sound levels were excluded when the wind was in excess of 20 km/h.

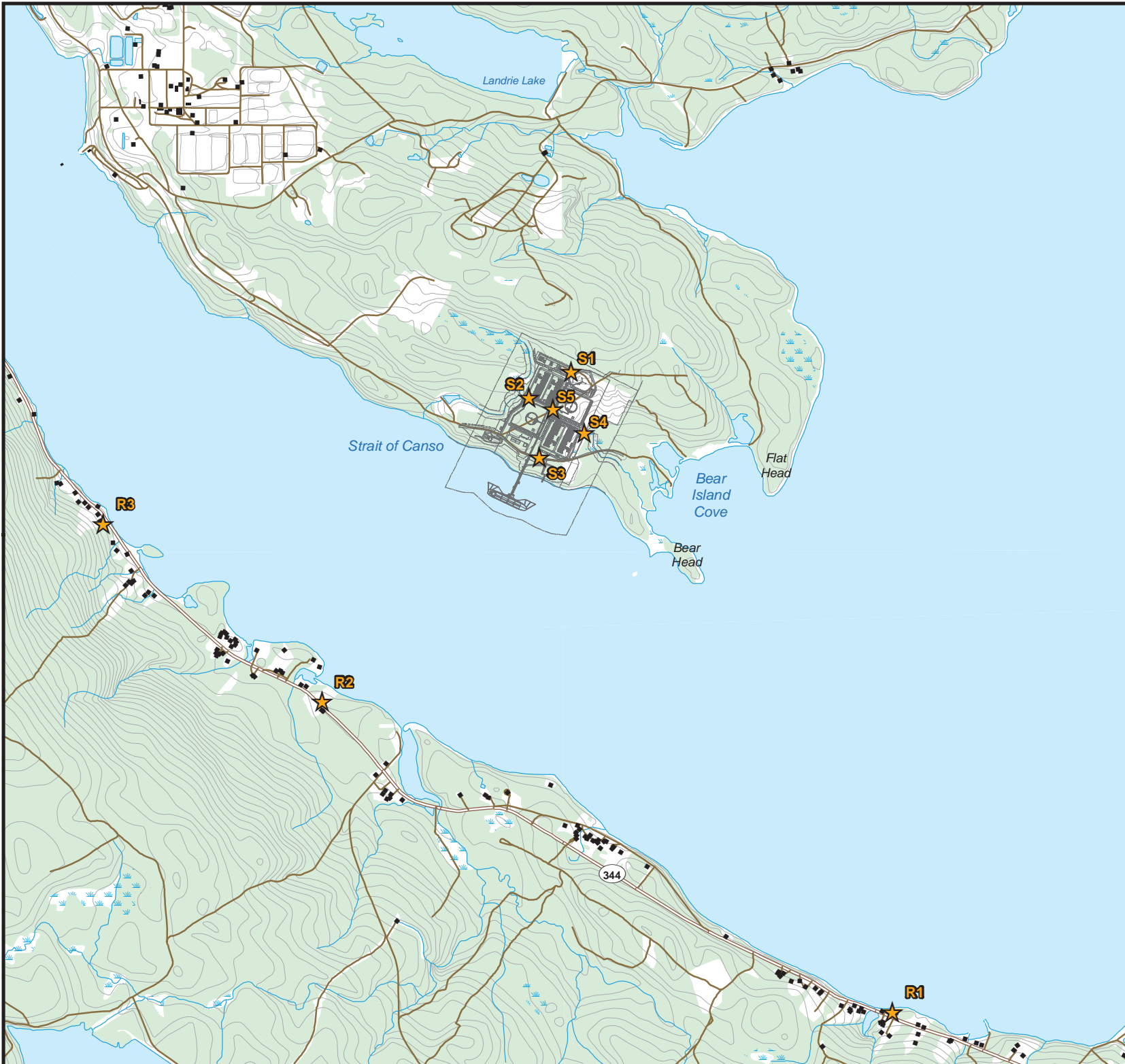
At the project site (locations S1 to S5), the noise from the wind farm was audible with the song of the birds and insects. At the south location (S3) the noise from the water waves breaking on the shoreline was also audible.

Across the Strait, at the residential receptors (R1 to R3), the audible noise originated from water waves breaking on the shoreline, occasional traffic passing by, songs of birds and insects, wind in the trees, and an occasional banging-on-metal noise from across the Strait.

The measured ambient sound levels prior to the construction of the LNG facility are lower than the NSE noise criteria.

Figure 1
Baseline Noise
Monitoring Stations

★ Noise Monitoring Locations



0 175 350 525 700 875
 Meters

Map Parameters
 Reference System: (ATS77)
 Projection: Modified Transverse Mercator (MTM)
 Zone: 4
 Scale: 1:15,000
 Project Number: 622560
 Date: February 16 2015

Source :
 - Service Nova Scotia and Municipal Relations,
 Access Nova Scotia, Nova Scotia Geomatics Centre.
 - Topographic map, 2011, 1:10 000
 - Plant Layout: LNG, BH-SK-00-016-base2D.dwg
 (Update: December 12, 2014)



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Table 2: Ambient Sound Levels at the Project Site, 01 October 2014

Monitoring Location	Coordinates (ATS77 MTM4)		Measured L_{Aeq} (dBA)	NSE Criteria 07:00 to 19:00 L_{Aeq} (dBA)
	Latitude	Longitude		
S1	4515671	5046815	35	65
S2	4515383	5046637	35	65
S3	4515453	5046228	44	65
S4	4515760	5046396	32	65

Table 3: Ambient Sound Levels at Residential Receptors across the Strait, 01-02 Oct. 2014

Monitoring Location	Coordinates (ATS77 MTM4)		Approximate distance from LNG Boundary, Loading Platform (km)	07:00 to 19:00	19:00 to 23:00	23:00 to 07:00	L_{dn} (dBA)
	Latitude	Longitude		L_{Aeq} (dBA)	L_{Aeq} (dBA)	L_{Aeq} (dBA)	
R1	4517855	5042450	4.4	50	47	43	55
R2	4513977	5044565	1.8	50	43	42	55
R3	4512490	5045776	2.8	50	41	40	54
S5	4515546	5046557	NA	46	39	37	45
NSE Criteria				65	60	55	NA

5 EFFECT ON NOISE ENVIRONMENT

5.1 Determination of Significance

The project can change the noise environment (i.e., changes in noise levels). Human response to changes in noise levels can result in annoyance, interference with communications, disruption of sleep, and health effects.

For adverse effects, the residual impacts after the application of mitigation measures will be evaluated. The evaluation is based on the magnitude, extent, duration, reversibility and context.

For magnitude a relative rating was established as defined in Table 4. The evaluation applied absolute values for the geographic extent, frequency and duration. Reversibility was considered as the ability to return to an equal or improved condition once the interaction with the Project has ended. The judgment about the reversibility was based on previous experience and research and is stated as “reversible” or “irreversible.”

Table 4: Definitions for Levels of Magnitude

Rating	Magnitude
High	An environmental effect affecting a whole stock, population, or definable group of people, or where a specific parameter is outside the range of natural variability determined from local knowledge over many seasons.
Medium	An environmental effect affecting a portion of a population, or one or two generations, or where there are rapid and unpredictable changes in a specific parameter so that it is temporarily outside the range of natural variability determined from local knowledge over many seasons.
Low	An environmental effect affecting a specific group of individuals in a population in a localized area, one generation or less, or where there are distinguishable changes in a specific parameter; however, the parameter is within the range of natural variability determined from local knowledge over many seasons.
Nil	No environmental effect.
Unknown	An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.

For adverse residual effects, the evaluation for the individual criteria was combined into an overall rating of significance:

- ◆ Major: Potential impact could jeopardize the long term sustainability of the resource, such that the impact is considered sufficient in magnitude, aerial extent, duration, and frequency, as well as being considered irreversible. Additional research, monitoring, and/or recovery initiatives should be considered.
- ◆ Medium: Potential impact could result in a decline of a resource in terms of quality/quantity, such that the impact is considered moderate in its combination of magnitude, aerial extent, duration, and frequency, but does not affect the long term sustainability (that is, it is considered reversible). Additional research, monitoring, and/or recovery initiatives may be considered.
- ◆ Minor: Potential impact may result in a localized or short-term decline in a resource during the life of the Project. Typically, no additional research, monitoring, and/or recovery

initiatives are considered.

- ◆ Minimal: Potential impact may result in a small, localized decline in a resource during the construction phase of the Project, and should be negligible to the overall baseline status of the resource.

An adverse impact was considered “significant” where its residual effects were classified as major; while they were considered “not significant” where residual effects were classified as medium, minor, or minimal.

Subsequently, those effects considered significant (i.e., “major”) would undergo an additional consideration of the likelihood of their occurrence and the level of confidence underlying the effects prediction.

The noise criteria from NSE and Health Canada are used to assess the noise impact from the LNG facility. A significant adverse noise effect has been determined to represent a condition where the recommended guidelines would be exceeded during normal operation (Table 5). The NS guidelines are 65 dB (A) for daytime, 60 dB (A) evening, and 55 dB (A) for night-time. The WHO guideline level of 45 dB (A) is commonly considered a standard for residential receptors at night to ensure minimal sleep disturbance.

Table 5: Noise Assessment Criteria

Day	Evening	Night	Day-Night
07:00 to 19:00	19:00 to 23:00	23:00 to 07:00	00:00 to 24:00
L _{Aeq} (dBA)	L _{Aeq} (dBA)	L _{Aeq} (dBA)	L _{dn} (dBA)
65	60	55	Predicted change in the community greater than 6.5 %HA where sound levels are in the range of L _{dn} : 45 to 75 dBA.

5.2 Construction Noise

Considerable civil works including site clearing, grading, roads, a ditch system and sedimentation ponds from the site and two concrete pads for the LNG storage tanks were built between 2004 and 2007 to construct and operate an LNG import facility. Major earthworks have therefore been completed.

Remaining construction activities at the Project site would involve installation of foundations for the planned Project facilities, other equipment settings, ancillary equipment, piping, and structures. The

construction equipment would consist mainly of concrete trucks, flat bed trucks and cranes to complete the construction of the facilities.

The construction of the marine terminal including a jetty platform, a vessel berthing and trestle structure, loading facilities, a temporary wharf and the installation piles over a period of 6-8 month period.

Construction is projected to begin in mid-2016 with proposed facilities placed into service by 2019. Construction of the Project would cause temporary increases in ambient noise levels in the immediate vicinity of the construction site. Construction hours will vary, but work will take place onsite during certain stages twenty four hours a day seven days a week.

Noise levels resulting from construction equipment are dependent on several factors including the number and type of equipment operating, the noise emission level, the usage factor and the distance between sources and receptors. The expected construction type equipment and quantities for the project construction are presented in Table 6. Noise emission levels were gathered from the Roadway Construction Noise Model (FHWA, 2006) and from literature.

The construction noise levels at the boundary of the LNG facility will depend on the proximity of the construction equipment to the property limits and are likely to be higher than the noise assessment criteria for the day period. However, the site is located in a remote area of the Point Tupper / Bear Head Industrial Park and the land is zoned for Port Industrial (I-2) use, which includes bulk terminals, marine terminals, and fuel bunkering facilities.

Assuming that all the construction equipment at the facility site would be operating at the same time, the composite sound level at several distances from the site are presented in Table 6. The receptors across the Strait are more than 1.8 km from the loading platform (Table 3 and Map 1). The construction sound levels at the nearest receptors (LAeq, Table 7) are lower than the noise assessment criteria for the day period (65 dBA). The increase in Day-Night sound level (Ldn, Table 7) is lower or equal to 3 dBA and the predicted change in the percent highly annoyed (0.3 to 1.7 %HA) in the community is lower than 6.5 %HA.

The sound levels of pile installation at the marine terminal are presented in (LAeq, Table 7). To mitigate noise levels, vibratory hammers will be employed to the extent possible in establishing piles. The sound level at the nearest receptors is lower than the noise assessment criteria for the day period (65 dBA). The increase in Day-Night sound level is lower or equal to 2 dBA and the predicted change in the percent highly annoyed (0.3 to 1.3 %HA) is lower than 6.5 %HA. In the event that impact (drop) hammers are used, the sound level at the nearest receptors is lower than the noise assessment criteria for the day period (65 dBA). But, driving piles by the drop hammer method generates highly impulsive noise and a correction factor of +12 dB was included in the calculation of the Day-Night sound level (Ldn), as per ISO 1996-2: 2007. The increase in Day-Night

sound level is high and the predicted change in the percent highly annoyed (up to 10.4 %HA) is higher than 6.5 %HA. The residual impact would be low, reversible and temporary. The significance of the residual impact would be minor. Additional noise mitigation will be considered if required to attenuate noise.

Noise impact from the construction of the facility is not expected at sensitive receptors but driving of piles at the marine terminal would create an adverse temporary effect. Noise mitigation of pile driving noise should be included for the construction of the marine terminal, as required, to reduce the impact of piling noise.

Table 6: Construction Equipment and Sound Levels at Various Distances

Construction Equipment	Quantity	Usage Factor %	dBA @ 15 m	Adjusted ¹ Sound Level (dBA) vs Distance (m)				
				50	500	1000	2000	4000
Air Tracks(blasting)	1	20	81	64	44	38	32	25
Backhoe	4	40	78	70	50	44	38	32
Blasting Equipment	1	1	94	64	44	38	32	25
Bulldozers	2	40	82	71	51	45	39	33
Compactor	4	20	83	72	52	46	40	34
Compressor	4	40	78	70	50	44	38	32
Concrete Truck	10	40	79	75	55	49	43	37
Concrete Pump Truck	2	20	81	67	47	41	35	29
Concrete Saws	2	20	90	76	56	50	44	38
Concrete Vibrators	2	20	80	66	46	40	34	28
Crane	4	16	81	69	49	43	37	31
Explosive Fasteners	4	20	79	68	48	42	36	30
Flat Bed Truck	4	40	74	66	46	40	34	28
Fork Truck	2	40	84	73	53	47	41	35
Generator	8	50	81	77	57	51	45	39
Grinders and Cutters	4	20	83	72	52	46	40	34
Hyd. Rock Breakers	2	40	94	83	63	57	51	45
Jack Hammers	4	20	89	78	58	52	46	40
Pickup Truck	4	40	75	67	47	41	35	29

Construction Equipment	Quantity	Usage Factor %	dBA @ 15 m	Adjusted ¹ Sound Level (dBA) vs Distance (m)				
				50	500	1000	2000	4000
Manlift	2	20	75	61	41	35	29	23
Welder	4	40	74	66	46	40	34	28
Composite Sound Level				87	67	61	55	49
Vibratory Hammers	2	20	101	87	67	61	55	49
Impact Pile Driver ²	2	20	101	87	67	61	55	49

1: Adjusted to quantity, usage factor and distance,
2: Impact hammers will only be used as required and will employ noise mitigative measures if required

5.3 Operation Noise

The operation of the proposed LNG facility and marine terminal will generate noise from the process equipment of the facility and from the LNG carriers. The LNG facility contains equipment that will generate noise such as the gas and steam turbine compressors, the BOG compressors, the air coolers, the pumps, the piping and utility equipment. Most of the facility noise sources are continuous. Intermittent sources of noise such as flaring and venting may take place during emergency operation.

Noise dispersion modelling was performed to predict the off-site noise impacts. The International Organization for Standardization Standard 9613-2 (ISO 1996) was used with the SoundPLAN V7.3 software to simulate the propagation of sound under favourable meteorological conditions from the source to the receptor. The methodology accounts for the sound wave divergence due to distance, atmospheric and ground absorption, reflection from object such as buildings, and sound attenuation from barriers and topography. The sound level is calculated for individual receptors. The calculated sound level represents the A-weighted continuous sound level (LAeq). An absorption coefficient of 0.1 was used for the area within the site boundary, 0.9 for areas outside the boundary and 0.0 for water. The ambient conditions are assumed to be 100°C with 70% relative humidity. The land topographic data was obtained from the Nova Scotia Geomatics Center (NSGC, 2011).

Table 7: LNG Facility Construction Sound Levels at Off-Site Receptors

Receptor	LNG Construction		Existing Baseline	Combined	Expected Increase
	L _{Aeq} (dBA)	L _{dn} * (dBA)	L _{dn} (dBA)	L _{dn} (dBA)	%HA
Construction at the facility site					
R1	48	46	55	56	0.3 %
R2	56	54	54	57	1.7 %
R3	52	50	54	55	0.7 %
Construction with vibratory hammers at marine terminal					
R1	48	46	55	56	0.3 %
R2	55	53	55	57	1.3 %
R3	52	50	54	56	0.7 %
Construction with impact hammers at marine terminal					
R1	48	58 **	55	60	3.3 %
R2	55	65 **	55	65	10.4 %
R3	52	62 **	54	63	6.9 %
* : Construction operating hours will vary, but work will take place on site during certain stages 24 hours per day 7 days a week. **: +12 dBA correction was included for the highly impulsive nature of pile driving noise , as per ISO 1996-2: 2007					

The noise-producing equipment along with the corresponding estimated noise emission levels were derived from several sources such as manufacturer data, estimation based on similar equipment from other facilities or from generic data from the literature. Table 8 presents the sound levels of the primary noise producing equipment of the proposed LNG facility. Table 9 presents the example noise attenuation for gas turbines that was included in the modelling. Mitigation measures for noise will be determined, as required, during detailed design.

Table 8: Sound Levels for Primary Noise Producing Equipment

Equipment	Quantity Modeled	Sound Power (dB, ref. 10-12 W) / Octave Spectrum Band (Hz)									
		32	63	125	250	500	1000	2000	4000	8000	dBA
Gas Turbine/MR Compressor Package	8	77	86	99	97	96	95	99	100	96	105
Gas Turbine Exhaust	8	91	107	119	126	130	129	128	129	120	135
Once Through Steam Generator	8	--	77	88	92	97	100	99	98	92	105
Boiler Feed Pumps	8	--	93	94	96	96	99	96	92	86	103
MR Air Coolers	8	115	118	118	115	112	108	105	102	94	114
BOG Compressors	5	113	114	118	116	107	108	105	101	95	113
Ammonia Compressors	8	109	109	108	106	106	108	112	111	107	116
Steam Turbines	8	98	102	103	100	99	99	97	96	92	105
Ammonia Air Coolers	8	120	123	123	120	117	113	110	107	99	119
Air Cooled Condensers	8	112	115	115	112	109	105	102	99	91	112
Instrument Air Compressors	12	91	96	93	98	95	91	88	90	89	98
Amine Charge Pumps	8	--	93	94	96	96	99	96	92	86	103
Amine Air Coolers	8	108	111	111	108	105	101	98	95	87	107
Liquefaction Train Piping	4	16	29	39	83	112	115	103	92	73	116
Miscellaneous Equipment	154	91	93	95	95	95	95	95	92	85	101

Table 9: Gas Turbine Attenuation included in Noise Modelling

Equipment	Attenuation (dB, ref. 10-12 W) / Octave Spectrum Band (Hz)									
	32	63	125	250	500	1000	2000	4000	8000	
Gas Turbine Exhaust Attenuation	2	5	12	24	34	40	39	31	11	

The results of the noise modelling for the LNG facility operation are presented in Table 10 and illustrated in Figure 2. The predicted noise levels at the boundary of the LNG facility are higher than the noise assessment criteria for the day, evening and night periods. However, the site is located in a remote area of the Point Tupper / Bear Head Industrial Park and the land is zoned for Port Industrial (I-2) use, which includes bulk terminals, marine terminals, and fuel bunkering facilities.

The predicted noise levels at the receptors across the Strait are lower than the noise assessment criteria for the day, evening and the night periods. The increase in Day-Night sound level is lower than 2 dBA and the predicted change in the percent highly annoyed (0.2 to 1.1 %HA) in the community is lower than 6.5 %HA.

Noise impact from the operation of the LNG facility is not expected at sensitive receptors. Noise aspects should be considered in the design of the LNG facility and mitigation measures should be included as required to meet the noise impact criteria.

Flaring and venting events may occur infrequently during start-up, shutdown and process upset of the LNG facility. High noise levels can result over a short duration during these events.

5.4 *Decommissioning Noise*

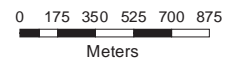
Noise impacts during decommissioning are expected to be comparable to the construction noise impacts. Mitigation measures proposed for the construction phase should be applied to the decommissioning phase.

**Figure 2
 Predicted
 Operation Sound
 Level**

★ Noise Monitoring Locations

$L_{Aeq 1h}$ (dBA)

- 45
- 50
- 55
- 60
- 65
- 70



Map Parameters
 Reference System: (ATS77)
 Projection: Modified Transverse Mercator (MTM)
 Zone: 4
 Scale: 1:15,000
 Project Number: 622560
 Date: February 16 2015

Source :
 - Service Nova Scotia and Municipal Relations,
 Access Nova Scotia, Nova Scotia Geomatics Centre.
 - Topographic map, 2011, 1:10 000
 - Plant Layout: LNG_L, BH-SK-00-016-base2D.dwg
 (Update: December 12, 2014)

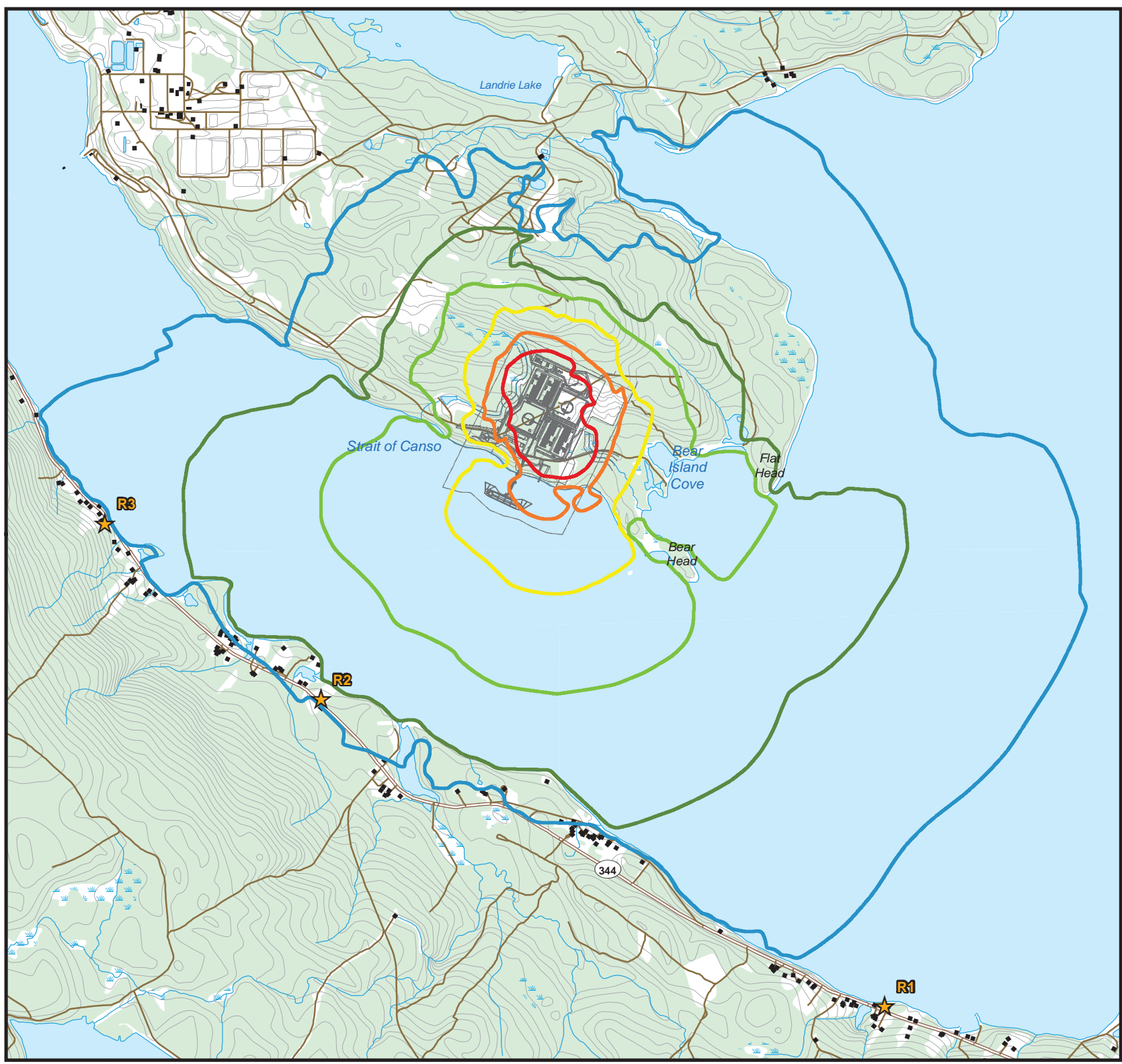


Table 10: LNG Facility Operation Sound Levels at Site Boundary and Off-Site Receptors

Receptor	LNG Facility		Existing Baseline	Combined	Expected Increase
	LAeq (dBA)	Ldn (dBA)	Ldn (dBA)	Ldn (dBA)	%HA
North Boundary *	70	NA	NA	NA	NA
West Boundary *	68	NA	NA	NA	NA
South Boundary *	64	NA	NA	NA	NA
East Boundary *	68	NA	NA	NA	NA
R1	38	44	55	55	0.2%
R2	46	52	55	57	1.1%
R3	42	48	54	55	0.5%

*: Relative to the Facility main axis, +25° from true north

6 RESIDUAL EFFECTS

The effects of noise during the construction, operation and decommissioning of the LNG facility are summarized in Table 11.

With proper design and mitigation of the piling noise at the marine terminal, the construction noise levels should be reduced below the assessment criteria (Table 5). The effects of the LNG facility construction phase are expected to be minor.

With proper design and mitigation, the operation noise levels should be reduced below the assessment criteria (Table 5). The effects of the LNG facility operation phase are expected to be minor.

The decommissioning phase noise levels should be similar to the construction phase noise levels, without the piling noise. The effects of the LNG facility decommissioning phase are expected to be minor.

Table 11: Significance of Residual Environmental Effects

	Positive (P) Adverse Effect (A)	Mitigation	Significance Criteria for Residual Environmental Effects *					Significance *
			Magnitude	Extent	Duration	Reversibility R= Reversible NR= Non revers	Context	
Construction								
Disturbance of residents across the Strait from construction equipment noise at the site and the jetty.	A	Drop hammer piling: acoustic shroud or non impulsive method (vibratory piling)	Low	Land adjacent to Project site	Construction phase	R	Rural setting; sparsely populated; nearest residential receptor at 1,8 km from the jetty	Minor
Operation								
Disturbance of residents across the Strait from LNG facility equipment continuous noise.	A	Gas turbine exhaust noise attenuation, if required.	Low	Land adjacent to Project site	Operation phase 24 h/ 7d	R	Rural setting; sparsely populated; nearest residential receptor at 1.8 km from the jetty	Minor
Emergency flaring and venting.	A	None	High	Land adjacent to Project site	Short and infrequent	R		Minor
Decommissioning								
Noise levels during decommissioning are expected to be comparable to the construction noise levels, without piling noise.	A	Mitigation measures proposed for construction phase should be applied to the decommissioning phase.	High	Land adjacent to the Project site	Short and infrequent	R	Rural setting; sparsely populated; nearest residential receptor at 1.8 km from the jetty	Minor
* For definitions, refer to section 5								

7 REFERENCES

BEAR HEAD LNG, December 2014, Bear Head LNG Project Basis of Design. Revision C

FEDERAL HIGHWAY ADMINISTRATION, 2006, Roadway Construction Noise Model

HEALTH CANADA, 2010, Useful Information for Environmental Assessments.

INTERNATIONAL ORGANISATION FOR STANDARDIZATION, 1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

MUNICIPALITY OF THE COUNTY OF GUYSBOROUGH, Noise Control By-Law, Accessed online November 2014, at <http://www.municipality.guysborough.ns.ca/residents/bylaws>.

MUNICIPALITY OF THE COUNTY OF RICHMOND, By-Law # 8 – Mischiefs and Nuisances, Accessed online November 2014, at <http://www.richmondcounty.ca/default.asp?mn=1.36.92>

NOVA SCOTIA ENVIRONMENT AND LABOR, June 2005, Amendment to Approval to Construct & Operate – Phase Two – Works for Construction and Commissioning for the Bear Head LNG Terminal, Bear Head, Rich. Co., N.S., No 2004-043229-A01, PID #7535709.

NOVA SCOTIA ENVIRONMENT AND LABOR, October 2004, Approval to Construct & Operate – Phase One – Earth Works for Liquefied Natural Gas Terminal, Bear Head, Rich. Co., N.S., No 2004-043229, PID #7535709.

NOVA SCOTIA GEOMATICS CENTRE, 2011, Topographic Map, Sheet number: 1045500061200, 1045500061200, 1045500061300 et 1045500061300.

Ambient Noise Monitoring, October 2014

