APPENDIX C

Noise Impact Assessment

GL Garrad Hassan

NOISE IMPACT ASSESSMENT

PUGWASH WIND FARM, NOVA SCOTIA

Client	Pugwash Wind Farm Inc.
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REVISION HISTORY

Issue	Issue Date	Summary
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1 INTRODUCTION

GL Garrad Hassan ("GL GH") was retained by Pugwash Wind Farm Inc. (the "Client") to prepare a Noise Impact Assessment (NIA) of the Pugwash Wind Farm ("Project"). Noise levels at Points of Reception are calculated on the basis of the ISO 9613 approved methodology. The Project is located in the county of Cumberland, Nova Scotia.

The Pugwash Wind Farm, comprising 12 Siemens SWT 2.3-101 and 1 alternate Siemens SWT 2.3-101 wind turbine, at a hub height of 99 m, is being proposed in order to supply clean energy to Nova Scotia Power Inc. using state-of-the-art wind energy technology.

The objectives of this assessment are to:

1 Confirm the sound level limit requirements for the Project;

2 Predict the noise levels generated by the Project at Points of Reception within 1.5 km of the turbines and 500 m of the substation; and

3 Compare the predicted sound level from the Project with the sound level limit.

The NIA also provides information on the noise sources, the prediction method and the parameters used for the assessment.

2 GENERAL DESCRIPTION OF PROJECT SITE

2.1 General Characteristics

The Project is located in the northern part of the county of Cumberland, Nova Scotia. More specifically, it is situated to the north and south of the Irishtown Road, east of the Village of Pugwash. The Client has not yet finalized its choice of turbine for the Project. However, the particular turbine locations as proposed at the time of this report are expected to be final. This Noise Impact Assessment has been completed using 12 Siemens SWT 2.3-101 and 1 alternate Siemens SWT 2.3-101 wind turbine generator (WTG) [1]. The mapping in Appendix A depicts the locations of these turbines, as chosen and planned by the Client.

The Client is also considering a configuration of the Project which would use the Siemens SWT 2.3-113 turbine at the same locations. The acoustic emissions of the Siemens SWT 2.3-113 are expected to be lower compared to the Siemens SWT 2.3-101 and accordingly, the predicted noise levels at each receptor are expected to be less from that turbine model than the results shown in this NIA.

Figure 2-1: Land features of the Pugwash Wind Farm site

The Project has been configured using wind turbines strategically sited on lands for which the Client holds lease agreements. Electricity generated by the turbines will be fed to a collector system terminating at a substation. The Pugwash site map showing the locations of the substation, wind turbines, Points of Reception and noise isocontours is presented in Appendix A.

The turbine elevations range between 10 m and 37 m asl.

2.2 Land Use Description

Land use around the Project is rural and mainly consists of agriculture, light industry, forestry and recreational. The area directly affected by the Project is located on private land.

2.3 Points of Reception

The Client provided a list of 181 building locations within 1.5 km of a turbine or 500 m of the substation, for the Project [2]. It should be noted that GL GH has not visited the site, and hence has not validated the buildings. Of these, 131 are dwellings or potential dwellings (i.e. Points of Reception) and were considered in this analysis. One cemetery was also considered in this analysis. The height of all the Points of Reception was set to 1.5 m. No other sensitive Point of Reception, such as schools, churches, campgrounds, etc. are found in the vicinity of the Project.

The coordinates of each Point of Reception are listed in Appendix B.

3 APPLICABLE NOISE LIMITS

Nova Scotia Environment and Labour has established the following noise limits [3]:

- Leq <= 65 dBA between 0700 and 1900 hours;
- Leq <= 60 dBA between 1900 and 2300 hours; and
- Leq <= 55 dBA between 2300 and 0700 hours.

It has been verified that no noise limit specific to wind turbines is prescribed by the Nova Scotia Government.

The County of Cumberland Land Use Bylaw [4] [5] doesn't specify any regulation with regards to noise.

Health Canada [6] recommends that technically and economically feasible mitigation measures be applied if the predicted sound level at receptors due to wind turbine operation exceeds 45 dBA, at maximum sound power from the turbine.

This Noise Impact Assessment verifies that the calculated sound pressure level is below 45 dBA for all Points of Reception.

Since specific modeling parameters are not mentioned in the referenced documents, an approach similar to other nearby Canadian jurisdictions has been taken for this analysis. This approach includes using criteria and parameters from the Ontario Noise Guidelines and the *ministère du Développement durable, de l'Environnement et des Parcs* (MDDEP) noise guidelines as inputs into the Pugwash analysis. These parameters are discussed in the subsequent sections of this report.

4 DESCRIPTION OF SOURCES

The Siemens SWT-2.3-101 wind turbines considered for the Project in this Noise Impact Assessment are horizontal-axis turbines with three-bladed upwind rotors, a rotor diameter of 101 m, and a hub height of 99 m. Table 4-1 presents the general specifications of the wind turbine [7]. Coordinates of all turbines are listed in Appendix D.

Table 4-1: Turbine description – Siemens SWT-2.3-101

Description	Characteristic
Model	Siemens SWT-2.3-101
Rated power	2.3 MW
Hub height	99 m
Rotor diameter	101 m
Rotor swept area	8000 m^2
Number of blades	3
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Nominal wind speed	12 m/s

5 WIND TURBINE NOISE EMISSION RATING

5.1 Noise Emission Rating for the Wind Turbines

Broadband sound power levels and octave band sound power levels of the Siemens SWT-2.3-101 wind turbine were provided by the Client and are shown in Appendix C [7]. Measurements were made in accordance with the IEC 61400 – 11 Ed. 2.1 [8] method using standardized wind speeds at 10 m height. The values corresponding to the maximum sound power level of the turbine were retained for the purpose of the noise impact assessment. The broadband values correspond to a 10 m height wind speed of 7 m/s or more and the octave band spectra correspond to a 10 m height wind speed of 8 m/s.

The octave band sound power levels used for the simulation in this NIA are those stated for each octave band centre frequency in Table 5-1.

Table 5-1: SWT-2.3-101 wind turbine Sound Power Level

SWT-2.3-101	**Octave Band Sound Power Level [dBA]**								
Frequency [Hz]	63	125	250	500	1000	2000	4000	8000	Broadband
PWL [dBA]	83.5	94.4	98.1	102.1	102.1	98.4	91.2	87.2	107.0

5.2 Noise Emission Rating for the Substation Transformer

The cumulative effect that the wind farm substation would have on nearby residents has been considered. Noise emission from the substation mainly originates from the high-voltage step-up transformer. The equipment proposed for the substations will be compliant with applicable standards (CAN/CSA-C88-M90, IEEE C57.12.90).

The Broadband Sound Power Level for the noise modeling calculations was conservatively assumed to be 95 dB(A) based on a typical transformer sized for the project and according to limits prescribed in standard CAN/CSA-C88-M90 for utility scale transformers. A 5 dB tonal penalty was added to the broadband level. The location of the substation transformer was provided by the Client. It is presented in Appendix D and shown in the Map in Appendix A.

Table 5-2 shows the octave band sound power levels of the substation transformer, using a typical transformer octave band sound distribution for a large transformer. The substation transformer was modeled at a height of 1.5 m agl.

Table 5-2: Substation transformer Sound Power Level (including tonal penalty)

Transformer	**Octave Band Sound Power Level [dBA]**								
Frequency [Hz]	63	125	250	500	1000	2000	4000	8000	Broadband
PWL [dBA]	64.4	81.5	86.0	99.4	88.6	70.8	66.6	60.5	100.0

6 NOISE IMPACT ASSESSMENT

The predicted overall (cumulative) sound pressure levels at each critical noise receptor for the aggregate of all wind turbines and substations associated with the Project were calculated based on the ISO 9613 method [9] using the CadnaA software. The simulation was run with the noise emission ratings of the wind turbines and substation transformer as specified in Section 4.

The ISO 9613 standard provides a prediction of the equivalent continuous A-weighted sound pressure level at a distance from one or more point sources under meteorological conditions favourable to propagation from sources of sound emission. These conditions are for downwind propagation, or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, which commonly occurs at night. Downwind propagation conditions assume a wind direction within an angle of + 45º of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver.

The method consists of octave-band algorithms (i.e. with nominal midband frequencies from 63 Hz to 8 kHz) for calculating the attenuation of the emitted sound. The algorithm takes into account the following physical effects:

- Geometrical divergence – attenuation due to spherical spreading from the sound source;
- Atmospheric absorption – attenuation due to absorption by the atmosphere; and
- Ground effect –attenuation due to the acoustical properties of the ground.

The following ISO-9613-2 parameters [10] were set as follows, for a conservative worst case scenario:

- Ambient Air Temperature: 10ºC;
- Ambient Barometric Pressure: 101.32 kPa;
- Relative Humidity: 70%;
- Topography: provided by the Client; and
- Ground Attenuation (G): 0.7 (site conditions considered as "mixed ground").

For ground attenuation (G), it should be noted that from ISO 9613 standard, G should be set to 1 for porous ground, "which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation, such as farming land". For hard ground such as "paving, water, ice, concrete and all other ground surfaces having a low porosity," G should be set to 0. "Tamped ground, for example, as often occurs around industrial sites, can be considered hard." The Pugwash site is considered to be "mixed ground" and a G of 0.7 was considered appropriate.

Additional calculations concerning propagation through foliage were not performed in this impact assessment, implying that the values calculated for sound attenuation are likely to be conservative in areas where there is foliage present in the line of sight between any turbine and a noise receptor. In addition, the ISO 9613 model is conservative as it assumes that the propagation of the sound from the WTGs to the source is downwind for all the WTGs at the same time. Consequently, the values calculated for sound attenuation are likely to be conservative in those cases where the line of sight between a turbine and a

noise receptor is blocked by trees or shrubs or if the wind direction is taken into account in the noise impact assessment. The estimated accuracy of the ISO 9613 method, as stated in ISO 9613-2, is ± 3 dB. The noise impact was calculated for Points of Reception located within 1.5 km of a turbine and 500 m of the substation, and the calculated noise level was then compared with the applicable noise limit of 45 dBA in accordance with Health Canada requirements. Noise levels were calculated at a height of 1.5 m for all Points of Reception.

7 WIND TURBINE NOISE IMPACT ASSESSMENT SUMMARY TABLE

7.1 Results

The noise level at Points of Reception within 1.5 km of any turbine and 500 m of the substation is tabulated in Information provided by the Client includes a number of buildings that may be barns, sheds or outbuildings and not habitable dwellings. To the extent any such building was found to be in an area having a predicted sound level below 40dBA, no further enquiry was done to determine whether the building is a habitable dwelling or a barn, for example. Therefore, the list of receptors noted below is likely much larger than the actual number of habitable dwellings.
Table 7-1. For each receptor, the following information is provided:

- Distance to the closest wind turbine;
- Sound pressure level at the receptor location at the applicable receptor height;
- Sound level limit for that receptor;
- Whether or not the noise levels at the receptor comply with the prescribed limit.

The Point of Reception with the highest calculated sound pressure level is Point of Reception 182 (cemetery) at 43.6 dBA, located 111 from the substation. The dwelling with the highest calculated sound pressure level is Point of Reception 63 at 39.9 dBA, located 665 m from Turbine 1.

The results show that the Pugwash Project complies with the applicable environmental noise guidelines cited in Section 3. A noise iso-contour map illustrating the contribution of the all wind turbines and the substation is presented in Appendix A.

Information provided by the Client includes a number of buildings that may be barns, sheds or outbuildings and not habitable dwellings. To the extent any such building was found to be in an area having a predicted sound level below 40dBA, no further enquiry was done to determine whether the building is a habitable dwelling or a barn, for example. Therefore, the list of receptors noted below is likely much larger than the actual number of habitable dwellings.

Table 7-1: Wind turbine noise impact assessment summary – Pugwash Wind Farm

Point of Reception ID	PID	Receptor Height [m agl]	Distance to Nearest Turbine [m]	Nearest Turbine [ID]	Calculated Sound Pressure Level at Receptor [dB(A)]	Applicable Noise Limit [dB(A)]	Compliance With Limit (Yes/No)
1	25359365	1.5	1265	11	35.1	45	Yes
2	25158403	1.5	1196	11	36.1	45	Yes
3	25357542	1.5	1155	12	36.5	45	Yes
4	25277054	1.5	1081	10	37.1	45	Yes
5	25339078	1.5	963	10	37.5	45	Yes
6	25159260	1.5	951	10	37.6	45	Yes
7	25339078	1.5	953	10	37.5	45	Yes
8	25159260	1.5	930	10	37.7	45	Yes
9	25159260	1.5	924	10	37.8	45	Yes
10	25159260	1.5	926	10	37.8	45	Yes
11	25158387	1.5	1074	12	37.4	45	Yes
12	25158379	1.5	908	10	38	45	Yes
13	25158379	1.5	890	10	38.1	45	Yes
14	25159260	1.5	891	10	38.1	45	Yes
15	25338625	1.5	888	10	38.3	45	Yes
16	25393877	1.5	837	10	38.6	45	Yes
17	25393877	1.5	831	10	38.7	45	Yes
18	25393877	1.5	826	10	38.7	45	Yes
19	25330333	1.5	867	10	38.6	45	Yes
20	25395005	1.5	796	10	39	45	Yes
21	25330325	1.5	833	10	38.8	45	Yes

Point of Reception ID	PID	Receptor Height [m agl]	Distance to Nearest Turbine [m]	Nearest Turbine [ID]	Calculated Sound Pressure Level at Receptor [dB(A)]	Applicable Noise Limit [dB(A)]	Compliance With Limit (Yes/No)
22	25097510	1.5	781	10	39.1	45	Yes
23	25330325	1.5	820	10	39	45	Yes
24	25462292	1.5	856	9	37.7	45	Yes
25	25158296	1.5	714	9	39.1	45	Yes
26	25159062	1.5	929	9	37	45	Yes
27	25158288	1.5	802	9	38.1	45	Yes
28	25158247	1.5	1068	9	36.1	45	Yes
29	25158056	1.5	1462	1	32.5	45	Yes
30	25158262	1.5	1231	1	34.6	45	Yes
32	25276734	1.5	1218	1	34.4	45	Yes
35	25158627	1.5	1392	1	32.2	45	Yes
38	25159310	1.5	1231	1	33.4	45	Yes
41	25159310	1.5	1235	1	33.4	45	Yes
42	25158635	1.5	1202	1	33.6	45	Yes
45	25158643	1.5	1202	1	33.5	45	Yes
46	25158643	1.5	1188	1	33.6	45	Yes
47	25158643	1.5	1169	1	33.7	45	Yes
48	25158619	1.5	1141	1	33.9	45	Yes
49	25158650	1.5	1096	1	34.3	45	Yes
50	25158650	1.5	1079	1	34.4	45	Yes
51	25353723	1.5	1027	1	34.8	45	Yes
52	25276353	1.5	946	1	35.5	45	Yes
53	25276353	1.5	957	1	35.4	45	Yes
54	25276353	1.5	939	1	35.5	45	Yes
55	25331687	1.5	728	1	37.8	45	Yes
56	25331687	1.5	746	1	37.6	45	Yes

Point of Reception ID	PID	Receptor Height [m agl]	Distance to Nearest Turbine [m]	Nearest Turbine [ID]	Calculated Sound Pressure Level at Receptor [dB(A)]	Applicable Noise Limit [dB(A)]	Compliance With Limit (Yes/No)
58	25357682	1.5	1350	1	31.9	45	Yes
59	25157413	1.5	1430	1	31.4	45	Yes
60	25154436	1.5	1228	1	32.9	45	Yes
62	25154428	1.5	1243	1	32.8	45	Yes
63	25154386	1.5	665	1	39.9	45	Yes
64	25154386	1.5	692	1	39.8	45	Yes
66	25154410	1.5	852	1	36.6	45	Yes
69	25154402	1.5	796	1	37.9	45	Yes
71	25336769	1.5	798	1	38.1	45	Yes
72	25275504	1.5	872	1	38.6	45	Yes
73	25154345	1.5	1002	3	38.2	45	Yes
76	25453523	1.5	899	3	38.5	45	Yes
77	25154022	1.5	901	3	38.4	45	Yes
78	25154048	1.5	941	3	37.8	45	Yes
80	25154014	1.5	876	3	38.2	45	Yes
81	25350372	1.5	910	3	37.9	45	Yes
82	25350372	1.5	936	3	37.7	45	Yes
83	25340431	1.5	1101	7	35.4	45	Yes
84	25051202	1.5	1079	3	36.6	45	Yes
87	25152786	1.5	1391	7	33.4	45	Yes
88	25152786	1.5	1296	7	34	45	Yes
90	25152786	1.5	1348	7	33.6	45	Yes
91	25454323	1.5	1012	7	36.1	45	Yes
92	25373713	1.5	1123	7	35.2	45	Yes
93	25153362	1.5	887	7	37.5	45	Yes
94	25152786	1.5	1347	7	33.6	45	Yes

Point of Reception ID	PID	Receptor Height [m agl]	Distance to Nearest Turbine [m]	Nearest Turbine [ID]	Calculated Sound Pressure Level at Receptor [dB(A)]	Applicable Noise Limit [dB(A)]	Compliance With Limit (Yes/No)
95	25336025	1.5	946	7	36.8	45	Yes
96	25153370	1.5	903	7	37.5	45	Yes
97	25336025	1.5	966	7	36.6	45	Yes
98	25454323	1.5	1033	7	35.9	45	Yes
100	25200627	1.5	928	7	37	45	Yes
101	25154006	1.5	1040	3	36.8	45	Yes
102	25153602	1.5	1013	3	37.5	45	Yes
103	25153602	1.5	1014	3	37.5	45	Yes
104	25153750	1.5	1043	3	37.4	45	Yes
105	25153602	1.5	1037	3	37.3	45	Yes
108	25346198	1.5	1051	3	36.8	45	Yes
109	25362013	1.5	1108	7	37.3	45	Yes
112	25346198	1.5	1064	3	36.7	45	Yes
113	25362013	1.5	1132	7	37.2	45	Yes
114	25348574	1.5	1207	3	36.6	45	Yes
115	25348574	1.5	1213	3	36.5	45	Yes
116	25393828	1.5	1177	7	36.4	45	Yes
117	25153396	1.5	1158	7	36.3	45	Yes
118	25153677	1.5	1175	3	36.1	45	Yes
120	25153404	1.5	1196	7	35.9	45	Yes
121	25393794	1.5	1203	7	36.5	45	Yes
122	25348558	1.5	1194	3	36.4	45	Yes
123	25153040	1.5	933	7	36.9	45	Yes
124	25451865	1.5	1123	7	35.2	45	Yes
125	25165440	1.5	999	7	36.2	45	Yes
126	25392028	1.5	1239	7	34.4	45	Yes

Point of Reception ID	PID	Receptor Height [m agl]	Distance to Nearest Turbine [m]	Nearest Turbine [ID]	Calculated Sound Pressure Level at Receptor [dB(A)]	Applicable Noise Limit [dB(A)]	Compliance With Limit (Yes/No)
128	25361247	1.5	804	1	36.8	45	Yes
129	25158692	1.5	747	1	37.9	45	Yes
130	25331695	1.5	724	1	38.2	45	Yes
131	25149790	1.5	894	SS	24.9	45	Yes
132	25149790	1.5	882	SS	25	45	Yes
134	25364191	1.5	697	SS	26.5	45	Yes
136	25149857	1.5	301	SS	34.6	45	Yes
138	25150087	1.5	570	SS	29.5	45	Yes
140	25150095	1.5	646	SS	28.8	45	Yes
141	25348335	1.5	892	SS	27.6	45	Yes
143	25150582	1.5	996	SS	27.4	45	Yes
144	25358334	1.5	899	SS	27.6	45	Yes
145	25150103	1.5	749	SS	28.2	45	Yes
146	25150103	1.5	769	SS	28.1	45	Yes
147	25150111	1.5	776	SS	28.1	45	Yes
149	25149881	1.5	191	SS	38.6	45	Yes
151	25149873	1.5	215	SS	37.5	45	Yes
152	25158932	1.5	184	SS	38.9	45	Yes
153	25149899	1.5	263	SS	35.9	45	Yes
156	25149899	1.5	319	SS	34.3	45	Yes
157	25340522	1.5	343	SS	33.7	45	Yes
158	25340522	1.5	361	SS	33.3	45	Yes
161	25149949	1.5	631	SS	29.4	45	Yes
164	25149949	1.5	654	SS	29.3	45	Yes
174	25149915	1.5	876	SS	28.4	45	Yes
175	25149956	1.5	893	SS	28.4	45	Yes

Point of Reception ID	PID	Receptor Height [m agl]	Distance to Nearest Turbine [m]	Nearest Turbine [ID]	Calculated Sound Pressure Level at Receptor [dB(A)]	Applicable Noise Limit [dB(A)]	Compliance With Limit (Yes/No)
176	25149964	1.5	936	SS	28.5	45	Yes
177	25276767	1.5	988	SS	28.5	45	Yes
178	25376716	1.5	635	SS	28.9	45	Yes
179	25366758	1.5	814	SS	28.1	45	Yes
180	25366741	1.5	723	SS	28.4	45	Yes
181	25366741	1.5	739	SS	28.4	45	Yes
182 (Cemetery)	25276684	1.5	111	SS	43.6	45	Yes

8 CONCLUSION

When modeled according to the ISO 9613 standard and the conditions specified in this report, the predicted sound level produced by the wind turbines and substation was found to be within the permissible sound level of 45 dBA for all the noise receptors identified. The results are therefore compliant with the most stringent applicable requirement for this region (Health Canada requirement). The Point of Reception with the highest calculated sound pressure level is Point of Reception 182 (cemetery) at 43.6 dBA. The dwelling with the highest calculated sound pressure level is Point of Reception 63 at 39.9 dBA.

Attenuation of sound through foliage was not considered in this NIA. In addition, it should be noted that the ISO 9613 model is conservative as it assumes that the propagation of the sound from the WTGs to the source is downwind for all the WTGs at the same time. Consequently, the values calculated for sound attenuation are likely to be conservative in those cases where the line of sight between a turbine and a noise receptor is blocked by trees or shrubs or if the wind direction is taken into account in the noise impact assessment.

9 REFERENCES

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[3] Guidelines for Environmental Noise Measurement and Assessment, Nova Scotia Environment and Labour, April 1990 (Administrative re-issue 18 May 2005).

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[6] Health Canada, 2006. Wind Farm Fact Sheet – Draft Document and *Health Canada Noise Impact Assessment Guidance for Environmental Assessments*. (to be issued)

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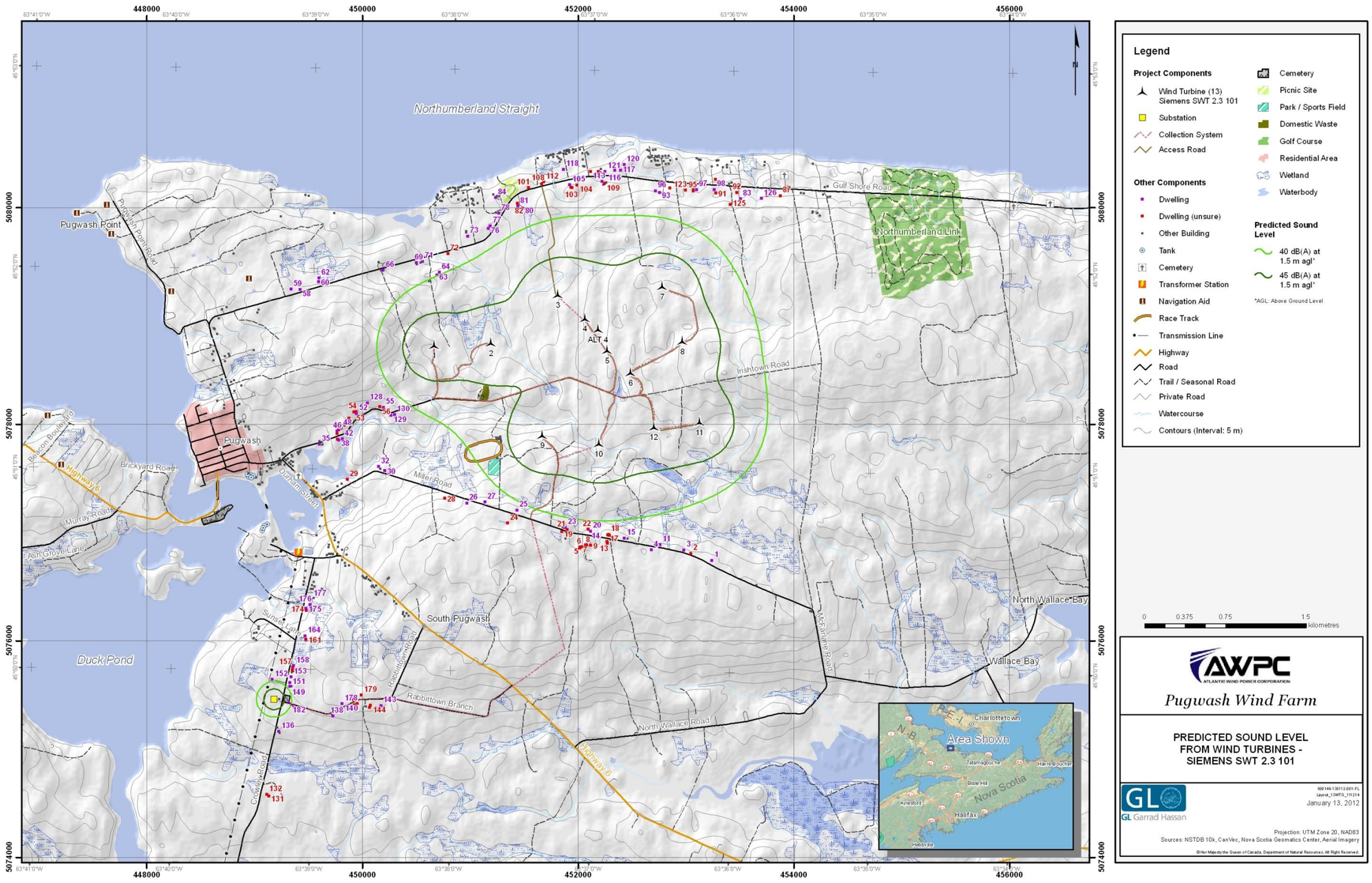
[9] International Organization for Standardization (ISO), 1993. Acoustics - Attenuation of Sound During Propagation Outdoors - Calculation of the Absorption of Sound by the Atmosphere. ISO 9613-1. 33 p.

[10] International Organization for Standardization (ISO), 1996. Acoustics - Attenuation of Sound During Propagation Outdoors - General Method of Calculation. ISO 9613-2. 25 p.

APPENDIX A NOISE ISO-CONTOUR MAP



GL Garrad Hassan

APPENDIX B POINTS OF RECEPTION COORDINATES

Point of Reception ID	Easting [m]	Northing [m]
1	453242	5076745
2	453048	5076810
3	452984	5076839
4	452684	5076842
5	452021	5076860
6	452040	5076868
7	452023	5076869
8	452080	5076884
9	452121	5076886
10	452074	5076889
11	452764	5076889
12	452274	5076902
13	452270	5076920
14	452107	5076920
15	452433	5076951
16	452292	5076975
17	452278	5076980
18	452287	5076986
19	451851	5077012
20	452118	5077015
21	451900	5077028
22	452095	5077032
23	451884	5077049
24	451351	5077090
25	451437	5077209
26	450970	5077274
27	451139	5077283
28	450765	5077318
29	449865	5077493
30	450208	5077573
32	450153	5077611
35	449603	5077817
38	449783	5077857
41	449771	5077866
42	449816	5077867
45	449767	5077918

Point of Reception ID	Easting [m]	Northing [m]
47	449781	5077952
48	449806	5077966
49	449842	5077993
50	449842	5078019
51	449878	5078057
52	449948	5078100
53	449922	5078114
54	449942	5078117
55	450197	5078159
56	450163	5078165
58	449425	5079246
59	449340	5079250
60	449597	5079319
62	449599	5079353
63	450693	5079380
64	450717	5079406
66	450196	5079425
69	450502	5079495
71	450560	5079507
72	450798	5079577
73	450980	5079741
76	451171	5079813
77	451190	5079835
78	451268	5079951
80	451490	5079998
81	451444	5080016
82	451439	5080042
83	453510	5080085
84	451237	5080097
87	453880	5080113
88	453754	5080116
90	453810	5080130
91	453281	5080138
92	453475	5080143
93	452760	5080144
94	453793	5080149

Point of Reception ID	Easting [m]	Northing [m]
46	449767	5077939
96	452721	5080159
97	453100	5080170
98	453267	5080171
100	452853	5080183
101	451544	5080188
102	451946	5080188
103	451936	5080191
104	451994	5080211
105	451925	5080215
108	451667	5080225
109	452248	5080228
112	451685	5080240
113	452227	5080244
114	452205	5080326
115	452192	5080336
116	452345	5080350
117	452398	5080350
118	451869	5080358
120	452430	5080400
121	452253	5080338
122	452121	5080337
123	452999	5080166
124	453278	5080266
125	453416	5080031
126	453702	5080089
128	450049	5078201
129	450268	5078083
130	450300	5078091
131	449135	5074568

Point of Reception ID	Easting [m]	Northing [m]
95	453073	5080158
132	449115	5074581
134	449066	5074773
136	449227	5075164
138	449728	5075307
140	449819	5075365
141	450069	5075387
143	450174	5075402
144	450077	5075405
145	449927	5075408
146	449947	5075410
147	449955	5075423
149	449329	5075581
151	449329	5075616
152	449167	5075644
153	449341	5075668
156	449352	5075729
157	449357	5075755
158	449365	5075771
161	449480	5076016
164	449470	5076047
174	449482	5076283
175	449478	5076302
176	449515	5076335
177	449527	5076386
178	449813	5075420
179	449993	5075500
180	449903	5075459
181	449918	5075485
182	449290	5075470

Coordinates are NAD83 UTM Zone 20.

APPENDIX C WIND TURBINES NOISE SPECIFICATION

SWT-2.3-101
Acoustic Emission

Sound Power Levels

The warranted sound power levels are presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 80 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (L_{WA}) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	4	5	6	7	8	9	10	11	12	Up to 18
Standard setting	95.1	99.8	105.1	107.0	107.0	107.0	107.0	107.0	107.0	107.0
"Setting -1 dB"	95.1	99.8	104.2	106.0	106.0	106.0	106.0	106.0	106.0	106.0
"Setting -2 dB"	95.1	99.8	103.2	105.0	105.0	105.0	105.0	105.0	105.0	105.0
"Setting -3 dB"	95.1	99.4	102.2	104.0	104.0	104.0	104.0	104.0	104.0	104.0
"Setting -4 dB"	95.1	98.6	101.2	103.0	103.0	103.0	103.0	103.0	103.0	103.0
"Setting -5 dB"	95.0	97.7	100.2	102.0	102.0	102.0	102.0	102.0	102.0	102.0

Tabel 1: Noise emission, L_{WA} [dB(A) re 1 pW]

Typical Octave Band

Typical, not warranted octave band spectra are tabulated below for 6 and 8 m/s referenced to 10m height.

Octave band, center frequency [Hz]	63	125	250	500	1000	2000	4000	8000
Standard setting	81.1	92.3	96.4	100.0	100.2	96.8	89.4	85.1
"Setting -1 dB"	81.8	93.0	96.2	98.7	98.8	96.3	88.5	84.1
"Setting -2 dB"	82.4	93.4	95.9	97.1	97.2	95.8	87.7	83.3
"Setting -3 dB"	82.7	93.3	95.1	95.1	95.3	95.0	87.0	82.8
"Setting -4 dB"	83.2	93.1	94.3	93.5	94.2	94.5	87.1	83.3
"Setting -5 dB"	82.8	91.9	92.3	92.6	94.1	93.3	87.2	83.8

Table 2: Typical octave band for 6 m/s

Octave band, center frequency [Hz]	63	125	250	500	1000	2000	4000	8000
Standard setting	83.5	94.4	98.1	102.1	102.1	98.4	91.2	87.2
"Setting -1 dB"	83.4	94.0	97.0	100.8	101.1	97.5	90.6	86.7
"Setting -2 dB"	83.3	93.6	95.9	99.6	100.2	96.6	90.1	86.2
"Setting -3 dB"	83.3	93.3	94.8	98.3	99.3	95.8	89.7	85.9
"Setting -4 dB"	83.2	92.9	93.6	96.9	98.3	94.8	89.2	85.4
"Setting -5 dB"	83.0	92.4	92.5	95.8	97.2	93.8	88.5	84.8

Table 3: Typical octave band for 8 m/s

APPENDIX D TURBINES AND SUBSTATION COORDINATES

Turbine ID	Easting [m]	Northing [m]
1	450666	5078715
2	451195	5078736
3	451813	5079184
4	452064	5078963
5	452271	5078668
6	452490	5078461
7	452783	5079258
8	452968	5078753
9	451670	5077885
10	452197	5077807
11	453128	5078004
12	452706	5077961
Alt 4	452187	5078863
Substation	452783	5079258

Coordinates are NAD83 UTM Zone 20.