



Rampion Offshore Wind Farm



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E.ON Climate & Renewables UK Rampion Offshore Wind Limited



E.ON Climate & Renewables

Onshore Noise from Offshore Piling

Noise Assessment

41318

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Office: Manchester

Author



Mark Evans

Date:

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**Technical
reviewer**



Ian Holmes

Date:

25th October 2012

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1 INTRODUCTION

A programme of monitoring has been undertaken in order to assess the potential noise impacts at the residential receptors on the south coast of England, as a result of piling works for the Rampion Offshore Wind Farm. The closest receptors to the piling works will be properties along the coast, and will vary as different turbine bases are installed. The closest piling works for construction of the wind farm bases will be taking place approximately 13.5km offshore.

The base for the meteorological mast was installed on 13 April 2012, using similar piling techniques to those that will be employed for construction of the turbine bases. Noise monitoring was undertaken on shore and on a boat close to the piling operations immediately before, during, and after the piling operation, and noise level changes as a result of the piling have been assessed.

2 METHODOLOGY AND MONITORING

The noise monitoring assessment was undertaken in two stages:

1. Onshore, attended noise monitoring on the seafront at the identified residential areas
2. Offshore, attended monitoring at various distances around the piling rig during operation between 07:00 and 08:00 (undertaken by Subacoustic).

The results of the monitoring will be combined to calculate the noise level expected onshore at the receptors. Figure 1 shows the monitoring locations.

2.1 Onshore Monitoring

The monitoring assessment was undertaken on the morning of the 13th April 2012, from approximately 04:45 until 08:30. Attended measurements were undertaken as follows:

- Littlehampton (17.13km from piling): 05:05 – 08:35 (RION NL-32, 00503253)
Co-ordinates: Easting, 505,392; Northing 101,438
The ambient noise sources were waves on the beach, seagulls and passing cars and people. Piling was not audible at the monitoring location.
- Worthing (13.59km from piling): 05:00 – 08:34 (RION NL-32, 00503257)
Worthing A Co-ordinates: Easting, 514,509; Northing 102,262
Worthing B Co-ordinates: Easting, 515,268; Northing 102,453
The ambient noise sources were waves on the beach, seagulls, waste removal activities, aircraft and passing cars and people. The monitoring location was changed at approximately 06:35 due to noise being made by a passer-by. The new location (Worthing B) is 13.66km from the piling works. Piling was not audible at either monitoring location.
- Shoreham (16.29km from piling): 04:43 – 08:08 (RION NL-32, 01013661)
Co-ordinates: Easting, 521,834; Northing 104,513
The ambient noise sources were waves on the beach, seagulls, increasing levels of traffic, occasional trains and pedestrians talking.

During the monitoring period, the weather was noted to be, clear sky, cool and a light north to south breeze. Sea conditions were calm.

Noise survey measurements were undertaken in accordance with BS 7455. The equipment used, conforming to the requirements of BS EN 61672. Calibration of each SLM took place before and after the monitoring period using a Norsonic Type 1251 Calibrator (Serial number 32194), no drift was observed.

2.2 Offshore Monitoring

Consultants 'Subacoustic' undertook monitoring from a boat during the piling works. The data supplied is presented in Appendix B. The data supplied covers the period 07:00 – 08:00 on the morning of the 13th April 2012. Measurements were taken at various distances from the piling works, ranging from 39m to 2.38km.

A Larson Davies Model 831 type 1 integrating sound level meter was installed on board the survey vessel. The meter was situated in the work area for control and monitoring, with the preamp and microphone connected at the end of an extension lead, fixed to the antenna framework.

The system was calibrated using a Larson Davies Type 200 calibrator before and after measurements. No significant drift in calibration was detected. The microphone was fitted with a heavy duty windshield. There was an unobstructed 360 degree view around the vessel. The weather during the survey was dry with light winds, which made conditions suitable for the measurement of environmental noise.

The noise was sampled as consecutive 1-minute files. Measurements were taken between 05.49 on 13th April 2012 as the vessel left port, to 08.04 after the piling operation was completed. Measurements were taken continuously throughout the foundation piling, including periods before and after piling where ambient noise was sampled. All relevant metrics were sampled, including LAeq, LAm_{ax}, LC_{peak} and LA90 with the fast time weighting.

2.3 Assessment

The data gathered from the offshore monitoring will be used to predict the noise level at the residential receptors. These noise levels have been compared to the measured background noise levels at each monitoring location to determine the likelihood of impact due to piling works.

3 RESULTS

3.1 Onshore Measurements

Attended measurements of background noise levels onshore were measured with a resolution of 1 minute. The results of the measurements at each location are shown graphically in Appendix A. Piling activities took place between 07:00 and 08:00. A summary of the measured ambient noise levels is displayed in Table 3.1.

Table 3.1: Summary of Onshore Monitoring Results

Location	Time Period	LAeq	LA90
Littlehampton	Before	46.6	43.2
	During	50.1	42.1
	After	55.9	40.2
Worthing	Before (A)	55.4	45.9
	Before (B)	53.2	48.1
	During	51.8	47.4
	After	51.8	48.5
Shoreham	Before	48.0	45.8
	During	50.6	45.4
	After	48.0	45.1

3.2 Offshore Measurements

Attended measurements of piling rig noise levels were measured with a resolution of 1 minute from a boat at various distances from the rig. The results of the measurements at each distance are displayed in Table 3.2.

3.3 Attenuation Calculations

Noise levels from the piling rig activities will be greatly reduced when they reach the receptors on the seafront at the locations where monitoring has been undertaken. The reduction will be as a result of both distance attenuation and atmospheric absorption. Distance attenuation is calculated using the formula:

$$20 \times \log_{10} \left(\frac{R_2}{R_1} \right)$$

whilst the attenuation due to the atmosphere can be conservatively calculated as 3dB per kilometre.

The total attenuation at the receptors due to these factors is shown in Table 3.2.

Table 3.2: Offshore Monitoring and Attenuation

Time	Distance (d) of Offshore Measurement to Piling [m]	SPL Measured Offshore at Distance (d) [dBA]	Attenuation Via Distance (d) & Atmospheric Absorption / Resultant Calculated Noise Level at Onshore Receptor [dBA]							
			Littlehampton		Worthing A		Worthing B		Shoreham	
07:11:00	74	83.6	98.7	<0	85.9	<0	86.3	<0	95.7	<0
07:12:00	74	82.8	98.7	<0	85.9	<0	86.3	<0	95.7	<0
07:13:00	72	83.0	98.9	<0	86.2	<0	86.5	<0	96.0	<0
07:14:00	70	79.0	99.2	<0	86.4	<0	86.8	<0	96.2	<0
07:15:00	70	78.9	99.2	<0	86.4	<0	86.8	<0	96.2	<0
07:16:00	70	76.5	99.2	<0	86.4	<0	86.8	<0	96.2	<0
07:17:00	70	94.3	99.2	<0	86.4	7.9	86.8	7.5	96.2	<0
07:18:00	70	67.7	99.2	<0	86.4	<0	86.8	<0	96.2	<0
07:26:00	58	98.1	100.8	<0	88.1	10.1	88.4	9.7	97.8	0.3
07:27:00	50	98.4	102.1	<0	89.3	9.1	89.7	8.7	99.1	<0
07:29:00	39	91.4	104.2	<0	91.5	<0	91.9	<0	101.3	<0
07:32:00	228	72.9	88.9	<0	76.2	<0	76.5	<0	85.9	<0
07:33:00	209	72.6	89.7	<0	76.9	<0	77.3	<0	86.7	<0
07:35:00	242	73.9	88.4	<0	75.6	<0	76.0	<0	85.4	<0
07:36:00	245	70.5	88.3	<0	75.5	<0	75.9	<0	85.3	<0
07:39:00	563	61.9	81.1	<0	68.3	<0	68.7	<0	78.1	<0
07:41:00	606	62.7	80.4	<0	67.7	<0	68.0	<0	77.5	<0
07:47:00	686	64.1	79.3	<0	66.6	<0	67.0	<0	76.4	<0
07:48:00	722	62.9	78.9	<0	66.2	<0	66.5	<0	75.9	<0
07:49:00	722	61.6	78.9	<0	66.2	<0	66.5	<0	75.9	<0
07:50:00	761	78.5	78.4	0.1	65.7	12.8	66.1	12.5	75.5	3.0
08:00:00	2380	54.0	68.5	<0	55.8	<0	56.2	<0	65.6	<0

4 ASSESSMENT

Table 4.1 shows the maximum predicted noise level reached by the piling operation at each location, compared to the measured LA90 background noise level for the same time period.

Table 4.1: Comparison of noise levels

Location	Time [hh:mm]	Predicted Level at receptor [dBA]	LA90 [dBA]	Difference [dBA]
Littlehampton	07:50	0.1	42.5	-42.4
Worthing B	07:50	12.5	48.6	-36.1
Shoreham	07:50	3.0	44.8	-41.8

The table shows that that even at the loudest part of the piling operations, the noise at the receptors is well below the background level and can therefore be considered to be of no impact.

The consultants conducting the monitoring at the receptor locations all noted that the piling operations were inaudible at the locations during the works. This observation is backed up by the attenuation calculations, which demonstrate that the levels from the piling rig should be inaudible above the background noise at each location.

5 CONCLUSION

Provided that the piling technique to employed during construction of the wind turbine bases is similar to that used during construction of the met mast base, it can be concluded that there is no potential for offshore piling noise to cause disturbance to sensitive receptors onshore.

FIGURES

Figure 1 – Noise Monitoring and Piling Rig Locations

APPENDIX A

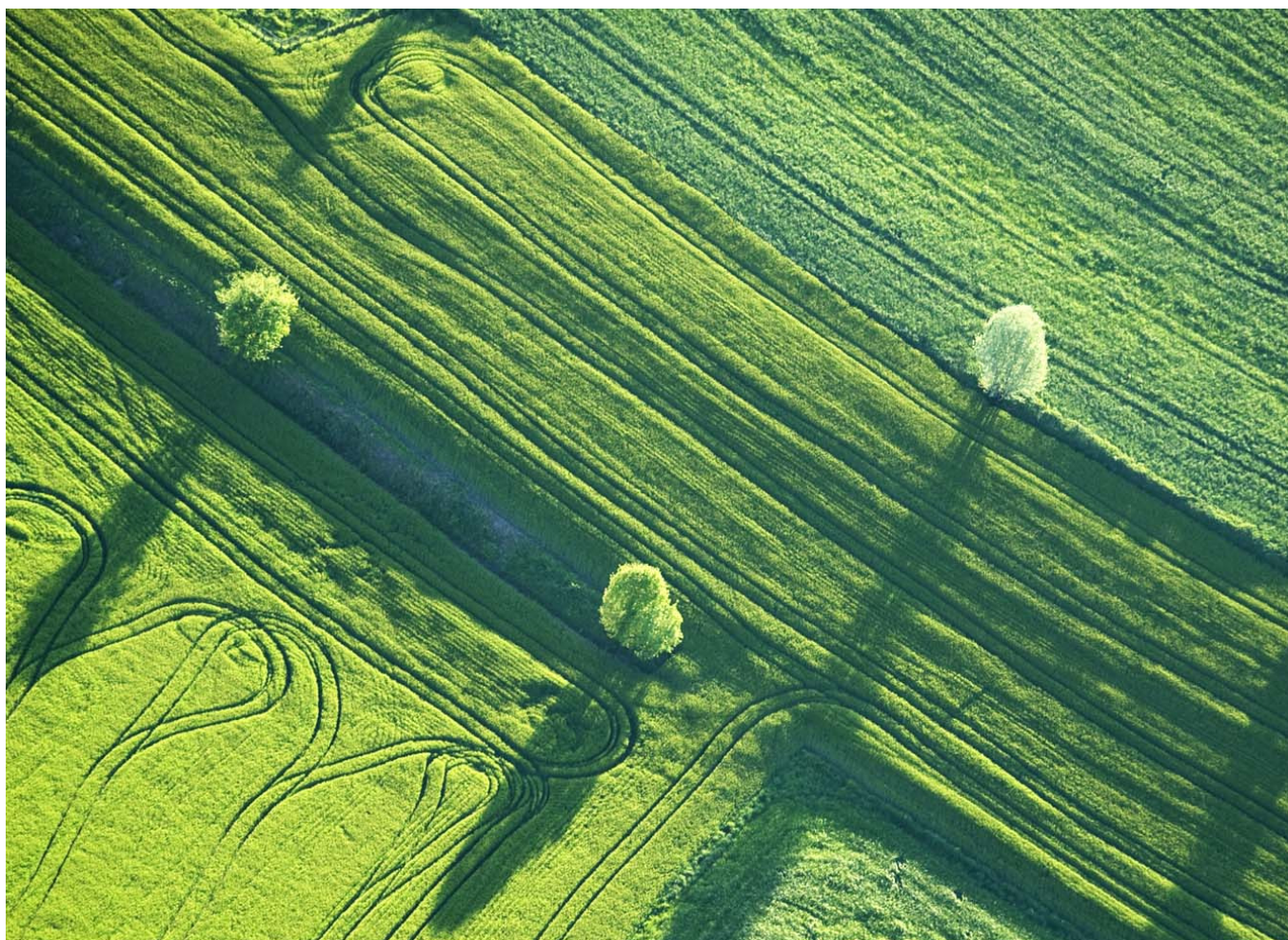
GRAPHS OF ONSHORE MONITORING DATA

APPENDIX B

OFFSHORE MONITORING DATA

Time	Range (m)	LAeq	LAFmax	LCpeak (max)	LAF1.00	LAF10.00	LAF90.00
07:00:00		65.8	69.1	99.6	68.6	67.1	65.0
07:01:00		66.0	71.0	99.0	70.4	67.1	65.1
07:02:00		65.9	70.4	99.2	69.6	67.6	64.7
07:03:00		65.0	72.3	93.4	66.4	65.4	64.4
07:04:00		65.2	68.8	97.4	67.3	65.6	64.6
07:05:00		66.4	77.8	101.1	70.4	68.0	64.6
07:06:00		65.9	80.1	101.4	74.3	68.3	60.3
07:07:00		62.5	73.1	95.1	67.9	63.4	60.6
07:08:00		67.9	74.3	101.7	71.0	69.9	65.0
07:09:00		64.0	65.6	93.1	65.0	64.6	63.3
07:10:00		65.8	72.5	100.9	71.9	68.2	63.5
07:11:00	74	83.6	101.6	119.5	98.9	68.6	58.5
07:12:00	74	82.8	102.4	119.5	97.7	71.3	58.4
07:13:00	72	83.0	99.9	116.9	97.8	77.8	58.5
07:14:00	70	79.0	96.6	113.9	93.4	77.4	57.6
07:15:00	70	78.9	96.1	113.1	93.9	72.3	57.0
07:16:00	70	76.5	94.8	110.5	90.6	75.0	55.8
07:17:00	70	94.3	103.0	119.6	101.8	98.9	80.2
07:18:00	70	67.7	90.5	113.8	82.3	60.6	56.0
07:19:00		60.2	81.0	101.1	72.0	60.0	53.7
07:20:00		68.0	74.7	102.3	70.8	70.1	60.6
07:21:00		64.5	68.4	97.9	67.7	65.0	63.6
07:22:00		65.0	69.8	99.8	68.6	66.9	63.8
07:23:00		64.8	67.6	99.8	67.1	66.4	63.5
07:24:00		64.6	67.5	99.1	67.1	65.0	63.9
07:25:00		74.9	97.7	114.6	85.9	66.1	63.6
07:26:00	58	98.1	105.3	123.0	104.3	102.2	87.7
07:27:00	50	98.4	106.6	124.4	105.5	102.4	88.2
07:28:00		95.6	106.2	124.4	105.0	100.4	80.7
07:29:00	39	91.4	98.4	117.8	97.6	95.8	79.1
07:30:00		87.7	95.7	114.0	94.3	92.4	76.8
07:31:00		77.0	84.7	104.4	83.7	81.0	67.6
07:32:00	228	72.9	79.9	98.2	78.4	76.7	63.5
07:33:00	209	72.6	79.8	97.9	78.2	76.8	62.1
07:34:00		72.9	84.0	102.6	78.6	77.1	61.6
07:35:00	242	73.9	79.8	103.4	78.9	77.2	63.0
07:36:00	245	70.5	75.9	100.2	74.8	73.2	67.3
07:37:00		67.2	75.5	103.4	74.0	71.1	55.1
07:38:00		63.3	70.0	88.6	68.9	67.3	54.2
07:39:00	563	61.9	68.0	87.9	67.0	65.8	54.2

Time	Range (m)	LAeq	LAFmax	LCpeak (max)	LAF1.00	LAF10.00	LAF90.00
07:40:00		62.0	68.2	90.1	67.3	66.0	54.3
07:41:00	606	62.7	81.4	106.8	68.4	66.0	53.7
07:42:00		61.9	73.4	93.3	69.3	66.0	53.0
07:43:00		63.1	73.0	92.6	70.3	67.1	54.1
07:44:00		65.3	73.4	92.7	72.5	69.6	54.7
07:45:00		64.2	71.8	91.1	70.9	68.6	53.4
07:46:00		62.9	69.5	90.8	68.8	67.2	52.4
07:47:00	686	64.1	79.1	97.9	71.1	67.9	52.6
07:48:00	722	62.9	72.1	90.5	70.1	67.3	50.9
07:49:00	722	61.6	69.7	90.7	68.6	65.9	50.8
07:50:00	761	78.5	83.3	109.1	82.9	81.8	68.1
07:51:00		79.8	84.1	107.8	83.5	82.5	65.7
07:52:00		82.4	84.0	107.3	83.6	83.1	81.6
07:53:00		82.0	84.0	107.4	83.5	82.9	81.1
07:54:00		63.9	74.4	101.9	73.9	67.4	42.0
07:55:00		50.4	60.1	90.4	58.3	54.9	41.3
07:56:00		57.5	63.9	93.9	62.4	59.9	53.8
07:57:00		54.4	61.0	91.0	59.6	57.6	48.5
07:58:00		53.5	59.9	91.0	58.5	56.4	48.5
07:59:00		51.3	64.1	87.3	56.2	53.6	47.0
08:00:00	2380	54.0	62.6	89.4	59.5	56.8	48.5



E.ON Climate & Renewables Ltd.

Noise Prediction Methodology

Appendix 27.3.

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RSK



RSK GENERAL NOTES

Project No.: P41318

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Author

Mark Evans

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Technical reviewer

Ian Holmes

Date:

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Glossary

1. Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level, which is measured on a logarithmic scale and expressed in decibels (dB). The logarithmic scale makes it easier to manage the large range of audible sound pressures, and also more closely represents the way the human ear responds to differences in sound pressure:

$$L_p = 20 \log_{10} (p/p_0)$$

where p = RMS (root mean square) sound pressure; and

p_0 = reference sound pressure 2×10^{-5} Pa.

2. Sound Power Level (L_W)

The sound power level is the sound power output of a source, also measured on a logarithmic scale and expressed in decibels (dB).

$$L_W = 10 \log_{10} (W/W_0)$$

where W = sound power; and

W_0 = reference sound power 1×10^{-12} W.

Sound power level can be calculated from a sound pressure level measured at a known distance from a sound source. For sound radiating uniformly and hemispherically from a point source on a flat reflecting surface such as hard ground, the equation is:

$$L_W = L_p + 20 \log_{10} r + 8 \quad L_W = L_p + 20 \log_{10} r + 8$$

where r = distance from the source in m.

3. Equivalent Continuous Sound Level (L_{eq})

Sound levels tend to fluctuate, and as such an 'instantaneous' measurement like sound pressure level cannot fully describe many real-world situations. A summation can be made of the measured sound energy over a certain period, and a notional steady level can be calculated which would contain the same total energy as the fluctuating sound. This notional level is termed the equivalent continuous sound level L_{eq} . L_{eq} can be determined over any time period, which is indicated as $L_{eq,T}$ where T is the time period (e.g. $L_{eq,24h}$).

In mathematical terms, for n discrete sound level measurements, L_{eq} is given by:

$$L_{eq,T} = 10 \log_{10} (t_1 \times 10^{L_1/10} + t_2 \times 10^{L_2/10} + \dots t_n \times 10^{L_n/10})/T$$

where t_1 = time at level L_1 dB;

t_2 = time at level L_2 dB;

and T = total time

4. Frequency Weighting Networks

Frequency weighting networks, which are generally built into sound level meters, attenuate the signal at some frequencies and amplify it at others. The A-weighting network approximately corresponds to human frequency response to sound. Sound levels measured with the A-weighting network are expressed in dB(A). Other weighting networks also exist, such as C-weighting which is nearly linear (i.e. unweighted) and other more specialised weighting networks. Variables such as L_p and L_{eq} that can be measured using such weightings are expressed as L_{Ap} / L_{Cp} , L_{Aeq} / L_{Ceq} etc.

5. Percentile or Statistical Levels (L_N)

Sometimes it is useful to calculate the level which is exceeded for a certain percent of a total period. Background noise is often defined as the A-weighted sound pressure level exceeded for 90% of the specified period T , expressed $L_{90,T}$. Road traffic noise is often characterised in terms of $L_{A10,18h}$.

1 NOISE PREDICTION METHODOLOGY

1.1 Introduction

- This document outlines the noise prediction methodology followed for the assessment of the operation of the onshore substation and offshore turbines associated with the proposed Rampion Offshore Wind Farm. This document forms Appendix 27.3 to *Section 27* of the Environmental Statement and should be read alongside this section, which also presents elements of the noise prediction methodology.

1.2 Operational Predictions –Receptor Points

1.2.1 Onshore Substation

Receptor points have been identified that may be affected by the operation of the Onshore Substation. These are detailed in Table 1.

Name	ID	Height (m)	Coordinates (m)	
			X	Y
Twineham Court Farm	R1	4.5	524485.66	120813.94
The Coach House	R2	4.5	524583.67	120622.35
Coombe Farm	R3	4.5	524910.16	120725.67
Coombe House	R4	4.5	524796.26	121490.70
Receptor to North	R5	4.5	524449.85	121692.12
Eastridge Lodge	R6	4.5	524089.18	121804.20
Farm to West	R7	4.5	523767.22	121584.13
Residence to south-west	R8	4.5	523852.82	121315.99
Woodpeckers / Downsview	R9	4.5	524753.07	120608.32

Table 1 Receptor points for Onshore Substation model

Receptor points have been identified which are considered to represent the shoreline that may be affected by the operation of the Offshore Turbines have been identified in Table 2.

Name	Height (m)	Coordinates (m)	
		X	Y
Worthing	4.5	515786.7	102668.0
Littlehampton	4.5	502656.0	101546.1
Brighton	4.5	533693.5	103449.9
Peacehaven	4.5	541769.5	100551.9
Newhaven	4.5	543946.7	100116.8
Sleaford	4.5	550784.0	97375.35

Table 2 Receptor points for Offshore Turbine models

1.3 Operational Predictions – Onshore Substation

1.3.1 Prediction Method

Modelling of the onshore substation for the Rampion Offshore Wind Farm development has been undertaken using CadnaA noise modelling software, which incorporates prediction methodology within ISO 9613: 1993 Acoustics - Attenuation of sound during propagation outdoors. The ISO 9613 method predicts a long-term equivalent continuous A-weighted sound pressure level (L_{Aeq}) under meteorological conditions favourable to propagation at distances from a variety of sources of known emission. The method is defined for octave bands for 63 Hz to 8 kHz.

1.3.2 Prediction parameters

The model assumes downwind propagation. The following parameters have been used within the modelling:

- No screening considered due to the flatness of the land surrounding the substation;
- 0.1 absorption coefficient on site ground assuming concrete and 0.7 absorption coefficient outside of site as per Datakustik methodology for fields/grassland/arable; and
- Temperature of 10°C and humidity of 70% for worst case sound propagation.

1.3.3 Noise Source Parameters

The following section describes the noise sources as they have been modelled within the CadnaA computer noise model representing the main noise emitting plant for an onshore substation of the type proposed for the Rampion Offshore Wind Farm development. Sources of data used in the modelling were as follows:

- Super Grid Transformer x 4
- Auxiliary Transformer x 4
- Reactor x 12
- STATCOM unit x 4
- Harmonic Filter Compound x 4
- Cooling Units (Transformers and STATCOM) x 12

Each source has been modeled using the indicative frequency spectrum shown in Table 3. The indicative spectrum was considered to represent a reasonable worst case assumption of low frequency dominance in the 125 Hz octave band. A full list of the individual point sources used within the model is presented in Table 4. Heights for point sources were based on 3/4 height of equipment.

Point Source	Octave Band (Hz) Sound Levels, dB(A)									Broadband Total, dB(A)
	31.5	63	125	250	500	1000	2000	4000	8000	
STATCOM	76.6	78.6	80.6	72.6	56.6	50.6	50.6	48.6	46.6	84.0
SGT	82.6	84.6	86.6	78.6	62.6	56.6	56.6	54.6	52.6	90.0
Filter	83.6	85.6	87.6	79.6	63.6	57.6	57.6	55.6	53.6	91.0
Aux Transformer	82.6	84.6	86.6	78.6	62.6	56.6	56.6	54.6	52.6	90.0
30 MV Reactor	70.6	72.6	74.6	66.6	50.6	44.6	44.6	42.6	40.6	78.0
15 MV Reactor	70.6	72.6	74.6	66.6	50.6	44.6	44.6	42.6	40.6	78.0
Cooling	67.6	69.6	71.6	63.6	47.6	41.6	41.6	39.6	37.6	75.0

Table 3 Model spectrum noise levels for substation sources

Name	With mitigation correction (dBA)	Height (m)	Coordinates (m)	
			X	Y
STATCOM	-15	4	524543.67	121024.8
STATCOM	-15	4	524484.23	121042.5
STATCOM	-15	4	524572.78	121017.1
STATCOM	-15	4	524622.92	121002.9
SGT	-25	3.5	524386.02	121024.3
SGT	-25	3.5	524428.7	121010.3
SGT	-25	3.5	524536.82	120978.6
SGT	-25	3.5	524579.52	120964.9
Filter	-20	4	524338.23	121022
Filter	-20	4	524467.22	120983.6
Filter	-20	4	524489.87	120976.3
Filter	-20	4	524619.51	120936.2
Aux Transformer	-25	3.5	524506.25	121029.5
Aux Transformer	-25	3.5	524414.75	121057.7
Aux Transformer	-25	3.5	524634.12	121022.9
Aux Transformer	-25	3.5	524608.14	121056.5
Reactor	-15	3	524351.27	121045.9
Reactor	-15	3	524470.14	121010.7
Reactor	-15	3	524502.08	121000.2
Reactor	-15	3	524621.36	120963.8
Reactor	-15	3	524434.52	121054.6
Reactor	-15	3	524446.39	121051.4
Reactor	-15	3	524534	121054.3
Reactor	-15	3	524545.56	121051.7
Reactor	-15	3	524588.24	121051.1
Reactor	-15	3	524585.35	121040.8
Reactor	-15	3	524632.53	121054
Reactor	-15	3	524629.32	121043.7
Cooling	0	6	524571.44	120967.8
Cooling	0	6	524545.36	120975.9
Cooling	0	6	524419.81	121013.2
Cooling	0	6	524395.08	121021.2
Cooling	0	6	524627.15	121001.7
Cooling	0	6	524577.42	121015.8
Cooling	0	6	524639.4	121021.5
Cooling	0	6	524614.03	121054.3
Cooling	0	6	524548.11	121024
Cooling	0	6	524510.62	121028.8
Cooling	0	6	524418.75	121056.8
Cooling	0	6	524488.4	121041.2

Table 4 Substation sources used in model

1.4 Operational Predictions – Offshore Turbines

1.4.1 Prediction Method

Modelling of the offshore turbines for the Rampion Offshore Wind Farm development has been undertaken using CadnaA noise modelling software, which incorporates prediction methodology within ISO 9613: 1993 Acoustics - Attenuation of sound during propagation outdoors. The ISO 9613 method predicts a long-term equivalent continuous A-weighted sound pressure level (L_{Aeq}) under meteorological conditions favourable to propagation at distances from a variety of sources of known emission. The method is defined for octave bands for 63 Hz to 8 kHz.

1.4.2 Prediction parameters

The model assumes downwind propagation. The following parameters have been used within the modelling:

- Ground absorption for the models is set to 0 to account for the reflective nature of the surface of the water.
- Temperature of 10°C and humidity of 70% for worst case sound propagation.

1.4.3 Noise Source Parameters

The following section describes the noise source data used within the CadnaA computer noise model. A sound power level of 112 dB(A) at a 10m high 10 m/s wind speed has been provided by Vestas Wind Systems Ltd for the V164-7MW (Vestas, 0011-5675 V00). The Vestas V164 had not been tested at the time of writing and therefore it was necessary to utilise an indicative sound spectrum. The sound spectrum for the Vestas V90-3MW turbine was used as a basis for the shape of the spectrum, with decibels added to each octave band frequency to bring the total noise level up to 112 dB(A).

The same spectrum has been used for the 3MW turbine in options E-F but with shape decreased in order for the total to equal the Vestas 112 3MW sound power level at 10 m/s of 106.5 dB(A).

The resulting sound power level used for the V164-7MW and V112-3MW is set out in Table 5.

Point Source	Octave Band (Hz) Sound Levels, dB(A)									Broadband Total, dB(A)
	31.5	63	125	250	500	1000	2000	4000	8000	
V164	93.6	99.1	100.5	103.6	105	106.7	103.0	100.2	97.0	112.0
V112	88.0	93.5	94.9	98.0	99.4	101.4	97.4	94.4	91.4	106.5

Table 5 Model spectrum for turbine sources

Location and height data for each of the modeled options A-H are provided in Tables 6-13. Options A-D use V90 spectrum data. Options E-H use V112 spectrum data

Turbine sources for option A were modeled using 7 MW turbines, spectrum data V90.

Height (m)	Coordinates (m)	
	X	Y
107	515578.4	88708.48
107	518093.8	89363.55
107	520609.2	90018.63
107	523125.1	90673.27
107	516962.1	88552.29
107	519477.5	89207.35
107	521992.9	89862.42
107	524508.9	90516.98
107	515830.3	87741.02
107	518345.7	88396.09
107	520861.1	89051.15
107	523376.5	89706.22
107	525891.9	90361.28
107	517214	87584.85
107	519729.4	88239.89
107	522244.8	88894.96
107	524760.2	89550.03
107	527275.6	90205.1
107	516082.3	86773.56
107	518597.7	87428.64
107	521113.1	88083.71
107	523628.5	88738.77
107	526143.9	89393.84
107	528659.2	90048.88
107	517465.9	86617.37
107	519981.4	87272.44
107	522496.8	87927.5
107	525012.1	88582.56
107	527527.5	89237.64
107	516334.2	85806.08
107	518849.6	86461.18
107	521365	87116.25
107	523880.4	87771.3
107	526395.8	88426.37
107	528911.2	89081.44
107	517717.9	85649.9
107	520233.3	86304.98
107	522748.7	86960.05

Height (m)	Coordinates (m)	
	X	Y
107	525264.1	87615.11
107	527779.5	88270.17
107	530294.8	88925.23
107	516586.2	84838.61
107	519101.6	85493.72
107	521617	86148.78
107	524132.4	86803.86
107	526647.8	87458.91
107	529163.1	88113.98
107	531678.5	88769.04
107	517969.9	84682.42
107	520485.3	85337.52
107	523000.7	85992.59
107	525516	86647.66
107	528031.4	87302.72
107	530546.8	87957.78
107	533062.1	88612.85
107	516838.1	83871.13
107	519353.5	84526.23
107	521869	85181.33
107	524384.3	85836.41
107	526899.7	86491.49
107	529415.1	87146.55
107	531930.4	87801.59
107	534445.8	88456.65
107	518221.8	83714.95
107	520737.2	84370.06
107	523252.6	85025.14
107	525768	85680.22
107	528283.4	86335.28
107	530798.7	86990.35
107	533314.1	87645.39
107	517090.1	82903.68
107	519605.5	83558.76
107	522120.9	84213.86
107	524636.3	84868.96
107	527151.7	85524.03
107	529667	86179.11
107	532182.4	86834.15
107	534697.7	87489.21
107	523504.6	84057.68
107	526019.9	84712.77

Height (m)	Coordinates (m)	
	X	Y
107	528535.3	85367.82
107	531050.7	86022.92
107	533566	86677.95
107	536081.4	87333.02
107	524888.2	83901.49
107	527403.6	84556.59
107	529919	85211.66
107	532434.3	85866.71
107	534949.7	86521.76
107	537465.6	87176.32
107	523756.5	83090.2
107	526271.9	83745.31
107	528787.3	84400.38
107	531302.6	85055.46
107	533818	85710.52
107	536333.3	86365.59
107	525140.2	82934.03
107	527655.6	83589.12
107	535201.6	85554.34
107	537716.9	86209.39

Table 6 Turbine sources used in model option A

Turbine sources for option B were modeled using 7 MW turbines, spectrum data V90.

Height (m)	Coordinates (m)	
	X	Y
107	515578.4	88708.48
107	516710.3	89003.27
107	517842.2	89298.05
107	518974.2	89592.83
107	520106.1	89887.62
107	521238	90182.39
107	522370.9	90476.44
107	523502	90771.88
107	524635.7	91065.23
107	515873.2	87576.56
107	517005.1	87871.35
107	518137	88166.12
107	519269	88460.89
107	520400.9	88755.67
107	521532.8	89050.45
107	522664.8	89345.23
107	523796.7	89640.02

Height (m)	Coordinates (m)	
	X	Y
107	524928.6	89934.8
107	526060.5	90229.58
107	527192.5	90524.32
107	516167.9	86444.6
107	517299.9	86739.41
107	518431.8	87034.2
107	519563.7	87328.97
107	520695.7	87623.76
107	521827.6	87918.53
107	522959.5	88213.32
107	524091.4	88508.08
107	525223.4	88802.86
107	526355.3	89097.66
107	527487.2	89392.43
107	528619.1	89687.2
107	516462.7	85312.67
107	517594.7	85607.47
107	518726.6	85902.26
107	519858.5	86197.06
107	520990.5	86491.83
107	522122.4	86786.6
107	523254.3	87081.39
107	524386.2	87376.16
107	525518.2	87670.92
107	526650.1	87965.72
107	527782	88260.49
107	528913.9	88555.29
107	530045.8	88850.06
107	531177.7	89144.83
107	516757.5	84180.73
107	517889.5	84475.53
107	519021.4	84770.31
107	520153.3	85065.12
107	521285.2	85359.9
107	522417.2	85654.68
107	523549.1	85949.48
107	524681	86244.25
107	525812.9	86539.03
107	526944.8	86833.81
107	528076.8	87128.58
107	529208.7	87423.37
107	530340.6	87718.14

Height (m)	Coordinates (m)	
	X	Y
107	531472.5	88012.91
107	532604.4	88307.7
107	533736.3	88602.47
107	517052.3	83048.81
107	518184.2	83343.58
107	519316.2	83638.38
107	520448.1	83933.17
107	521580	84227.96
107	522712	84522.75
107	523843.9	84817.55
107	524975.8	85112.34
107	526107.7	85407.12
107	527239.6	85701.91
107	528371.5	85996.67
107	529503.5	86291.48
107	530635.4	86586.25
107	531767.3	86881.02
107	532899.2	87175.78
107	534031.1	87470.55
107	535163	87765.34
107	523006.8	83390.83
107	524138.7	83685.61
107	525270.6	83980.41
107	526402.5	84275.21
107	527534.4	84569.98
107	528666.3	84864.76
107	529798.2	85159.55
107	530930.1	85454.34
107	532062.1	85749.1
107	533194	86043.87
107	534325.9	86338.66
107	535457.8	86633.42
107	536589.7	86928.21
107	537722.4	87222.26
107	523301.5	82258.9
107	524433.4	82553.68
107	525565.4	82848.47
107	526697.3	83143.26
107	536884.4	85796.34
107	538016.4	86091.09
107	539148.5	86385.63

Table 7 Turbine sources used in model option B

Turbine sources for option C were modeled using 7 MW turbines, spectrum data V90.

Height (m)	Coordinates (m)	
	X	Y
107	515578.4	88708.48
107	517803.5	89287.96
107	520028.7	89867.46
107	522254.6	90446.34
107	524480.5	91025.18
107	516799.3	88582.22
107	519024.5	89161.7
107	521249.6	89741.18
107	523474.8	90320.63
107	525700.2	90899.91
107	515795.1	87876.46
107	518020.2	88455.95
107	520245.4	89035.43
107	522470.6	89614.92
107	524695.7	90194.36
107	517016	87750.21
107	519241.1	88329.68
107	521466.3	88909.16
107	523691.5	89488.64
107	525916.6	90068.14
107	516011.7	87044.45
107	518236.9	87623.95
107	520462.1	88203.41
107	522687.2	88782.9
107	524912.4	89362.38
107	527137.5	89941.86
107	517232.6	86918.2
107	519457.8	87497.67
107	521683	88077.16
107	523908.1	88656.63
107	526133.3	89236.12
107	528358.4	89815.59
107	516228.4	86212.41
107	518453.6	86791.93
107	520678.7	87371.42
107	522903.9	87950.88
107	525129	88530.36
107	527354.2	89109.84
107	529579.3	89689.33
107	517449.3	86086.17
107	519674.5	86665.66

Height (m)	Coordinates (m)	
	X	Y
107	521899.7	87245.14
107	524124.8	87824.62
107	526350	88404.09
107	528575.1	88983.58
107	530800.2	89563.04
107	516445.1	85380.39
107	518670.3	85959.91
107	520895.4	86539.4
107	523120.6	87118.87
107	525345.7	87698.34
107	527570.9	88277.83
107	529796	88857.31
107	517666	85254.15
107	519891.2	85833.65
107	522116.4	86413.12
107	524341.5	86992.61
107	526566.6	87572.08
107	528791.8	88151.57
107	531016.9	88731.04
107	516661.8	84548.37
107	518886.9	85127.88
107	521112.1	85707.38
107	523337.3	86286.88
107	525562.4	86866.34
107	527787.5	87445.82
107	530012.7	88025.3
107	532237.8	88604.79
107	517882.7	84422.11
107	520107.9	85001.63
107	522333	85581.11
107	524558.2	86160.61
107	526783.3	86740.1
107	529008.4	87319.56
107	531233.6	87899.03
107	533458.7	88478.51
107	516878.4	83716.34
107	519103.6	84295.84
107	521328.8	84875.35
107	523553.9	85454.86
107	525779.1	86034.34
107	528004.2	86613.83
107	530229.3	87193.31

Height (m)	Coordinates (m)	
	X	Y
107	532454.5	87772.76
107	534679.6	88352.24
107	518099.4	83590.08
107	520324.5	84169.6
107	522549.7	84749.1
107	524774.8	85328.6
107	527000	85908.09
107	529225.1	86487.57
107	531450.2	87067.05
107	533675.4	87646.51
107	535900.9	88225.66
107	517095.1	82884.34
107	519320.3	83463.83
107	521545.5	84043.34
107	523770.6	84622.85
107	525995.8	85202.35
107	518316.1	82758.07

Table 8 Turbine sources used in model option C

Turbine sources for option D were modeled using 7 MW turbines, spectrum data V90.

Height (m)	Coordinates (m)	
	X	Y
107	515578.4	88708.48
107	516691	88998.23
107	517803.5	89287.96
107	518916.1	89577.72
107	520028.7	89867.46
107	521141.3	90157.2
107	522254.6	90446.34
107	523366.7	90736.47
107	524480.5	91025.18
107	515795.1	87876.46
107	516907.6	88166.21
107	518020.2	88455.95
107	519132.8	88745.69
107	520245.4	89035.43
107	521358	89325.17
107	522470.6	89614.92
107	523583.1	89904.64
107	524695.7	90194.36
107	525808.3	90484.08
107	516011.7	87044.45

Height (m)	Coordinates (m)	
	X	Y
107	517124.3	87334.21
107	518236.9	87623.95
107	519349.5	87913.67
107	520462.1	88203.41
107	521574.7	88493.15
107	522687.2	88782.9
107	523799.8	89072.64
107	524912.4	89362.38
107	526025	89652.13
107	527137.5	89941.86
107	528250.1	90231.59
107	516228.4	86212.41
107	517341	86502.18
107	518453.6	86791.93
107	519566.2	87081.66
107	520678.7	87371.42
107	521791.3	87661.16
107	522903.9	87950.88
107	524016.5	88240.62
107	525129	88530.36
107	526241.6	88820.1
107	527354.2	89109.84
107	528466.8	89399.58
107	529579.3	89689.33
107	516445.1	85380.39
107	517557.7	85670.16
107	518670.3	85959.91
107	519782.8	86249.66
107	520895.4	86539.4
107	522008	86829.13
107	523120.6	87118.87
107	524233.1	87408.61
107	525345.7	87698.34
107	526458.3	87988.09
107	527570.9	88277.83
107	528683.4	88567.58
107	529796	88857.31
107	530908.5	89147.04
107	516661.8	84548.37
107	517774.4	84838.13
107	518886.9	85127.88
107	519999.5	85417.64

Height (m)	Coordinates (m)	
	X	Y
107	521112.1	85707.38
107	522224.7	85997.11
107	523337.3	86286.88
107	524449.8	86576.62
107	525562.4	86866.34
107	526675	87156.09
107	527787.5	87445.82
107	528900.1	87735.56
107	530012.7	88025.3
107	531125.2	88315.03
107	532237.8	88604.79
107	533350.3	88894.52
107	516878.4	83716.34
107	517991	84006.08
107	519103.6	84295.84
107	520216.2	84585.62
107	521328.8	84875.35
107	522441.4	85165.1
107	523553.9	85454.86
107	524666.5	85744.61
107	525779.1	86034.34
107	526891.6	86324.09
107	528004.2	86613.83
107	529116.8	86903.58
107	530229.3	87193.31
107	531341.9	87483.04
107	532454.5	87772.76
107	533567	88062.51
107	534679.6	88352.24
107	517095.1	82884.34
107	518207.7	83174.08
107	519320.3	83463.83
107	520432.9	83753.59
107	521545.5	84043.34
107	522658.1	84333.09
107	523770.6	84622.85
107	524883.2	84912.59
107	525995.8	85202.35

Table 9 Turbine sources used in model option D

Turbine sources for option E were modeled using 3 MW turbines, spectrum data V112.

Height (m)	Coordinates (m)	
	X	Y
94	515578.4	88708.48
94	517513.3	89212.37
94	519448.2	89716.29
94	521383.2	90220.15
94	523318.4	90723.82
94	516640.3	88597.64
94	518575.2	89101.53
94	520510.2	89605.43
94	522445.1	90109.33
94	524380.7	90612.66
94	515767.3	87982.88
94	517702.3	88486.79
94	519637.2	88990.68
94	521572.1	89494.58
94	523507	89998.47
94	525442.2	90502.14
94	516829.3	87872.05
94	518764.2	88375.93
94	520699.1	88879.82
94	522634.1	89383.73
94	524569	89887.64
94	526503.9	90391.52
94	515956.3	87257.29
94	517891.2	87761.21
94	519826.2	88265.08
94	521761.1	88768.98
94	523696	89272.88
94	525630.9	89776.79
94	527565.8	90280.65
94	517018.2	87146.45
94	518953.2	87650.34
94	520888.1	88154.25
94	522823	88658.14
94	524757.9	89162.04
94	526692.8	89665.93
94	528627.7	90169.82
94	516145.2	86531.68
94	518080.2	87035.61
94	520015.1	87539.5
94	521950	88043.4
94	523885	88547.28
94	525819.9	89051.19

Height (m)	Coordinates (m)	
	X	Y
94	527754.8	89555.08
94	517207.2	86420.84
94	519142.1	86924.76
94	521077.1	87428.66
94	523012	87932.54
94	524946.9	88436.43
94	526881.8	88940.33
94	528816.7	89444.24
94	516334.2	85806.08
94	518269.1	86310.01
94	520204.1	86813.91
94	522139	87317.8
94	524073.9	87821.69
94	526008.8	88325.59
94	527943.7	88829.49
94	529878.6	89333.38
94	517396.2	85695.25
94	519331.1	86199.17
94	521266	86703.07
94	523200.9	87206.96
94	525135.9	87710.84
94	527070.8	88214.74
94	529005.7	88718.64
94	530940.5	89222.52
94	516523.2	85080.48
94	518458.1	85584.41
94	520393.1	86088.31
94	522328	86592.2
94	524262.9	87096.12
94	526197.8	87599.99
94	528132.7	88103.89
94	530067.6	88607.79
94	532002.5	89111.69
94	517585.1	84969.65
94	519520.1	85473.56
94	521455	85977.47
94	523389.9	86481.37
94	525324.8	86985.26
94	527259.7	87489.15
94	529194.6	87993.05
94	531129.5	88496.94
94	516712.1	84354.87

Height (m)	Coordinates (m)	
	X	Y
94	518647.1	84858.8
94	520582	85362.71
94	522516.9	85866.61
94	524451.8	86370.53
94	526386.7	86874.41
94	528321.7	87378.31
94	530256.5	87882.19
94	532191.4	88386.1
94	517774.1	84244.03
94	519709	84747.96
94	521644	85251.87
94	523578.9	85755.78
94	525513.8	86259.68
94	527448.7	86763.57
94	529383.6	87267.48
94	531318.5	87771.35
94	533253.4	88275.25
94	516901.1	83629.27
94	518836.1	84133.19
94	520771	84637.12
94	522705.9	85141.02
94	524640.8	85644.94
94	526575.7	86148.84
94	528510.6	86652.74
94	530445.5	87156.63
94	532380.4	87660.51
94	534315.3	88164.39
94	517963.1	83518.43
94	519898	84022.35
94	521832.9	84526.27
94	523767.8	85030.18
94	525702.7	85534.1
94	527637.6	86038
94	529572.6	86541.91
94	531507.4	87045.78
94	533442.3	87549.66
94	535377.2	88053.55
94	517090.1	82903.68
94	519025	83407.59
94	520960	83911.52
94	522894.9	84415.43
94	524829.8	84919.35

Height (m)	Coordinates (m)	
	X	Y
94	526764.7	85423.25
94	528699.6	85927.14
94	530634.5	86431.06
94	532569.3	86934.92
94	534504.2	87438.82
94	536439.1	87942.72
94	518152.1	82792.84
94	520087	83296.75
94	523956.8	84304.59
94	525891.7	84808.51
94	527826.6	85312.4
94	529761.5	85816.31
94	531696.4	86320.2
94	533631.3	86824.07
94	535566.2	87327.97
94	523083.8	83689.83
94	525018.7	84193.75
94	526953.6	84697.65
94	528888.5	85201.55
94	530823.4	85705.48
94	532758.3	86209.34
94	534693.2	86713.23
94	536628.1	87217.12
94	524145.8	83579
94	526080.7	84082.92
94	528015.6	84586.82
94	529950.5	85090.72
94	531885.4	85594.62
94	533820.2	86098.5
94	535755.1	86602.39
94	537690.6	87105.77
94	523272.8	82964.23
94	525207.7	83468.16
94	527142.6	83972.06
94	529077.5	84475.97
94	531012.4	84979.89
94	532947.3	85483.77
94	534882.2	85987.67
94	536817	86491.56
94	524334.7	82853.39
94	526269.6	83357.31
94	528204.5	83861.23

Height (m)	Coordinates (m)	
	X	Y
94	530139.4	84365.13
94	532074.3	84869.04
94	534009.2	85372.93
94	535944.1	85876.83
94	537878.9	86380.7
94	523461.8	82238.65
94	525396.7	82742.55

Table 10 Turbine sources used in model option E

Turbine sources for option F were modeled using 3 MW turbines, spectrum data V112.

Height (m)	Coordinates (m)	
	X	Y
94	515578.4	88708.48
94	516429.7	88930.21
94	517281.1	89151.92
94	518132.5	89373.63
94	518983.9	89595.35
94	519835.2	89817.08
94	520686.6	90038.79
94	521538.1	90260.41
94	522390.2	90481.46
94	523241.1	90703.6
94	524092.8	90925
94	524945.2	91145.9
94	515800.1	87857.11
94	516651.5	88078.85
94	517502.8	88300.55
94	518354.2	88522.26
94	519205.6	88743.98
94	520056.9	88965.69
94	520908.3	89187.4
94	521759.7	89409.13
94	522611	89630.84
94	523462.4	89852.55
94	524313.8	90074.28
94	525165.3	90295.85
94	526016.5	90517.7
94	516021.8	87005.75
94	516873.2	87227.48
94	517724.5	87449.21
94	518575.9	87670.9
94	519427.3	87892.61

Height (m)	Coordinates (m)	
	X	Y
94	520278.6	88114.33
94	521130	88336.04
94	521981.4	88557.76
94	522832.7	88779.47
94	523684.1	89001.18
94	524535.5	89222.9
94	525386.8	89444.62
94	526238.2	89666.34
94	527089.5	89888.06
94	527940.9	90109.76
94	516243.5	86154.38
94	517094.9	86376.09
94	517946.3	86597.82
94	518797.6	86819.54
94	519649	87041.25
94	520500.4	87262.98
94	521351.7	87484.69
94	522203.1	87706.39
94	523054.5	87928.11
94	523905.8	88149.83
94	524757.2	88371.53
94	525608.5	88593.24
94	526459.9	88814.97
94	527311.3	89036.68
94	528162.6	89258.4
94	529014	89480.12
94	529865.3	89701.81
94	516465.2	85303
94	517316.6	85524.73
94	518168	85746.45
94	519019.4	85968.17
94	519870.7	86189.9
94	520722.1	86411.61
94	521573.5	86633.32
94	522424.8	86855.04
94	523276.2	87076.76
94	524127.5	87298.46
94	524978.9	87520.17
94	525830.3	87741.88
94	526681.6	87963.6
94	527533	88185.32
94	528384.3	88407.03

Height (m)	Coordinates (m)	
	X	Y
94	529235.7	88628.75
94	530087	88850.46
94	530938.4	89072.17
94	531789.7	89293.9
94	516687	84451.63
94	517538.3	84673.34
94	518389.7	84895.08
94	519241.1	85116.8
94	520092.4	85338.53
94	520943.8	85560.25
94	521795.2	85781.95
94	522646.5	86003.67
94	523497.9	86225.41
94	524349.3	86447.11
94	525200.6	86668.82
94	526052	86890.53
94	526903.3	87112.25
94	527754.7	87333.96
94	528606	87555.68
94	529457.4	87777.39
94	530308.7	87999.1
94	531160.1	88220.81
94	532011.4	88442.52
94	532862.8	88664.25
94	516908.7	83600.25
94	517760	83821.97
94	518611.4	84043.69
94	519462.8	84265.43
94	520314.2	84487.15
94	521165.5	84708.87
94	522016.9	84930.59
94	522868.3	85152.31
94	523719.6	85374.04
94	524571	85595.76
94	525422.3	85817.47
94	526273.7	86039.19
94	527125	86260.92
94	527976.4	86482.62
94	528827.8	86704.33
94	529679.1	86926.06
94	530530.5	87147.76
94	531381.8	87369.46

Height (m)	Coordinates (m)	
	X	Y
94	532233.2	87591.18
94	533084.5	87812.88
94	533935.9	88034.59
94	534787.2	88256.31
94	517130.4	82748.9
94	517981.8	82970.6
94	518833.1	83192.33
94	519684.5	83414.05
94	520535.9	83635.78
94	523090	84300.95
94	523941.3	84522.67
94	524792.7	84744.39
94	525644.1	84966.12
94	526495.4	85187.84
94	527346.8	85409.55
94	528198.1	85631.26
94	529049.5	85852.98
94	529900.8	86074.71
94	530752.2	86296.43
94	531603.5	86518.12
94	532454.9	86739.82
94	533306.2	86961.53
94	534157.6	87183.24
94	535008.9	87404.96
94	535860.3	87626.67
94	523311.7	83449.58
94	524163	83671.31
94	525014.4	83893.03
94	525865.8	84114.75
94	526717.1	84336.48
94	527568.5	84558.19
94	528419.8	84779.9
94	529271.2	85001.63
94	530122.5	85223.34
94	530973.9	85445.07
94	531825.2	85666.77
94	532676.6	85888.48
94	533527.9	86110.19
94	534379.3	86331.9
94	535230.6	86553.6
94	536082	86775.33
94	536933.4	86996.94

Height (m)	Coordinates (m)	
	X	Y
94	537785.6	87218
94	523533.4	82598.22
94	524384.8	82819.93
94	525236.1	83041.66
94	526087.5	83263.39
94	526938.8	83485.11
94	527790.2	83706.83
94	528641.6	83928.54
94	529492.9	84150.27
94	530344.3	84371.99
94	531195.6	84593.71
94	532047	84815.42
94	532898.3	85037.14
94	533749.6	85258.85
94	534601	85480.58
94	535452.3	85702.28
94	536303.7	85924
94	537155	86145.7
94	538006.4	86367.4

Table 11 Turbine sources used in model option F

Turbine sources for option G were modeled using 3 MW turbines, spectrum data V112.

Height (m)	Coordinates (m)	
	X	Y
94	515578.4	88708.48
94	517223.1	89136.8
94	518867.8	89565.12
94	520512.4	89993.44
94	522157.8	90421.23
94	523802.1	90849.78
94	516482.6	88608.23
94	518127.3	89036.52
94	519772	89464.85
94	521416.7	89893.16
94	523061.6	90321.3
94	524707.3	90748.76
94	515742.1	88079.63
94	517386.8	88507.94
94	519031.5	88936.25
94	520676.2	89364.58
94	522320.9	89792.9
94	523965.6	90221.16

Height (m)	Coordinates (m)	
	X	Y
94	525610.5	90649.3
94	516646.4	87979.39
94	518291.1	88407.68
94	519935.7	88835.99
94	521580.4	89264.3
94	523225.1	89692.62
94	524869.8	90120.93
94	526514.5	90549.24
94	515905.9	87450.8
94	517550.6	87879.1
94	519195.3	88307.4
94	520840	88735.71
94	522484.7	89164.04
94	524129.3	89592.35
94	525774	90020.67
94	527418.8	90448.89
94	516810.1	87350.53
94	518454.8	87778.83
94	520099.5	88207.14
94	521744.2	88635.46
94	523388.9	89063.78
94	525033.6	89492.08
94	526678.2	89920.39
94	516069.7	86821.93
94	517714.4	87250.26
94	519359.1	87678.57
94	521003.7	88106.89
94	522648.4	88535.19
94	524293.1	88963.49
94	525937.8	89391.81
94	527582.4	89820.13
94	516973.9	86721.68
94	518618.6	87149.98
94	520263.3	87578.3
94	521908	88006.61
94	523552.6	88434.93
94	525197.3	88863.23
94	526842	89291.55
94	528486.7	89719.86
94	516233.4	86193.07
94	517878.1	86621.4
94	519522.8	87049.72

Height (m)	Coordinates (m)	
	X	Y
94	521167.5	87478.04
94	522812.2	87906.35
94	524456.9	88334.65
94	526101.5	88762.97
94	527746.2	89191.28
94	529390.9	89619.58
94	517137.7	86092.82
94	518782.4	86521.14
94	520427	86949.46
94	522071.7	87377.76
94	523716.4	87806.08
94	525361.1	88234.37
94	527005.8	88662.69
94	528650.4	89091.02
94	530295.1	89519.31
94	516397.2	85564.22
94	518041.9	85992.54
94	519686.6	86420.87
94	521331.3	86849.19
94	522976	87277.5
94	524620.6	87705.79
94	526265.3	88134.11
94	527910	88562.43
94	529554.7	88990.75
94	531199.3	89419.04
94	517301.4	85463.96
94	518946.1	85892.29
94	520590.8	86320.61
94	522235.5	86748.92
94	523880.2	87177.24
94	525524.9	87605.53
94	527169.5	88033.84
94	528814.2	88462.16
94	530458.8	88890.46
94	516561	84935.37
94	518205.7	85363.7
94	519850.4	85792.03
94	521495.1	86220.34
94	523139.7	86648.66
94	524784.4	87076.95
94	526429.1	87505.26
94	528073.7	87933.58

Height (m)	Coordinates (m)	
	X	Y
94	529718.4	88361.9
94	531363.1	88790.2
94	517465.2	84835.1
94	519109.9	85263.43
94	520754.6	85691.75
94	522399.3	86120.07
94	524044	86548.4
94	525688.6	86976.69
94	527333.3	87405.01
94	528978	87833.32
94	530622.6	88261.62
94	532267.3	88689.93
94	516724.7	84306.5
94	518369.4	84734.83
94	520014.1	85163.17
94	521658.8	85591.49
94	523303.5	86019.82
94	524948.2	86448.12
94	526592.8	86876.43
94	528237.5	87304.74
94	529882.2	87733.06
94	531526.8	88161.35
94	533171.5	88589.67
94	517629	84206.24
94	519273.7	84634.58
94	520918.4	85062.91
94	522563	85491.22
94	524207.7	85919.55
94	525852.4	86347.85
94	527497.1	86776.18
94	529141.7	87204.49
94	530786.4	87632.78
94	532431	88061.09
94	534075.7	88489.4
94	516888.5	83677.65
94	518533.2	84105.96
94	520177.9	84534.31
94	521822.6	84962.63
94	523467.3	85390.97
94	525111.9	85819.28
94	526756.6	86247.6
94	528401.3	86675.91

Height (m)	Coordinates (m)	
	X	Y
94	530045.9	87104.24
94	531690.6	87532.51
94	533335.2	87960.82
94	534979.9	88389.13
94	517792.8	83577.38
94	519437.4	84005.71
94	521082.1	84434.05
94	522726.8	84862.38
94	524371.5	85290.71
94	526016.2	85719.02
94	527660.8	86147.33
94	529305.5	86575.66
94	530950.1	87003.95
94	532594.8	87432.25
94	534239.4	87860.56
94	517052.3	83048.81
94	518697	83477.12
94	520341.7	83905.46
94	521986.4	84333.79
94	523631	84762.12
94	525275.7	85190.44
94	526920.4	85618.76
94	517956.5	82948.54
94	519601.2	83376.86
94	522890.6	84233.53
94	524535.3	84661.86
94	526179.9	85090.18
94	517216.1	82419.96
94	518860.8	82848.28
94	523794.8	84133.28
94	525439.5	84561.6

Table 12 Turbine sources used in model option G

Turbine sources for option H were modeled using 3 MW turbines, spectrum data V112.

Height (m)	Coordinates (m)	
	X	Y
94	515578.4	88708.48
94	516400.7	88922.65
94	517223.1	89136.8
94	518045.4	89350.95
94	518867.8	89565.12
94	519690.1	89779.28

Height (m)	Coordinates (m)	
	X	Y
94	520512.4	89993.44
94	521334.8	90207.57
94	522157.8	90421.23
94	522980.1	90635.38
94	523802.1	90849.78
94	524626	91062.73
94	515771.2	88087.19
94	516593.5	88301.36
94	517415.9	88515.51
94	518238.2	88729.65
94	519060.6	88943.81
94	519882.9	89157.98
94	520705.2	89372.13
94	521527.6	89586.3
94	522349.9	89800.44
94	523172.3	90014.6
94	523994.7	90228.71
94	524817.5	90442.45
94	525639.5	90656.87
94	515934.9	87458.35
94	516757.3	87672.51
94	517579.6	87886.67
94	518402	88100.81
94	519224.3	88314.97
94	520046.7	88529.12
94	520869	88743.28
94	521691.3	88957.44
94	522513.7	89171.59
94	523336	89385.75
94	524158.4	89599.9
94	524980.7	89814.07
94	525803	90028.23
94	526625.4	90242.39
94	527447.8	90456.44
94	516098.7	86829.48
94	516921	87043.66
94	517743.4	87257.82
94	518565.7	87471.98
94	519388.1	87686.12
94	520210.4	87900.28
94	521032.8	88114.44
94	521855.1	88328.59

Height (m)	Coordinates (m)	
	X	Y
94	522677.5	88542.75
94	523499.8	88756.9
94	524322.1	88971.06
94	525144.5	89185.21
94	525966.8	89399.38
94	526789.1	89613.53
94	527611.5	89827.68
94	528433.8	90041.84
94	516262.4	86200.63
94	517084.8	86414.79
94	517907.1	86628.96
94	518729.5	86843.12
94	519551.8	87057.28
94	520374.2	87271.44
94	521196.5	87485.6
94	522018.9	87699.75
94	522841.2	87913.89
94	523663.5	88128.06
94	524485.9	88342.2
94	525308.2	88556.36
94	526130.6	88770.52
94	526952.9	88984.68
94	527775.2	89198.84
94	528597.6	89412.99
94	529419.9	89627.14
94	516426.2	85571.77
94	517248.6	85785.94
94	518070.9	86000.11
94	518893.3	86214.27
94	519715.6	86428.44
94	520538	86642.59
94	521360.3	86856.76
94	522182.7	87070.9
94	523005	87285.05
94	523827.3	87499.21
94	524649.7	87713.35
94	525472	87927.51
94	526294.3	88141.67
94	527116.7	88355.83
94	527939	88569.99
94	528761.3	88784.16
94	529583.7	88998.3

Height (m)	Coordinates (m)	
	X	Y
94	530406	89212.44
94	531228.3	89426.6
94	516590	84942.91
94	517412.4	85157.09
94	518234.7	85371.25
94	519057	85585.43
94	519879.4	85799.58
94	520701.7	86013.74
94	521524.1	86227.9
94	522346.4	86442.05
94	523168.8	86656.22
94	523991.1	86870.37
94	524813.4	87084.52
94	525635.8	87298.67
94	526458.1	87512.83
94	527280.4	87726.98
94	528102.8	87941.13
94	528925.1	88155.3
94	529747.4	88369.45
94	530569.7	88583.6
94	531392.1	88797.76
94	532214.4	89011.93
94	516753.8	84314.06
94	517576.1	84528.22
94	518398.5	84742.39
94	519220.8	84956.57
94	520043.2	85170.73
94	520865.5	85384.89
94	521687.8	85599.04
94	522510.2	85813.21
94	523332.5	86027.37
94	524154.9	86241.54
94	524977.2	86455.68
94	525799.5	86669.83
94	526621.9	86884
94	527444.2	87098.15
94	528266.5	87312.3
94	529088.9	87526.46
94	529911.2	87740.61
94	530733.5	87954.75
94	531555.8	88168.9
94	532378.2	88383.07

Height (m)	Coordinates (m)	
	X	Y
94	533200.5	88597.23
94	534022.8	88811.38
94	516917.5	83685.2
94	517739.9	83899.35
94	518562.2	84113.53
94	519384.6	84327.7
94	520206.9	84541.88
94	521029.3	84756.03
94	521851.6	84970.2
94	522674	85184.36
94	523496.3	85398.52
94	524318.6	85612.68
94	525141	85826.84
94	525963.3	86041
94	526785.6	86255.16
94	527608	86469.33
94	528430.3	86683.47
94	529252.6	86897.64
94	530075	87111.78
94	530897.3	87325.92
94	531719.6	87540.07
94	532541.9	87754.23
94	533364.3	87968.39
94	534186.6	88182.53
94	535008.9	88396.7
94	517081.3	83056.36
94	517903.7	83270.52
94	518726	83484.68
94	519548.4	83698.85
94	520370.7	83913.02
94	521193.1	84127.18
94	522015.4	84341.35
94	522837.7	84555.51
94	523660.1	84769.67
94	524482.4	84983.83
94	525304.7	85198.01
94	526127.1	85412.16
94	526949.4	85626.32
94	527771.7	85840.47
94	517245.1	82427.52
94	518067.5	82641.67
94	518889.8	82855.83

Height (m)	Coordinates (m)	
	X	Y
94	519712.1	83070

Table 13 Turbine sources used in model option H

1.4.4 Assessment Results

The results of the CadnaA predictions based on the L_w calculated through the methodology above were compared to project criteria. The results of this assessment are presented in *Section 27* of the Environmental Statement.