



APPENDIX 12-2

***NOISE MODELLING
ASSUMPTIONS & PARAMETERS***

APPENDIX 12-2. NOISE MODELLING PARAMETERS

Prediction calculations for turbine noise have been conducted in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation*, 1996. Guidance in terms of the calculation settings has been obtained from the *Institute of Acoustics (IOA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (2013) (IOA GPG) and its associated supplementary guidance notes. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Ground Effect:

Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation).

Noise predictions have been carried out using a source height corresponding to the hub height of the proposed turbines, a receiver height of 4m and a ground effect factor of G=0.5.

Geometrical Divergence

This term relates to the spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to the following equation:

$$A_{geo} = 10 \log(d) - 11 \text{ dB}$$

where d = distance from the source

A wind turbine may be considered as a point source beyond a distance corresponding to one rotor diameter.

Atmospheric Adsorption

Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies.

In accordance with the guidance set out in the IOA GPG for calculations, a temperature of 10°C and a relative humidity of 70% have been used, which give relatively low levels of atmosphere attenuation and corresponding worst case noise predictions.

Topographic Screening

In the IOA GPG, section 4.3.11 the following is stated: "*Topographic screening effects of the terrain (ISO 9613-2, Equation 12) should be limited to a reduction of no more than 2 dB, and then only if there is no direct line of sight between the highest point on the turbine rotor*

and the receiver location." The modelling software takes account of these limitations on the degree of screening from terrain. The "valley correction" from section 4.3.9 of the IOA GPG is also applied where relevant.

The atmospheric attenuation outlined in Table A12-1 were used for all calculations in accordance with the guidance outlined in the IOA GPG. No meteorological corrections were applied to all calculations.

Table A12-1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

Table A12-2 Coordinates (ITM) for Noise Sensitive Locations (NSLs)

House	Involved/C	ITMX	ITMY	House	Involved/C	ITMX	ITMY
H001	Derelict - Involved - 500m Setback	620,077	586,759	H155	Involved	622,404	590,180
H002	Involved - 500m Setback	619,444	586,208	H156		616,774	587,895
H003	Involved - 500m Setback	619,243	586,207	H157		616,809	587,943
H004		615,489	586,827	H158		623,083	588,139
H005		615,964	585,588	H159		618,939	584,464
H006		616,425	585,806	H160		614,477	584,984
H007		620,806	588,444	H161		616,377	584,911
H008		620,143	588,545	H162		617,464	583,934
H009		618,697	585,694	H163		617,021	588,238
H010		614,670	586,250	H164		621,718	590,550
H011		617,225	585,879	H165		616,631	584,474
H012		621,602	588,311	H166		623,258	587,922
H013		618,241	584,782	H167		617,556	583,895
H014		618,535	585,653	H168		615,101	584,679
H015		615,485	585,430	H169		618,996	584,462
H016		615,743	586,974	H170		617,211	583,995
H017		619,806	590,273	H171		623,348	587,751
H018		620,855	588,394	H172		616,055	584,789
H019		621,052	586,437	H173		617,645	583,848
H020		616,507	586,690	H174		622,858	589,912
H021		621,542	588,300	H175		622,775	590,018
H022		616,480	586,732	H176		620,798	585,682
H023		620,095	590,318	H177		620,868	585,658
H024		614,767	585,691	H178		623,030	589,657
H025		614,834	585,608	H179		617,508	588,558

H026		619,673	590,281	H180		622,764	590,065
H027	Involved - 500m Setback	621,557	586,458	H181		622,777	590,056
H028		621,991	589,680	H182		615,148	584,602
H029		618,600	587,874	H183		621,361	590,813
H030		615,814	587,032	H184		613,841	586,392
H031		614,644	585,892	H185		622,250	590,437
H032		619,540	586,012	H186		622,894	589,929
H033		621,388	589,934	H187		622,811	590,039
H034		619,855	590,322	H188		620,697	585,677
H035		617,178	585,779	H189		623,175	588,745
H036		621,069	588,267	H190		615,158	584,566
H037		621,289	586,367	H191		621,510	590,801
H038		621,158	586,355	H192		618,595	583,967
H039		618,572	587,916	H193		621,538	590,797
H040		617,625	587,828	H194		613,780	586,332
H041	Involved	619,597	588,793	H195		622,992	589,879
H042		616,544	586,780	H196		621,629	590,768
H043		619,718	590,353	H197		623,083	589,721
H044		616,500	586,845	H198		622,883	590,046
H045		620,070	590,400	H199		622,939	589,989
H046		614,779	585,554	H200		623,131	589,686
H047	Involved - 500m Setback	621,573	586,350	H201		621,580	590,825
H048		614,590	585,851	H202		615,231	584,486
H049	Involved – 540m Setback	620,840	590,278	H203		613,885	585,396
H050		616,542	586,826	H204		622,975	589,995
H051		614,944	585,392	H205		622,903	590,116
H052		618,459	584,793	H206		623,030	589,957
H053		616,805	586,343	H207		623,259	588,564
H054		621,209	588,179	H208		615,347	584,440
H055		620,096	590,462	H209		621,918	590,703
H056		621,355	586,282	H210		613,793	586,806
H057	Involved	615,722	585,336	H211		623,437	588,158
H058		619,985	590,437	H212		622,281	590,619
H059		621,455	590,032	H213		617,480	588,760
H060		619,634	585,890	H214		620,252	591,367
H061		617,265	587,696	H215		619,714	591,309
H062		618,973	585,613	H216		617,066	588,626
H063	Involved	621,242	590,176	H217	Involved	621,031	591,241
H064		618,376	587,925	H218		621,064	591,229
H065		620,102	590,501	H219		613,842	585,227
H066	Involved	614,468	585,996	H220	Involved	620,897	591,304

H067	Involved	620,662	590,466	H221		617,369	588,773
H068		619,534	588,623	H222		618,771	583,847
H069		619,995	590,474	H223		623,495	588,171
H070		619,747	588,552	H224		617,301	588,764
H071		622,409	586,190	H225		616,917	583,794
H072	Involved	619,849	585,912	H226		615,465	584,342
H073		619,485	588,647	H227		623,480	588,228
H074		622,346	586,139	H228		623,443	588,300
H075		619,810	585,874	H229		617,159	588,712
H076		618,895	589,620	H230		623,475	588,256
H077		620,465	586,422	H231		622,221	590,721
H078		615,989	587,239	H232		623,490	588,231
H079		619,977	590,524	H233		619,561	584,907
H080		616,114	587,244	H234		620,738	585,398
H081		620,410	590,611	H235		621,266	591,169
H082		614,762	585,332	H236		623,484	588,258
H083		614,375	585,945	H237		623,637	587,880
H084		620,518	590,616	H238		623,500	588,242
H085		620,568	590,609	H239		618,816	583,830
H086		619,977	590,579	H240		617,086	588,703
H087		622,337	586,054	H241		623,497	588,253
H088	Involved	620,472	590,632	H242		623,523	588,206
H089		615,406	585,108	H243		623,515	588,243
H090		622,790	587,888	H244		623,524	588,237
H091		616,861	585,867	H245		613,790	585,179
H092		623,064	587,052	H246		613,779	587,068
H093		614,336	586,066	H247		623,539	588,233
H094		620,363	590,669	H248		613,630	586,770
H095		617,801	584,294	H249		623,532	588,261
H096		616,920	584,777	H250		623,599	588,111
H097		618,189	584,349	H251		623,546	588,240
H098	Involved	619,821	590,639	H252		623,540	588,253
H099		620,480	590,697	H253		613,776	585,150
H100	Involved	619,917	590,643	H254		620,705	585,327
H101		619,402	585,684	H255		617,148	588,787
H102		617,423	588,065	H256		622,208	585,159
H103		619,303	585,648	H257		618,806	583,740
H104		620,293	590,723	H258		622,273	585,152
H105		614,793	585,175	H259		621,557	591,114
H106		617,010	587,749	H260		623,573	588,269
H107		622,113	590,037	H261		623,679	588,009
H108		616,964	587,713	H262		621,751	591,043
H109		620,206	590,757	H263		623,290	585,588
H110		614,815	585,110	H264	Involved	623,274	590,014
H111		620,457	590,776	H265		623,333	589,911
H112		620,147	590,770	H266		623,228	585,528
H113		621,557	590,300	H267		613,741	587,156

H114	Involved - 500m Setback	618,659	588,676	H268		622,114	590,881
H115		622,069	590,100	H269		616,825	583,692
H116		623,219	586,973	H270		623,957	586,802
H117		622,652	589,638	H271		616,923	588,764
H118		623,001	587,852	H272		622,748	590,638
H119		618,573	584,403	H273		613,724	585,013
H120		623,247	586,900	H274		622,088	590,948
H121		616,135	585,088	H275		622,049	590,970
H122		614,851	585,012	H276		618,962	583,717
H123		620,998	590,663	H277		623,450	585,617
H124		622,808	589,469	H278		620,284	584,923
H125		619,029	585,051	H279		613,730	584,970
H126		614,872	584,972	H280		622,312	590,909
H127		619,314	585,422	H281		619,128	591,439
H128		622,871	589,322	H282		623,621	585,779
H129		616,820	587,738	H283		621,968	591,053
H130		614,987	584,909	H284		616,944	588,855
H131		622,870	589,424	H285		623,709	588,286
H132		614,169	586,621	H286		622,072	591,003
H133		623,328	586,907	H287		623,154	585,325
H134		615,284	584,832	H288		623,576	585,681
H135		619,899	590,854	H289		615,648	584,099
H136		614,178	585,589	H290		620,575	585,010
H137		622,636	589,863	H291		616,370	583,885
H138		622,181	590,204	H292		622,767	590,739
H139		616,573	584,900	H293		620,155	591,689
H140		622,413	590,092	H294		615,772	584,096
H141		614,135	586,625	H295		623,556	589,827
H142		623,289	586,551	H296		619,052	583,624
H143		617,575	588,381	H297		617,009	589,052
H144		622,617	589,940	H298		616,463	588,722
H145		621,330	590,614	H299		617,086	589,153
H146		622,995	588,915	H300	Involved - 500m Setback	619,331	589,459
H147		616,543	584,872	H301	Derelict	614,833	586,313
H148		616,703	587,712	H302	Derelict	615,375	586,678
H149		622,581	590,012	H303		619,199	584,469
H150	Involved	616,636	587,588	H304		620,695	585,136
H151		616,550	584,816	H305		620,720	585,343
H152		621,278	590,662	H306		621,438	591,070
H153		622,158	590,291	H307		615,654	587,138
H154		618,206	588,531				

Table A12-3 below show the NSL list at proximity of the Proposed Grid Connection.

Table A12-3 Noise Sensitive Locations near the Proposed Grid Connection

ID	ITM X	ITM Y	ID	ITM X	ITM Y
H308	613,788	588,660	H337	614,496	588,502
H309	614,447	589,142	H338	613,847	589,189
H310	612,826	588,490	H339	614,646	589,377
H311	612,616	589,202	H340	616,108	589,390
H312	613,605	589,019	H341	612,802	590,299
H313	614,522	589,225	H342	612,289	589,380
H314	615,188	588,492	H343	612,109	589,961
H315	613,781	588,465	H344	612,503	589,834
H316	615,987	588,471	H345	613,454	589,421
H317	616,139	589,218	H346	613,400	589,389
H318	615,287	589,282	H347	615,257	589,321
H319	613,169	589,134	H348	614,723	589,348
H320	613,371	589,110	H349	612,093	589,922
H321	614,364	588,572	H350	613,501	591,015
H322	613,811	588,389	H351	613,042	590,595
H323	613,695	588,439	H352	613,482	589,449
H324	613,278	587,834	H353	612,462	589,324
H325	612,921	588,333	H354	612,628	590,738
H326	612,659	589,111	H355	612,562	590,166
H327	612,595	589,142	H356	613,767	589,336
H328	612,653	588,923	H357	614,816	589,314
H329	612,510	589,274	H358	612,234	590,426
H330	613,143	589,124	H359	612,201	590,428
H331	613,628	589,073	H360	612,143	590,428
H332	613,722	588,738	H361	612,243	590,428
H333	613,518	588,810	H362	612,188	590,428
H334	613,716	588,677	H363	612,960	590,537
H335	613,834	588,438	H364	613,628	589,485
H336	614,573	589,253	H365	614,495	589,500

Table A12-4 presents the proposed wind turbines locations in Irish Transverse Mercator coordinates system.

Table A12-4 Turbine Coordinates in Irish Transverse Mercator

Turbine	Easting	Northing	Turbine model and Hub Height
T1	619,870	589,557	V150 100 m HH
T10	620,784	587,144	V162 104 m HH
T11	621,314	587,391	V162 104 m HH
T12	621,876	587,432	V162 104 m HH
T13	617,902	587,077	V150 100 m HH
T14	618,391	587,029	V150 100 m HH
T15	618,908	587,147	V150 100 m HH
T16	619,106	586,747	V150 100 m HH
T17	619,562	586,713	V150 100 m HH
T18	617,635	586,534	V150 100 m HH
T19	618,079	586,508	V150 100 m HH
T2	620,325	589,626	V150 100 m HH
T20	618,468	586,358	V150 100 m HH

T21	617,920	586,003	V150 100 m HH
T22	615,346	586,108	V150 95 m HH
T23	615,933	586,293	V150 95 m HH
T3	620,459	589,176	V150 100 m HH
T4	620,938	589,327	V150 100 m HH
T5	621,227	589,009	V150 100 m HH
T6	621,717	589,023	V150 100 m HH
T7	619,339	587,736	V162 104 m HH
T8	619,803	587,602	V162 104 m HH
T9	620,382	587,597	V162 104 m HH

Tables below present the cumulative wind farms turbines coordinates.

Table A12-5 Turbine Coordinates in Irish Transverse Mercator

Wind Farm	XITM	YITM	Turbine Model and Hub Height
Knocknamona	616,315	590,758	E138 and N133 92.5 m HH
Knocknamona	616,728	590,433	E138 and N133 92.5 m HH
Knocknamona	616,737	591,081	E138 and N133 92.5 m HH
Knocknamona	615,592	591,289	E138 and N133 92.5 m HH
Knocknamona	615,273	590,794	E138 and N133 92.5 m HH
Knocknamona	615,541	590,321	E138 and N133 92.5 m HH
Knocknamona	616,037	591,708	E138 and N133 92.5 m HH
Knocknamona	617,188	590,835	E138 and N133 92.5 m HH

Table A12-6 Turbine Coordinates in Irish Transverse Mercator

Wind Farm	XITM	YITM	Turbine Model and Hub Height
Woodhouse	614,657	592,222	N100 75 m HH
Woodhouse	614,940	592,044	N100 75 m HH
Woodhouse	615,056	591,659	N90 80 m HH
Woodhouse	615,459	591,747	N90 80 m HH
Woodhouse	615,689	592,044	N90 80 m HH
Woodhouse	615,637	592,428	N100 75 m HH

Woodhouse	615,227	592,530	N100 75 m HH
Woodhouse	615,531	592,726	N100 75 m HH

Table 12-4 shows the background noise monitoring location representative of non-surveyed locations as well as the Landowner properties.

Table 12-7 Representative Noise Monitoring Locations

Noise Monitoring Location	Noise Sensitive Location
NML 1	H017, H023, H026, H033, H034, H043, H045, H049, H055, H058, H059, H063, H065, H067, H069, H079, H081, H084, H085, H086, H088, H094, H098, H099, H100, H104, H109, H111, H112, H123, H135, H145, H152, H183, H191, H193, H196, H201, H214, H215, H217, H218, H220, H235, H259, H262, H281, H293, and H306
NML 2	H001 ¹ , H002, H003, H009, H013, H014, H032, H052, H060, H062, H072, H075, H095, H097, H101, H103, H119, H125, H127, H159, H169, H192, H222, H233, H239, H254, H257, H276, H278, H290, H296, H303, H304, and H305
NML 3	H012, H021, H028, H090, H107, H113, H115, H117, H118, H124, H128, H131, H137, H138, H140, H144, H146, H149, H153, H155, H158, H164, H166, H171, H174, H175, H178, H180, H181, H185, H186, H187, H189, H195, H197, H198, H199, H200, H204, H205, H206, H207, H209, H211, H212, H223, H227, H228, H230, H231, H232, H236, H237, H238, H241, H242, H243, H244, H247, H249, H250, H251, H252, H260, H261, H264, H265, H268, H272, H274, H275, H280, H283, H285, H286, H292, and H295
NML 4	H007, H008, H018, H029, H036, H039, H041, H054, H064, H068, H070, H073, H076, H114, H154, and H300
NML 5	H019, H027, H037, H038, H047, H056, H071, H074, H077, H087, H092, H116, H120, H133, H142, H176, H177, H188, H234, H256, H258, H263, H266, H270, H277, H282, H287, and H288
NML 6	H005, H006, H011, H016, H020, H022, H030, H035, H042, H044, H050, H053, H091, H096, H121, H139, H147, H151, H161, H162, H165, H167, H170, H172, H173, H225, H269, H291, and H307
NML 7	H004, H010, H015, H024, H025, H031, H046, H048, H051, H057, H066, H082, H083, H089, H093, H105, H110, H122, H126, H130, H132, H134, H136, H141, H160, H168, H182, H184, H190, H194, H202, H203, H208, H210, H219, H226, H245, H246, H248, H253, H267, H273, H279, H289, H294, H301 ¹ , and H302 ¹
NML 8	H040, H061, H078, H080, H102, H106, H108, H129, H143, H148, H150, H156, H157, H163, H179, H213, H216, H221, H224, H229, H240, H255, H271, H284, H297, H298, and H299
Landowner	H001, H002, H003, H027, H041, H047, H049, H057, H063, H066, H067, H072, H088, H098, H100, H114, H150, H155, H217, H220, H264, and H300

Note 1: These properties are derelict and considered non-habitable.