APPENDIX 12-3

NOISE MODELLING ASSUMPTIONS AND PARAMETERS

APPENDIX 12-3. 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) and its associated supplementary guidance notes (IOA GPG). The following section sets out the key aspects considered in relation to the noise predictions presented.

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.

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.

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

Propagation Effects

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. For calculation of wind turbine noise, barrier and ground corrections have been applied in accordance with of ISO 9613-2 and IOA GPG parameters in terrain screening and valley correction.

The noise prediction calculations have been undertaken using OSI ground topography data to account for propagation effects. The noise prediction software, iNoise, described in Section 12.5.4.1 of the EIAR incorporates the setting outlined in this appendix.

Table A12-2 list detail of the receptors used in the noise model and considered in the assessment.

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

Loc. Ref. ID	X (ITM)	Y (ITM)	Nearest Turbine(m)	Loc. Ref. ID	X (ITM)	Y (ITM)	Nearest Turbine(m)
H001	512,959	681,692	1011	H111	509,615	680,069	1916
H002	510,037	680,382	1485	H112	509,696	680,051	1837
H003	510,356	680,257	1163	H113	509,724	680,070	1807
H004	510,316	680,500	1222	H114	509,678	680,112	1848
H005	510,730	680,605	852	H115	509,674	680,427	1850
H006	510,770	680,743	878	H116	509,867	680,221	1653
H008	510,938	681,006	895	H117	509,917	680,334	1602
H009	513,335	681,873	1375	H118	509,980	680,331	1539
H010	510,947	681,400	1062	H119	510,014	680,366	1507
H011	510,885	681,380	1102	H120	511,520	682,641	1895
H012	511,286	681,320	755	H121	514,374	681,289	1711
H013	511,498	681,770	1048	H122	510,426	677,805	1755
H014	511,486	681,803	1083	H123	509,009	678,732	2523
H015	511,947	681,473	721	H124	509,411	678,733	2129
H016	511,914	681,606	847	H125	513,854	681,975	1775
H017	513,918	681,411	1396	H126	513,829	682,028	1805
H018	511,977	681,591	843	H127	513,781	682,180	1902
H019	512,018	681,562	824	H128	514,515	681,384	1879
H020	512,121	681,532	791	H129	514,626	681,269	1930
H021	510,900	679,953	701	H130	514,597	681,350	1937

H022	513,494	681,026	824	H131	514,712	679,990	1932
H023	513,394	680,942	694	H132	514,752	679,980	1974
H024	512,990	682,133	1422	H133	514,741	679,897	1987
H025	513,545	681,794	1459	H134	514,065	679,550	1548
H026	511,473	681,721	1009	H135	514,653	681,233	1942
H028	514,261	680,402	1414	H136	514,389	680,026	1613
H029	514,194	681,136	1482	H137	514,374	679,933	1629
H030	514,177	680,393	1331	H138	513,829	682,281	2008
H031	513,205	678,918	1233	H139	512,144	682,310	1527
H032	510,982	678,011	1295	H140	509,572	680,455	1954
H033	512,883	681,128	529	H141	509,541	680,471	1986
H034	510,904	678,525	894	H142	509,504	680,520	2028
H035	513,408	680,033	734	H143	509,485	680,450	2040
H036	514,131	680,060	1357	H144	509,459	680,471	2068
H037	514,099	679,783	1445	H145	509,427	680,496	2102
H038	513,819	679,734	1241	H146	509,403	680,517	2128
H039	513,135	679,825	742	H147	509,766	678,105	2042
H040	513,196	679,763	809	H148	510,942	677,077	2195
H041	513,819	679,469	1422	H149	509,882	677,362	2443
H042	513,637	679,436	1311	H150	509,969	677,376	2376
H043	513,648	679,167	1428	H151	514,662	679,079	2308
H044	512,843	678,925	997	H152	509,194	679,412	2303
H045	512,975	679,142	914	H153	514,772	679,447	2196
H046	512,787	679,131	816	H154	514,971	679,660	2284
H047	512,623	678,763	931	H155	509,027	679,746	2520
H048	512,160	678,577	889	H156	509,161	679,898	2389
H049	512,128	678,331	1082	H157	514,945	679,900	2181
H050	512,076	678,307	1072	H158	514,845	679,952	2071
H051	511,589	678,103	1105	H159	515,134	680,154	2311
H052	511,392	678,086	1121	H160	509,325	680,288	2193
H053	511,320	678,044	1171	H161	509,041	680,417	2481
H054	511,020	678,050	1244	H162	509,153	680,404	2369
H055	510,797	678,048	1346	H163	509,292	680,609	2250
H056	510,923	678,542	869	H164	515,202	681,165	2440
H057	510,955	678,584	816	H165	514,930	681,245	2205
H058	510,961	678,680	742	H166	514,879	681,271	2166
H059	510,573	678,899	964	H167	515,170	681,285	2445
H060	510,479	678,248	1389	H168	514,841	681,288	2137
H061	510,655	679,499	884	H169	514,869	681,317	2173
H062	510,401	679,349	1096	H170	514,962	681,433	2304
H063	510,216	679,245	1272	H171	514,370	681,890	2052
H064	512,920	682,076	1343	H172	514,661	682,085	2399
H065	510,123	679,050	1373	H173	513,890	682,244	2021
H066	513,085	681,948	1296	H174	513,930	682,336	2118
H067	512,874	681,435	748	H175	513,875	682,469	2179
H068	511,216	682,745	2063	H176	513,882	682,545	2242
H069	511,290	682,552	1857	H177	510,125	682,551	2447

H070	511,430	682,538	1809	H178	510,325	682,586	2342
H071	511,656	682,715	1953	H179	513,792	682,597	2227
H072	512,190	682,273	1482	H180	510,371	682,606	2329
H073	514,053	681,411	1502	H181	510,580	682,615	2215
H074	514,213	681,116	1491	H182	510,467	682,626	2288
H075	514,281	681,048	1528	H183	510,182	682,625	2464
H076	514,554	680,578	1704	H184	513,406	682,629	2048
H077	514,430	680,545	1579	H185	513,422	682,652	2075
H078	514,383	680,513	1532	H186	510,247	682,661	2449
H079	514,569	680,015	1788	H187	510,603	682,685	2261
H080	511,122	677,099	2135	H188	510,644	682,692	2246
H081	510,665	677,585	1815	H189	510,330	682,700	2429
H082	510,605	677,650	1786	H190	510,863	682,745	2189
H083	510,581	677,892	1594	H191	510,885	682,752	2186
H084	510,369	677,865	1744	H192	511,046	682,767	2138
H085	510,312	677,906	1750	H193	512,787	682,981	2191
H086	509,934	678,094	1909	H194	512,491	683,212	2397
H088	509,834	678,108	1983	H196	509,219	678,095	2525
H089	510,088	677,446	2246	H197	514,912	680,559	2062
H090	509,781	678,170	1995	H198	511,271	682,545	1855
H091	509,602	677,883	2302	H199	513,358	680,234	578
H092	509,544	677,972	2301	H200	513,124	679,838	726
H093	509,648	678,403	2006	H201	510,037	679,237	1451
H094	509,789	678,839	1737	H202	509,927	680,052	1608
H095	509,704	679,161	1784	H203	509,805	679,974	1741
H096	509,354	678,132	2387	H204	509,784	678,050	2057
H097	509,296	678,103	2452	H205	509,307	679,988	2231
H098	509,188	678,275	2480	H206	512,820	679,156	812
H099	509,233	678,315	2423	H207	512,834	679,145	828
H100	509,213	679,104	2277	H208	512,255	681,989	1191
H101	509,131	679,893	2419	H209	513,416	678,991	1334
H102	509,301	679,892	2252	H210	512,202	677,877	1506
H103	509,391	679,883	2165	H211	510,696	682,057	1698
H104	509,418	679,874	2140	H213	510,476	682,691	2336
H105	509,668	679,886	1893	H214	509,184	678,698	2359
H106	509,631	679,917	1923	H215	511,374	683,149	2420
H109	509,446	680,029	2088	H216	513,352	675,755	
H110	509,557	680,037	1977				

Table A12-3 to Table 12-6 presents the Proposed Turbines and other wind turbines locations in Irish Transverse Mercator coordinates system.

Table A12-3 Proposed Turbines Coordinates in Irish Transverse Mercator

Turbine ID	ITM X	ITM Y
T1	511,800	680,767
T2	512,456	680,815
T3	511,518	680,283

T4	512,025	680,280
T5	512,851	680,510
T6	512,392	679,845
T7	511,487	679,203
T8	511,996	679,451
T9	511,797	679,833

Table A12-5 Illaunbaun Turbine Coordinates in Irish Transverse Mercator

Turbine ID	ITM X	ITM Y
T1	509,248	681,617
T2	510,339	681,648
T3	509,924	681,348
T4	508,957	681,920
T5	509,773	681,776
T6	510,310	681,176

Table A12-6 Slievecallan Turbine Coordinates in Irish Transverse Mercator

Turbine ID	ITM X	ITM Y
T1	511,874	677,250
T2	512,030	675,965
T3	512,315	677,334
T4	512,561	677,703
T5	512,604	676,148
T6	512,790	676,977
T7	512,914	678,154
T8	513,008	677,701
T9	513,103	676,222
T10	513,111	675,045
T11	513,235	677,054
T12	513,401	678,227
T13	513,432	678,605
T14	513,563	675,137
T15	513,594	676,319
T16	513,807	678,159
T17	513,843	675,811
T18	513,962	676,789
T19	513,984	678,554
T20	514,177	676,137
T21	514,216	678,943
T22	514,225	678,157
T23	514,290	676,568
T24	514,307	675,703
T25	514,746	676,497
T26	514,941	676,998
T27	515,150	677,762
T28	515,189	677,308

Turbine ID	ITM X	ITM Y
T29	515,319	676,765