TOBIN

Rooaunalaghta Green Energy Project

Appendix 12-2

Noise Modelling Parameters

ROOAUNALAGHTA
Green Energy

BUILT ON KNOWLEDGE

APPENDIX 11-2. 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 guidance provided in ARWTN does not require any modifications to the modelling parameters described below.

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:

$$A_{div} = 20\log(d) + 11 \text{ dB}$$

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 relativity 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)

F_ID	ITM_EAST	ITM_NORTH	Type of property	F_ID	ITM_EAST	ITM_NORTH	Type of property
1	527,440	751,476	Residential	217	525,638	752,540	Residential
2	527,401	751,477	Residential	218	525,073	752,951	Residential
3	523,754	747,931	Residential	219	521,678	748,483	Residential
4	524,138	749,464	Residential	220	521,607	750,037	Residential
5	524,152	749,418	Residential	221	521,626	750,049	Residential
6	524,267	749,308	Residential	222	521,748	750,223	Residential
7	524,300	749,515	Residential	223	521,807	750,297	Residential
8	524,310	749,434	Residential	224	521,826	750,330	Residential
9	524,312	749,314	Residential	225	521,849	750,379	Residential
10	524,324	749,282	Residential	226	521,808	748,721	Residential
11	523,927	749,369	Residential	227	521,843	748,759	Residential
12	523,768	749,363	Residential	228	521,628	748,786	Residential
13	524,616	748,587	Residential	229	521,521	748,849	Residential
14	524,548	748,762	Residential	230	521,687	748,881	Residential
15	525,404	749,162	Residential	231	521,606	748,729	Residential
16	525,357	749,269	Residential	232	523,155	752,051	Residential
17	525,556	749,301	Residential	233	523,172	752,119	Residential
18	525,417	749,225	Residential	234	523,268	752,078	Residential
19	524,509	748,791	Residential	235	523,501	752,067	Residential
20	524,427	749,010	Residential	236	523,526	752,192	Residential
21	525,212	749,367	Residential	237	523,567	752,006	Residential
22	525,283	749,398	Residential	238	523,563	752,135	Residential
23	523,706	750,649	Residential	239	523,440	751,990	Residential
24	524,286	750,338	Commercial	240	523,465	752,049	Residential
25	524,386	750,168	Residential	241	522,933	751,744	Commercial
26	524,645	750,521	Residential	242	522,953	751,764	Residential
27	524,346	750,186	Residential	243	522,960	752,013	Residential
28	524,418	749,440	Residential	244	522,985	752,031	Residential
29	524,551	749,498	Residential	245	523,127	751,777	Residential
30	524,574	749,508	Residential	246	522,774	751,718	Residential

31	524,614	749,543	Residential	247	522,736	751,698	Residential
32	524,629	749,564	Derelict	248	523,656	750,684	Residential
33	524,532	749,502	Residential	249	523,342	750,811	Residential
34	524,494	749,464	Residential	250	523,204	750,890	Residential
35	524,362	749,449	Residential	251	523,084	751,248	Residential
36	524,652	749,904	Residential	252	522,974	751,334	Residential
37	524,708	749,605	Residential	253	523,406	750,840	Residential
38	524,736	749,847	Residential	254	522,878	751,068	Residential
39	524,776	749,813	Residential	255	522,778	749,079	Residential
40	524,686	749,882	Residential	256	522,801	749,090	Residential
41	524,782	749,637	Residential	257	523,549	749,121	Residential
42	524,795	749,717	Residential	258	523,304	749,291	Residential
43	524,826	749,717	Residential	259	523,561	749,310	Residential
44	524,847	749,656	Residential	260	523,527	749,315	Residential
45	524,851	749,773	Residential	261	523,584	749,323	Residential
46	524,859	749,722	Residential	262	523,031	748,656	Residential
47	524,886	749,670	Residential	263	523,037	748,687	Residential
48	524,897	749,817	Residential	264	522,927	748,741	Residential
49	524,895	749,747	Residential	265	523,221	748,768	Residential
50	524,732	750,389	Residential	266	522,779	748,838	Residential
51	524,781	750,344	Residential	267	522,017	751,619	Residential
52	524,867	750,274	Residential	268	522,075	751,646	Residential
53	524,881	750,263	Residential	269	521,997	752,074	Residential
54	524,924	750,240	Residential	270	522,096	752,091	Residential
55	524,950	750,228	Residential	271	521,980	752,091	Residential
56	524,973	750,205	Residential	272	522,076	752,112	Residential
57	524,907	750,183	Residential	273	522,060	752,131	Residential
58	524,923	750,141	Residential	274	522,133	752,035	Residential
59	524,817	750,359	Residential	275	522,255	751,807	Residential
60	525,161	749,636	Residential	276	522,230	751,832	Residential
61	524,993	749,681	Residential	277	522,255	751,892	Commercial
62	525,049	749,714	Residential	278	522,301	751,912	Commercial
63	525,083	749,716	Residential	279	522,377	751,929	Commercial
64	525,178	749,722	Residential	280	522,325	751,941	Residential
65	525,323	749,701	Residential	281	522,277	751,771	Residential
66	525,007	749,751	Residential	282	522,271	751,784	Residential
67	525,024	749,795	Residential	283	522,294	751,661	Residential
68	525,030	749,737	Residential	284	522,454	751,683	Commercial
69	524,949	749,994	Residential	285	522,358	751,689	Residential
70	524,992	750,032	Derelict	286	522,557	751,727	Residential
71	525,010	750,018	Residential	287	522,300	751,747	Residential
72	524,962	750,086	Derelict	288	522,191	751,504	Residential
73	525,059	749,940	Residential	289	522,174	751,639	Residential
74	524,964	749,866	Residential	290	522,215	751,848	Residential
75	525,038	749,893	Residential	291	522,193	751,878	Commercial
76	524,842	750,075	Residential	292	522,208	751,940	Residential
77	525,036	749,860	Residential	293	522,166	751,992	Residential

78	525,030	749,830	Residential	294	522,213	750,839	Residential
79	526,648	752,672	Residential	295	522,150	752,011	Residential
80	526,717	752,715	Derelict	296	522,192	750,809	Residential
81	526,758	752,727	Residential	297	522,171	750,788	Residential
82	526,770	752,777	Residential	298	522,369	750,991	Residential
83	526,801	752,718	Residential	299	522,420	751,033	Residential
84	526,836	752,734	Residential	300	522,596	751,327	Residential
85	526,905	751,968	Residential	301	522,616	751,351	Residential
86	527,219	750,985	Residential	302	522,562	751,468	Residential
87	527,158	751,539	Residential	303	522,608	751,552	Residential
88	526,955	750,432	Residential	304	522,572	751,304	Residential
89	527,006	751,517	Residential	305	522,394	751,009	Residential
90	526,814	749,420	Residential	306	522,620	751,412	Residential
91	526,825	749,508	Residential	307	522,000	750,111	Residential
92	526,747	749,911	Residential	308	521,873	750,416	Residential
93	526,668	749,929	Residential	309	521,985	750,614	Residential
94	526,749	749,985	Residential	310	522,094	750,660	Residential
95	526,819	750,030	Residential	311	522,240	749,082	Residential
96	526,893	750,352	Residential	312	522,366	748,937	Residential
97	526,633	749,933	Residential	313	522,552	749,004	Residential
98	526,832	749,989	Residential	314	522,618	748,773	Residential
99	526,601	749,939	Residential	315	522,630	748,821	Residential
100	527,088	751,333	Residential	316	522,647	748,876	Residential
101	526,817	752,792	Residential	317	522,670	749,064	Residential
102	527,387	751,537	Residential	318	522,327	748,929	Residential
103	527,315	751,550	Residential	319	521,887	748,779	Commercial
104	527,153	750,946	Shed	320	521,887	748,875	Residential
105	526,230	752,169	Residential	321	522,082	748,858	Residential
106	526,288	752,208	Residential	322	522,217	748,414	Residential
107	526,264	752,287	Residential	323	521,933	749,033	Residential
108	526,416	751,210	Residential	324	522,167	748,424	Residential
109	526,449	751,240	Residential	325	522,134	748,422	Residential
110	526,391	751,250	Residential	326	521,097	749,236	Residential
111	526,304	751,250	Residential	327	521,170	749,545	Residential
112	526,429	751,282	Derelict	328	521,231	749,591	Residential
113	526,420	751,377	Residential	329	521,105	749,621	Residential
114	526,536	751,395	Residential	330	521,126	749,652	Residential
115	526,253	752,610	Residential	331	521,281	750,033	Residential
116	526,275	752,449	Residential	332	522,214	751,676	Residential
117	526,496	752,667	Residential	333	522,274	751,519	Residential
118	526,366	752,659	Residential	334	522,352	751,520	Residential
119	526,366	750,892	Residential	335	520,927	750,639	Residential
120	526,394	750,965	Residential	336	523,207	747,801	Residential
121	526,322	751,014	Residential	337	523,095	747,810	Residential
122	526,333	751,041	Residential	338	523,175	747,826	Residential
123	526,380	750,401	Residential	339	522,973	748,399	Residential
124	526,033	750,486	Residential	340	522,998	748,426	Residential

125	526,099	750,560	Residential	341	523,065	748,521	Residential
126	526,159	751,511	Residential	342	523,087	748,653	Residential
127	526,204	750,526	Residential	343	522,382	747,881	Residential
128	525,994	752,543	Residential	344	522,932	747,884	Residential
129	526,022	752,762	Residential	345	522,902	748,043	Residential
130	526,046	752,707	Residential	346	522,842	748,112	Residential
131	526,049	752,555	Residential	347	522,730	748,252	Residential
132	526,061	752,677	Residential	348	522,688	748,256	Residential
133	526,079	752,643	Residential	349	522,645	748,276	Residential
134	526,099	752,605	Residential	350	520,929	749,555	Residential
135	526,104	752,577	Residential	351	521,043	749,579	Residential
136	526,035	752,731	Residential	352	527,032	752,931	Residential
137	526,056	751,836	Residential	353	524,697	748,591	Residential
138	526,035	751,889	Residential	354	522,115	750,831	Residential
139	525,905	751,900	Residential	355	523,269	752,086	Commercial
140	526,008	751,965	Residential	356	524,363	752,272	Derelict
141	525,943	752,085	Residential	357	525,043	753,122	Commercial
142	525,936	752,108	Residential	358	526,936	752,885	Residential
143	525,967	752,148	Residential	359	527,769	751,781	Residential
144	525,916	752,159	Residential	360	527,762	751,750	Residential
145	526,048	753,027	Residential	361	527,737	751,626	Residential
146	526,068	753,102	Residential	362	527,679	751,683	Residential
147	525,884	753,102	Residential	363	526,921	750,381	Commercial
148	525,863	753,124	Residential	364	525,608	753,269	Residential
149	526,096	753,132	Residential	365	525,806	753,225	Planning application
150	525,861	753,188	Residential	366	523,964	752,148	Planning application
151	525,966	753,102	Residential	367	522,084	750,320	Planning application
152	526,176	753,220	Residential	369	526,226	749,186	Planning application
153	526,200	753,163	Residential	370	526,268	750,922	Planning application
154	525,481	753,189	Residential	371	526,276	750,951	Planning application
155	525,700	753,215	Residential	372	526,326	751,204	Planning application
156	525,655	753,259	Residential	373	525,488	752,561	Planning application
157	525,610	752,538	Residential	374	526,411	753,339	Residential
158	525,661	752,539	Commercial	375	526,283	753,573	Residential
159	525,829	753,216	Residential	376	524,994	750,060	Planning application
160	525,792	753,257	Residential	377	525,177	751,937	Planning application
161	525,742	753,326	Residential	380	526,306	753,398	Planning application
162	525,811	753,340	Commercial	383	526,865	753,011	Planning application
163	525,132	752,076	Residential	382	526,303	750,976	Planning application
164	525,250	752,434	Residential	381	525,854	750,562	Planning application

165	525,311	752,455	Residential	379	525,274	752,900	Planning application
166	525,335	752,465	Residential	378	524,792	753,437	Planning application
167	525,407	752,490	Residential	385	526,795	749,240	Residential
168	525,366	752,482	Residential	386	526,786	749,207	Residential
169	525,167	752,439	Residential	387	526,729	753,066	Residential
170	525,136	752,433	Residential	388	526,740	753,041	Residential
171	525,103	752,431	Residential	389	526,330	753,331	Residential
172	525,143	753,465	Residential	384	524,896	753,708	Planning application
173	525,050	753,467	Residential	390	524,287	753,749	Residential
174	524,858	753,515	Residential	391	521,946	752,136	Residential
175	524,933	753,515	Residential	392	521,917	752,155	Residential
176	524,898	753,515	Residential	393	521,895	752,171	Residential
177	524,795	753,523	Residential	394	521,881	752,189	Residential
178	525,037	752,883	Residential	395	522,044	752,151	Residential
179	524,881	753,315	Derelict	396	523,326	747,499	Residential
180	524,939	753,341	Residential	397	523,312	747,529	Residential
181	524,866	753,365	Residential	398	523,363	747,575	Residential
182	524,913	753,367	Residential	399	523,335	747,588	Residential
183	525,132	752,837	Residential	400	523,281	747,576	Residential
184	524,404	752,288	Residential	401	523,264	747,603	Residential
185	524,457	752,298	Residential	402	523,251	747,622	Residential
186	524,513	752,359	Residential	403	523,300	747,676	Residential
187	524,616	752,395	Residential	404	523,245	747,752	Residential
188	524,762	752,445	Residential	405	523,132	747,715	Residential
189	524,922	752,410	Residential	406	522,864	747,690	Residential
190	524,947	752,415	Residential	407	522,855	747,605	Residential
191	524,258	753,452	Residential	408	522,704	747,570	Residential
192	524,520	753,470	Residential	409	522,653	747,649	Residential
193	524,671	752,788	Residential	410	522,729	747,685	Residential
194	524,714	753,537	Residential	411	522,636	747,695	Residential
195	524,596	753,504	Residential	412	522,579	747,737	Residential
196	524,214	753,574	Residential	413	522,470	747,761	Residential
197	524,226	753,626	Residential	414	521,715	748,198	Residential
198	524,275	753,667	Residential	415	521,708	748,218	Residential
199	524,859	753,574	Residential	416	521,681	748,236	Residential
200	523,789	752,117	Residential	417	521,656	748,265	Residential
201	523,813	752,122	Residential	418	521,643	748,191	Residential
202	523,959	752,092	Residential	419	521,622	748,300	Residential
203	524,015	752,089	Residential	420	521,473	748,284	Residential
204	523,795	752,056	Residential	421	521,434	748,249	Residential
205	523,776	752,130	Residential	422	520,840	750,681	Residential
206	527,622	751,490	Residential	423	522,387	753,057	Residential
207	527,642	751,545	Residential	424	522,400	753,092	Residential
208	527,623	751,576	Residential	425	522,419	753,122	Residential
209	525,570	749,050	Residential	426	522,467	753,191	Residential

210	526,075	749,175	Residential	427	522,475	753,226	Residential
211	526,573	749,216	Residential	428	522,492	753,253	Residential
212	526,647	749,322	Residential	429	522,511	753,288	Residential
213	526,952	749,793	Residential	430	523,093	753,648	Residential
214	526,898	749,761	Residential	431	524,172	753,778	Residential
215	525,178	752,337	Residential	432	524,241	753,798	Residential
216	525,748	752,483	Residential	433	527,134	752,880	Residential

Table A12-3 presents the proposed wind turbines locations in Irish Transverse Mercator coordinates system.

Table A12-3 Turbine Coordinates in Irish Transverse Mercator

Turbine Id	X ITM	Y ITM	Hub Height
T9	524,675	751,173	82m
T8	524,788	751,502	82m
T7	524,525	751,670	82m
T6	523,987	751,232	82m
T5	524,247	751,004	82m
T4	522,876	750,243	82m
T3	522,973	749,924	82m
T2	523,199	750,168	82m
T13	525,514	751,396	82m
T12	525,604	751,129	82m
T11	525,287	750,834	82m
T10	525,024	751,075	82m
T1	523,647	750,010	82m