

APPENDIX 3

Preliminary Noise Analysis

Thunderbolt Energy Hub

Scoping Assessment

S6576C4

October 2020

sonus.

Document Title : Thunderbolt Energy Hub - Windfarm – Scoping Assessment

Document Reference : S6576C4

Date : October 2020

Author : Mathew Ward

Reviewer : Jason Turner

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GLOSSARY

A-weighting	Frequency adjustment applied to measured noise levels to replicate the frequency response of the human ear.
Ambient noise level	The noise level of the existing noise sources in the environment (in the absence of the wind farm).
Background noise level	The ambient noise level which excludes intermittent noise sources.
Bulletin	<i>Wind Energy: Noise Assessment Bulletin - For State significant wind energy development (NSW Department of Planning and Environment, December 2016)</i>
CONCAWE	<i>The oil companies' international study group for conservation of clean air and water - Europe, The propagation of noise from petrochemical complexes to neighbouring communities (May 1981).</i>
dB(A)	A-weighted noise or sound power level in decibels.
EIS	Environmental Impact Statement
Equivalent noise level	Energy averaged noise level over a prescribed period of time
Involved Dwelling	A Dwelling with a commercial agreement with the wind farm.
Non-involved Dwelling	Not an Involved Dwelling
SEARs	Secretary's Environmental Assessment Requirements
Sound power level	A measure of the sound energy emitted from a source of noise.
The Project	Thunderbolt Energy Hub (windfarm component only)
Weather category 6	Weather category which is most conducive for the propagation of noise, resulting in highest predicted noise levels when using CONCAWE.
Worst-case	Conditions resulting in the highest noise level at dwellings.
WTG	Wind turbine generator comprising a three bladed, upstream facing, horizontal axis turbine mounted on steel towers with a common set of generic design components comprising a foundation, tower, nacelle, hub and blades

1 INTRODUCTION

A Scoping (Noise Impact) Assessment has been made in accordance with the New South Wales Planning and Environment *Wind Energy: Noise Assessment Bulletin* (**the Bulletin**) for the Thunderbolt Energy Hub (Windfarm component only) (**the Project**).

The Project is located approximately 40 kilometres (km) north east of Tamworth adjacent to the New England Highway and includes the construction, operation, and maintenance of approximately 70 turbines and associated infrastructure including a solar farm and a battery.

The Scoping Assessment relates to the windfarm component only and has been prepared to assist in applying for the Secretary's Environmental Assessment Requirements (**SEARs**) and to guide the preparation of the Environmental Impact Statement (**EIS**) for the Project.

2 SCOPING NOISE IMPACT ASSESSMENT

The Scoping (noise impact) Assessment is based on the following:

- Wind turbine generator (**WTG**) locations as summarised in Appendix A. The locations represent a scoping layout only and is expected to evolve through the EIS process;
- Dwelling locations (subject to ground-truthing) are summarised in Appendix B. Appendix B also includes the status of the dwelling with respect to the project, the nearest WTG, the distance to the nearest WTG, and preliminary predicted noise level;
- Local topographical contours;
- An indicative WTG with a maximum sound power level of 104 dB(A) and a hub height of 165m that is representative of the type, generation capacity and size for this type of project; and,
- The WTG being free of any excessive levels of tonality or any other special noise characteristics at the dwellings.

2.1 Methodology

Predictions have been made using the CONCAWE noise propagation model and SoundPLAN noise modelling software. The model considers the following:

- sound power levels and preliminary locations of WTGs;
- separation distances between WTGs and dwellings;
- topography of the area;
- influence of the ground;
- air absorption; and,
- meteorological conditions.

The CONCAWE system divides meteorological conditions into six separate “weather categories”, depending on wind speed, wind direction, time of day and level of cloud cover. Weather Category 6 provides “worst-case” (i.e. highest noise level) conditions which are conducive to the propagation of WTG noise.

The preliminary assessment has been based on the following noise model input conditions:

- weather category 6 (representing a temperature inversion and wind conditions that assist with the propagation of noise);
- atmospheric conditions at 10°C and 80% relative humidity (representing conditions that result in low levels of noise absorption from the atmosphere);
- wind direction from all WTGs to the particular dwelling under consideration, even in circumstances where WTGs are located in opposite directions from the dwelling;
- acoustically soft ground (representing the pastoral nature of the land and in accordance with CONCAWE requirements); and,
- maximum barrier attenuation from topography of 2 dB(A) (representing a conservative assessment of any shielding provided by topography).

2.2 Criteria

The Bulletin provides a baseline noise criterion of 35 dB(A) at non-involved dwellings. The Bulletin enables the baseline criterion to be increased / relaxed for involved dwellings and at dwellings with high background noise levels. That is, the background noise level monitoring conducted as part of the EIS process may result in an increase in the noise assessment criteria above that of the 35 dB(A) baseline noise criterion.

2.3 Results

The 35 dB(A) noise contour and the dwelling locations are shown in Figure 1 for the scenario of every WTG in the Scoping layout concurrently producing a maximum sound power level of 104 dB(A).

The baseline criterion of 35 dB(A) is achieved at all non-involved dwellings with the exception of “Dwelling 219”, located to the north of the site, which has a predicted noise level of 36 dB(A).

The Project will be refined during the preparation of the EIS to ensure compliance at all dwellings when compared against the noise criteria determined from the background noise monitoring. Where the noise is required to be reduced at any dwelling, modifications to the WTG layout or the development of a curtailment strategy are options that could be used to ensure compliance at all involved and non-involved dwellings.

3 EIS ASSESSMENT

A detailed acoustic assessment will be prepared for inclusion in the EIS addressing the following components:

- WTG noise in accordance with the Bulletin;
- Ancillary noise in accordance with the *NSW Noise Policy for Industry, 2017*;
- Construction noise in accordance with the *Interim Construction Noise Guideline, 2009*;
- Traffic noise in accordance with the *NSW Road Noise Policy, 2011*; and
- Vibration in accordance with *Assessing Vibration: A Technical Guideline, 2006*.

The EIS will incorporate the following information:

1. Background noise monitoring results;
2. Establishment of criteria in accordance with the background noise monitoring results;
3. Predictions which account for the sound power levels and locations of WTGs and ancillary infrastructure;
4. A construction noise assessment and framework for a management plan;
5. A traffic noise assessment and input to a management plan where required;
6. Commentary on vibration impacts; and,
7. Noise reduction measures (such as modifying the WTG layout and/or applying a curtailment strategy) where the relevant operational (or construction) assessment criteria cannot be achieved.

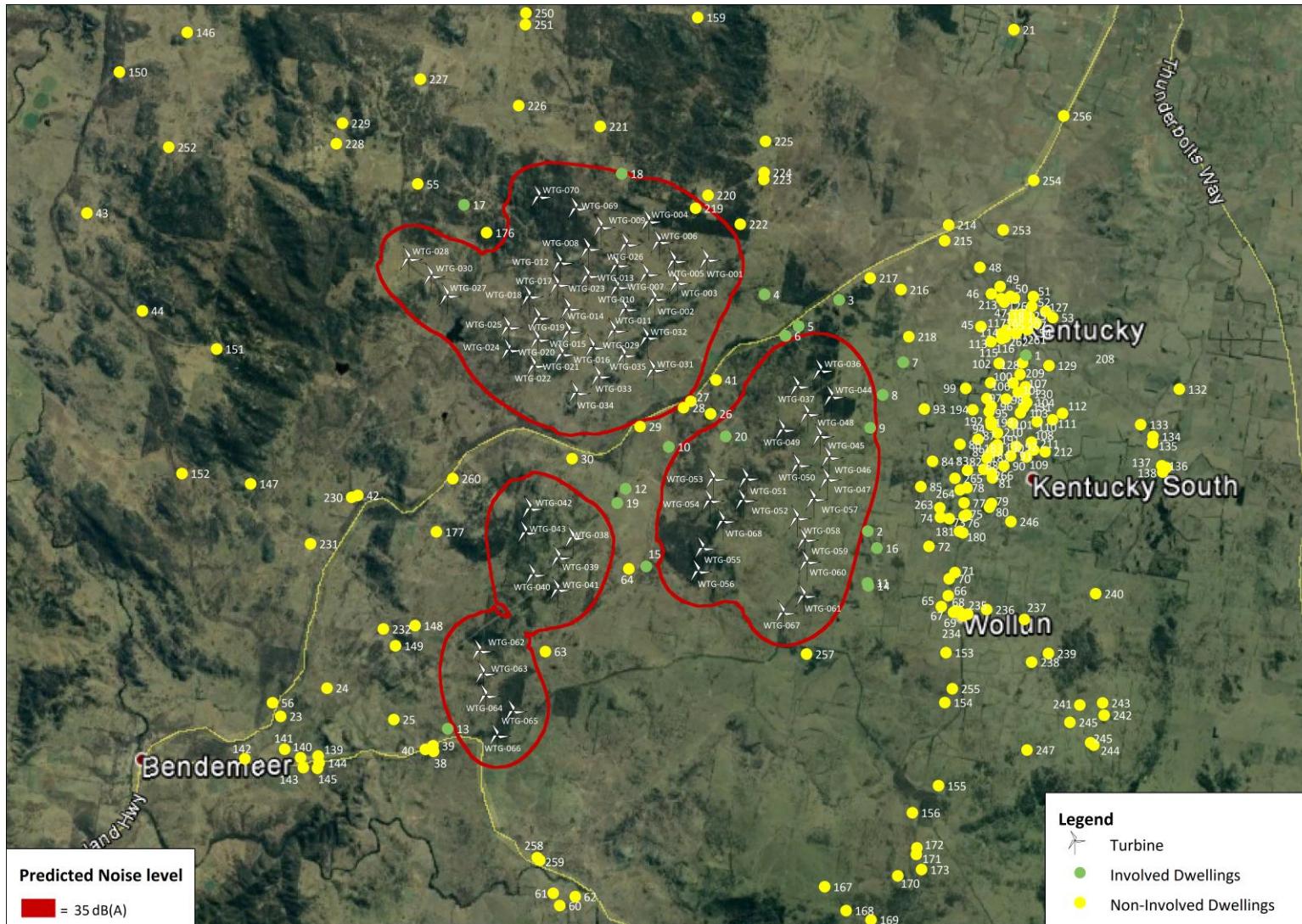


Figure 1: 35 dB(A) Noise contour with WTGs and nearby dwellings

APPENDIX A:

WTG ID	WTG Coordinates (UTM WGS84 55H)	
	Easting	Northing
WTG-001	341827	6598026
WTG-002	340196	6596793
WTG-003	340897	6597300
WTG-004	340004	6599227
WTG-005	340801	6597982
WTG-006	340330	6598582
WTG-007	339944	6597567
WTG-008	338102	6598364
WTG-009	338506	6599047
WTG-010	339020	6597164
WTG-011	339273	6596471
WTG-012	337219	6597930
WTG-013	339003	6597848
WTG-014	337487	6596486
WTG-015	337503	6595771
WTG-016	338253	6595271
WTG-017	337134	6597237
WTG-018	336248	6596871
WTG-019	336542	6596200
WTG-020	336516	6595513
WTG-021	337282	6595056
WTG-022	336408	6594695
WTG-023	338095	6597514
WTG-024	335614	6595188
WTG-025	335589	6595903
WTG-026	339304	6598507
WTG-027	333671	6596894
WTG-028	332461	6598046
WTG-029	338917	6595795
WTG-030	333170	6597511
WTG-031	340149	6594563
WTG-032	339945	6595577
WTG-033	338432	6594362
WTG-034	337731	6593841
WTG-035	339229	6595025
WTG-036	345402	6594540

WTG ID	WTG Coordinates (UTM WGS84 55H)	
	Easting	Northing
WTG-037	344679	6594042
WTG-038	337615	6589295
WTG-039	337172	6588671
WTG-040	336378	6588135
WTG-041	337142	6587665
WTG-042	336270	6590211
WTG-043	336137	6589461
WTG-044	345748	6593722
WTG-045	345390	6592485
WTG-046	345663	6591816
WTG-047	345617	6591132
WTG-048	344991	6593176
WTG-049	344222	6592681
WTG-050	344694	6591578
WTG-051	343073	6591152
WTG-052	342964	6590472
WTG-053	342036	6591144
WTG-054	341921	6590454
WTG-055	341693	6588965
WTG-056	341551	6588238
WTG-057	345189	6590507
WTG-058	344663	6589910
WTG-059	344903	6589236
WTG-060	344967	6588537
WTG-061	344881	6587469
WTG-062	334685	6585741
WTG-063	334806	6585033
WTG-064	334879	6584336
WTG-065	335738	6583845
WTG-066	335232	6583080
WTG-067	344223	6586936
WTG-068	342332	6589818
WTG-069	337712	6599631
WTG-070	336555	6600000

APPENDIX B:

Dwelling ID	Dwelling Coordinates (UTM WGS84 55H)		Involved Dwelling (Yes/No)	Nearest WTG	Distance to Nearest WTG (m)	Predicted Level (dB(A))
	Easting	Northing				
1	351844	6595007	Yes	WTG-044	6229	<20
2	346877	6589487	Yes	WTG-057	1972	34
3	345978	6596744	Yes	WTG-036	2278	29
4	343635	6596914	Yes	WTG-001	2123	31
5	344710	6595921	Yes	WTG-036	1544	33
6	344299	6595615	Yes	WTG-036	1540	34
7	347994	6594786	Yes	WTG-044	2485	28
8	347347	6593760	Yes	WTG-044	1599	34
9	346955	6592728	Yes	WTG-044	1564	36
10	340629	6592135	Yes	WTG-053	1720	34
11	346872	6587861	Yes	WTG-060	2021	32
12	339274	6590819	Yes	WTG-038	2253	32
13	333687	6583283	Yes	WTG-066	1557	34
14	346896	6587768	Yes	WTG-061	2038	32
15	339916	6588381	Yes	WTG-056	1640	34
16	347166	6588953	Yes	WTG-060	2238	32
17	334195	6599732	Yes	WTG-070	2375	31
18	339149	6600709	Yes	WTG-004	1711	35
19	339010	6590368	Yes	WTG-038	1760	33
20	342417	6592461	Yes	WTG-053	1371	37
21	351468	6605230	No	WTG-001	12035	<20
22	347299	6607047	No	WTG-001	10551	<20
23	328436	6583675	No	WTG-064	6477	<20
24	329894	6584558	No	WTG-063	4935	<20
25	331992	6583573	No	WTG-064	2986	26
26	341941	6593172	No	WTG-053	2030	34
27	341318	6593565	No	WTG-031	1537	35
28	341090	6593361	No	WTG-031	1527	35
29	339724	6592770	No	WTG-031	1842	34
30	337592	6591761	No	WTG-042	2037	33
31	334165	6574176	No	WTG-066	8967	<20
32	333743	6574737	No	WTG-066	8475	<20
33	333550	6575188	No	WTG-066	8069	<20
34	332278	6575160	No	WTG-066	8452	<20
35	332401	6575431	No	WTG-066	8156	<20
36	332373	6575309	No	WTG-066	8280	<20
37	332053	6575279	No	WTG-066	8423	<20
38	333237	6582574	No	WTG-066	2058	30
39	333223	6582754	No	WTG-066	2035	30
40	332982	6582633	No	WTG-066	2293	28
41	342111	6594228	No	WTG-031	1991	34
42	330861	6590610	No	WTG-043	5400	<20
43	322353	6599475	No	WTG-028	10208	<20
44	324095	6596401	No	WTG-028	8526	<20
45	350428	6595909	No	WTG-044	5165	<20
46	350760	6596933	No	WTG-036	5868	<20
47	351163	6596676	No	WTG-036	6144	<20
48	350402	6597768	No	WTG-036	5951	<20

Dwelling ID	Dwelling Coordinates (UTM WGS84 55H)		Involved Dwelling (Yes/No)	Nearest WTG	Distance to Nearest WTG (m)	Predicted Level (dB(A))
	Easting	Northing				
49	351037	6597171	No	WTG-036	6219	<20
50	351357	6596859	No	WTG-036	6391	<20
51	352079	6596850	No	WTG-044	7061	<20
52	352033	6596541	No	WTG-044	6888	<20
53	352685	6596192	No	WTG-044	7363	<20
54	352166	6596026	No	WTG-044	6818	<20
55	332742	6600385	No	WTG-028	2356	28
56	328178	6584101	No	WTG-063	6694	<20
57	335396	6574882	No	WTG-066	8199	<20
58	336720	6575172	No	WTG-066	8047	<20
59	337017	6575218	No	WTG-066	8062	<20
60	337201	6577730	No	WTG-066	5701	<20
61	336999	6578118	No	WTG-066	5267	<20
62	337687	6578014	No	WTG-066	5629	<20
63	336750	6585708	No	WTG-041	1996	34
64	339373	6588304	No	WTG-038	2018	33
65	349185	6587121	No	WTG-061	4318	21
66	349404	6587462	No	WTG-061	4523	21
67	349567	6586936	No	WTG-061	4717	20
68	349641	6586986	No	WTG-061	4785	<20
69	349861	6586818	No	WTG-061	5023	<20
70	349435	6587993	No	WTG-060	4501	22
71	349615	6588184	No	WTG-060	4661	21
72	348802	6589005	No	WTG-047	3830	25
73	349441	6589881	No	WTG-047	4024	24
74	349159	6589919	No	WTG-047	3744	25
75	349982	6589998	No	WTG-047	4510	22
76	349901	6589958	No	WTG-047	4442	22
77	349900	6590372	No	WTG-047	4350	22
78	349995	6590851	No	WTG-047	4387	22
79	350764	6590358	No	WTG-047	5205	<20
80	350703	6590240	No	WTG-047	5164	<20
81	350794	6591161	No	WTG-046	5172	<20
82	350517	6591428	No	WTG-046	4869	21
83	350009	6591391	No	WTG-046	4366	22
84	348912	6591679	No	WTG-046	3252	27
85	348543	6590885	No	WTG-047	2936	28
86	349771	6592214	No	WTG-046	4127	23
87	350336	6592367	No	WTG-046	4705	21
88	350623	6591779	No	WTG-046	4960	20
89	350836	6592039	No	WTG-046	5178	<20
90	351151	6591535	No	WTG-046	5495	<20
91	351367	6591850	No	WTG-046	5704	<20
92	351537	6592142	No	WTG-046	5883	<20
93	348653	6593325	No	WTG-044	2932	27
94	350752	6592819	No	WTG-044	5085	<20
95	350687	6593239	No	WTG-044	4962	<20
96	350759	6593414	No	WTG-044	5020	<20
97	350621	6593652	No	WTG-044	4873	<20

Dwelling ID	Dwelling Coordinates (UTM WGS84 55H)		Involved Dwelling (Yes/No)	Nearest WTG	Distance to Nearest WTG (m)	Predicted Level (dB(A))
	Easting	Northing				
98	351224	6593636	No	WTG-044	5476	<20
99	349956	6593969	No	WTG-044	4215	22
100	350733	6594144	No	WTG-044	5002	<20
101	351425	6592879	No	WTG-044	5739	<20
102	351006	6594750	No	WTG-044	5357	<20
103	351672	6593198	No	WTG-044	5947	<20
104	351875	6593523	No	WTG-044	6130	<20
105	351596	6593846	No	WTG-044	5849	<20
106	351440	6594137	No	WTG-044	5707	<20
107	351832	6594018	No	WTG-044	6091	<20
108	352019	6592278	No	WTG-046	6372	<20
109	351863	6591814	No	WTG-046	6200	<20
110	352194	6592923	No	WTG-044	6495	<20
111	352681	6592980	No	WTG-044	6972	<20
112	352992	6593184	No	WTG-044	7264	<20
113	350745	6595432	No	WTG-044	5281	<20
114	351071	6595685	No	WTG-044	5673	<20
115	351089	6595524	No	WTG-044	5636	<20
116	351201	6595574	No	WTG-044	5758	<20
117	351230	6595794	No	WTG-044	5860	<20
118	351472	6596274	No	WTG-044	6267	<20
119	351622	6595934	No	WTG-044	6276	<20
120	351694	6596113	No	WTG-044	6408	<20
121	351690	6596290	No	WTG-044	6473	<20
122	351759	6596290	No	WTG-044	6536	<20
123	351834	6595992	No	WTG-044	6495	<20
124	351860	6596057	No	WTG-044	6542	<20
125	351959	6596205	No	WTG-044	6688	<20
126	351484	6596799	No	WTG-036	6488	<20
127	352465	6596381	No	WTG-044	7224	<20
128	351740	6594770	No	WTG-044	6082	<20
129	352568	6594685	No	WTG-044	6887	<20
130	351814	6593798	No	WTG-044	6066	<20
131	351780	6593384	No	WTG-044	6041	<20
132	356665	6593943	No	WTG-044	10919	<20
133	355450	6592830	No	WTG-044	9743	<20
134	355837	6592460	No	WTG-044	10167	<20
135	355823	6592263	No	WTG-046	10170	<20
136	356114	6591539	No	WTG-046	10454	<20
137	356251	6591483	No	WTG-046	10593	<20
138	356142	6591342	No	WTG-046	10489	<20
139	329617	6582431	No	WTG-064	5596	<20
140	329065	6582378	No	WTG-064	6135	<20
141	328559	6582639	No	WTG-064	6543	<20
142	327313	6582341	No	WTG-064	7825	<20
143	329144	6582063	No	WTG-064	6168	<20
144	329644	6582207	No	WTG-064	5651	<20
145	329591	6582042	No	WTG-066	5735	<20
146	325501	6605143	No	WTG-028	9940	<20

Dwelling ID	Dwelling Coordinates (UTM WGS84 55H)		Involved Dwelling (Yes/No)	Nearest WTG	Distance to Nearest WTG (m)	Predicted Level (dB(A))
	Easting	Northing				
147	327492	6590972	No	WTG-027	8558	<20
148	332659	6586519	No	WTG-062	2170	29
149	332044	6585886	No	WTG-062	2645	27
150	323374	6603902	No	WTG-028	10810	<20
151	326424	6595206	No	WTG-028	6671	<20
152	325339	6591294	No	WTG-028	9814	<20
153	349332	6585674	No	WTG-061	4800	<20
154	349300	6584108	No	WTG-061	5552	<20
155	349098	6581494	No	WTG-067	7306	<20
156	348277	6580647	No	WTG-067	7482	<20
157	341814	6574663	No	WTG-066	10685	<20
158	342219	6574823	No	WTG-066	10816	<20
159	341534	6605613	No	WTG-004	6567	<20
160	341680	6609068	No	WTG-004	9983	<20
161	340171	6609233	No	WTG-069	9912	<20
162	340177	6608682	No	WTG-069	9381	<20
163	339493	6607822	No	WTG-070	8356	<20
164	339859	6607653	No	WTG-069	8305	<20
165	342253	6606897	No	WTG-004	7993	<20
166	338263	6576638	No	WTG-066	7119	<20
167	345520	6578325	No	WTG-067	8708	<20
168	346196	6577576	No	WTG-067	9566	<20
169	346978	6577284	No	WTG-067	10038	<20
170	347823	6578667	No	WTG-067	9019	<20
171	348404	6579340	No	WTG-067	8671	<20
172	348417	6579546	No	WTG-067	8497	<20
173	348568	6578862	No	WTG-067	9169	<20
174	346271	6576298	No	WTG-067	10833	<20
175	346726	6576269	No	WTG-067	10956	<20
176	334904	6598856	No	WTG-070	2008	34
177	333328	6589464	No	WTG-043	2809	27
178	332005	6575172	No	WTG-066	8541	<20
179	347241	6576540	No	WTG-067	10826	<20
180	349759	6589477	No	WTG-047	4461	22
181	349864	6589437	No	WTG-047	4573	22
182	350727	6591942	No	WTG-046	5065	<20
183	350829	6592073	No	WTG-046	5172	<20
184	350944	6592070	No	WTG-046	5287	<20
185	350924	6592006	No	WTG-046	5264	<20
186	350951	6592004	No	WTG-046	5291	<20
187	350874	6592077	No	WTG-046	5217	<20
188	350950	6592120	No	WTG-046	5295	<20
189	350947	6592195	No	WTG-046	5297	<20
190	350919	6592123	No	WTG-046	5265	<20
191	350872	6592131	No	WTG-046	5218	<20
192	350779	6592890	No	WTG-044	5099	<20
193	350739	6592927	No	WTG-044	5054	<20
194	350177	6593296	No	WTG-044	4449	21
195	351445	6596084	No	WTG-044	6167	<20

Dwelling ID	Dwelling Coordinates (UTM WGS84 55H)		Involved Dwelling (Yes/No)	Nearest WTG	Distance to Nearest WTG (m)	Predicted Level (dB(A))
	Easting	Northing				
196	351608	6595911	No	WTG-044	6255	<20
197	351620	6595886	No	WTG-044	6258	<20
198	351612	6595865	No	WTG-044	6243	<20
199	351595	6595809	No	WTG-044	6208	<20
200	351540	6595693	No	WTG-044	6118	<20
201	351699	6596172	No	WTG-044	6435	<20
202	351791	6596263	No	WTG-044	6555	<20
203	351820	6596188	No	WTG-044	6553	<20
204	351868	6596090	No	WTG-044	6562	<20
205	351905	6595928	No	WTG-044	6540	<20
206	351858	6595903	No	WTG-044	6487	<20
207	351851	6595868	No	WTG-044	6469	<20
208	351894	6595808	No	WTG-044	6490	<20
209	351662	6594407	No	WTG-044	5953	<20
210	350955	6592566	No	WTG-044	5333	<20
211	352089	6592041	No	WTG-046	6430	<20
212	352445	6591982	No	WTG-046	6784	<20
213	351073	6596787	No	WTG-036	6100	<20
214	349414	6599099	No	WTG-036	6073	<20
215	349291	6598605	No	WTG-036	5626	<20
216	347923	6597066	No	WTG-036	3569	23
217	346955	6597433	No	WTG-036	3283	24
218	348169	6595592	No	WTG-036	2960	26
219	341469	6599624	No	WTG-004	1518	36
220	341858	6600032	No	WTG-001	2006	33
221	338474	6602191	No	WTG-069	2671	29
222	342872	6599122	No	WTG-001	1514	33
223	343614	6600525	No	WTG-001	3072	26
224	343624	6600743	No	WTG-001	3257	25
225	343664	6601724	No	WTG-001	4129	22
226	335911	6602846	No	WTG-070	2918	25
227	332822	6603678	No	WTG-070	5240	<20
228	330187	6601650	No	WTG-028	4261	<20
229	330378	6602290	No	WTG-028	4727	<20
230	330667	6590549	No	WTG-043	5578	<20
231	329376	6589088	No	WTG-062	6276	<20
232	331664	6586415	No	WTG-062	3095	24
234	349737	6586967	No	WTG-061	4882	<20
235	350023	6586881	No	WTG-061	5176	<20
236	350613	6587023	No	WTG-061	5750	<20
237	351799	6586714	No	WTG-061	6959	<20
238	352027	6585374	No	WTG-061	7447	<20
239	352555	6585647	No	WTG-061	7888	<20
240	354036	6587523	No	WTG-060	9125	<20
241	353540	6584027	No	WTG-061	9318	<20
242	354298	6583708	No	WTG-061	10140	<20
243	354255	6584094	No	WTG-061	9963	<20
244	353980	6582769	No	WTG-061	10241	<20
245	353881	6582847	No	WTG-061	10118	<20

Dwelling ID	Dwelling Coordinates (UTM WGS84 55H)		Involved Dwelling (Yes/No)	Nearest WTG	Distance to Nearest WTG (m)	Predicted Level (dB(A))
	Easting	Northing				
245	353230	6583487	No	WTG-061	9250	<20
246	351373	6589786	No	WTG-047	5911	<20
247	351880	6582617	No	WTG-061	8516	<20
248	341622	6606381	No	WTG-004	7335	<20
249	342236	6606379	No	WTG-004	7493	<20
250	336141	6605752	No	WTG-070	5767	<20
251	336123	6605391	No	WTG-070	5408	<20
252	324918	6601540	No	WTG-028	8313	<20
253	351136	6598941	No	WTG-036	7228	<20
254	352087	6600498	No	WTG-036	8955	<20
255	349536	6584540	No	WTG-061	5500	<20
256	353035	6602520	No	WTG-036	11043	<20
257	344957	6585629	No	WTG-067	1499	32
258	336574	6579159	No	WTG-066	4144	<20
259	336496	6579240	No	WTG-066	4043	<20
260	333842	6591136	No	WTG-042	2599	28
261	351629	6596047	No	WTG-044	6323	<20
262	351593	6595839	No	WTG-044	6216	<20
263	349138	6590218	No	WTG-047	3638	25
264	349778	6590786	No	WTG-047	4175	23
265	349616	6591150	No	WTG-047	3999	24
266	350771	6591324	No	WTG-046	5131	<20