

Technical Appendix 13.4: Noise Assessment Graphs (ETSU-R-97)

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1.0 Introduction

This Technical Appendix provides the detailed calculation results of the predicted wind turbine noise immission level at each of the Noise Sensitive Receptors (NSRs). Set out subsequently for each NSR is the following information both in tabular and graphical format:

- The overall ETSU-R-97 noise limits for the daytime (shown graphically as a solid black line) and night-time (shown graphically as a solid blue line);
- The cumulative total wind turbine noise (shown graphically as a solid red line) incorporating all of the subsequent wind farm noise immission levels;
- The Proposed Development wind turbine noise (shown graphically as a dashed red line);
- Clyde Wind Farm immission level (shown graphically as a dashed sand line);
- Clyde Wind Farm Extension immission level (shown graphically as a dot-dashed sand line);
- Glenkerie Wind Farm immission level (shown graphically as a dashed blue line);
- Glenkerie Extension Wind Farm immission level (shown graphically as a dot-dashed blue line);
- Grayside Wind Farm immission level (shown graphically as a dashed grey line);
- Whitelaw Brae Wind Farm immission level (shown graphically as a dashed green line);
- The margin between the cumulative total wind turbine noise and the ETSU-R-97 daytime limit (shown in the tables only); and
- The margin between the cumulative total wind turbine noise and the ETSU-R-97 night-time limit (shown in the tables only).

The predicted noise immission levels from all neighbouring wind farms to the Proposed Development include the appropriate uplift as discussed in Chapter 13 of the EIA Report. It should be noted that all calculations have been carried out to one decimal place and the results shown to the nearest whole decibel. Therefore, in some cases the margin may not exactly equal the difference between the limit and cumulative immission presented: e.g. NSR01 at 8 m/s day limit is 43.2 dB (43 dB presented), cumulative immission is 39.5 dB (40 dB presented), giving a margin of -3.7 dB (4 dB presented; however, 3 dB may be expected if the rounded values are used).

2.0 Noise Sensitive Receptors (NSRs)

2.1 NSR01 – Menzion Farm

Graph 1 – NSR01 Menzion Farm Assessment Graph

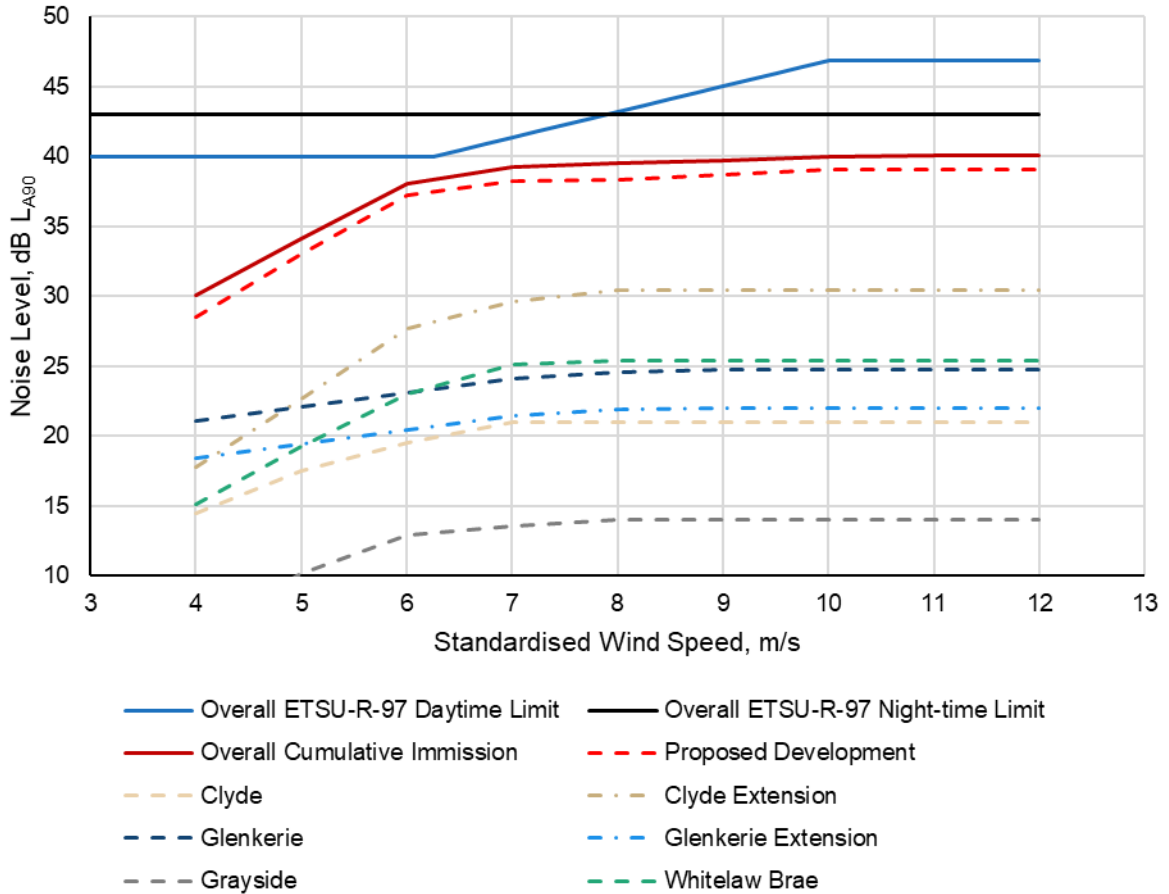


Table 1 – NSR01 Menzion Farm Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	40	41	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	30	34	38	39	40	40	40	40	40	
Proposed Development	28	33	37	38	38	39	39	39	39	
Clyde Wind Farm	15	18	20	21	21	21	21	21	21	
Clyde Wind Farm Extension	18	23	28	30	30	30	30	30	30	
Glenkerie Wind Farm	21	22	23	24	25	25	25	25	25	
Glenkerie Wind Farm Extension	18	19	20	21	22	22	22	22	22	
Grayside Wind Farm	6	10	13	14	14	14	14	14	14	
Whitelaw Brae Wind Farm	15	19	23	25	25	25	25	25	25	
Margin (Cumulative - ESTU-R-97) Day	-10	-6	-2	-2	-4	-5	-7	-7	-7	
Margin (Cumulative - ESTU-R-97) Night	-13	-9	-5	-4	-3	-3	-3	-3	-3	

2.2 NSR02 – Oliver Farm

Graph 2 – NSR02 Oliver Farm Assessment Graph

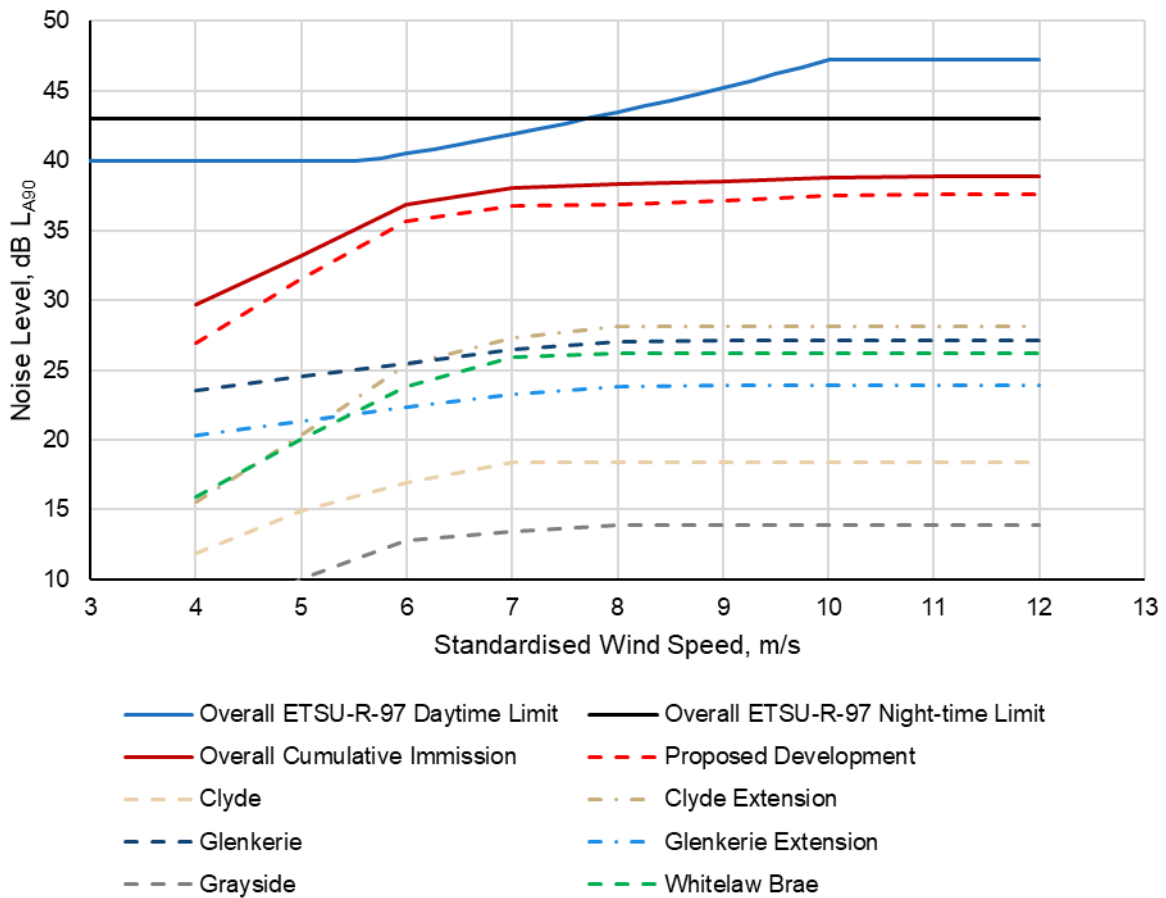


Table 2 – NSR02 Oliver Farm Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	30	33	37	38	38	39	39	39	39	
Proposed Development	27	31	36	37	37	37	38	38	38	
Clyde Wind Farm	12	15	17	18	18	18	18	18	18	
Clyde Wind Farm Extension	16	20	25	27	28	28	28	28	28	
Glenkerie Wind Farm	24	25	26	27	27	27	27	27	27	
Glenkerie Wind Farm Extension	20	21	22	23	24	24	24	24	24	
Grayside Wind Farm	6	10	13	13	14	14	14	14	14	
Whitelaw Brae Wind Farm	16	20	24	26	26	26	26	26	26	
Margin (Cumulative - ESTU-R-97) Day	-10	-7	-3	-4	-5	-7	-8	-8	-8	
Margin (Cumulative - ESTU-R-97) Night	-13	-10	-6	-5	-5	-4	-4	-4	-4	

2.3 NSR03 – Oliver Bank

Graph 3 – NSR03 Oliver Bank Assessment Graph

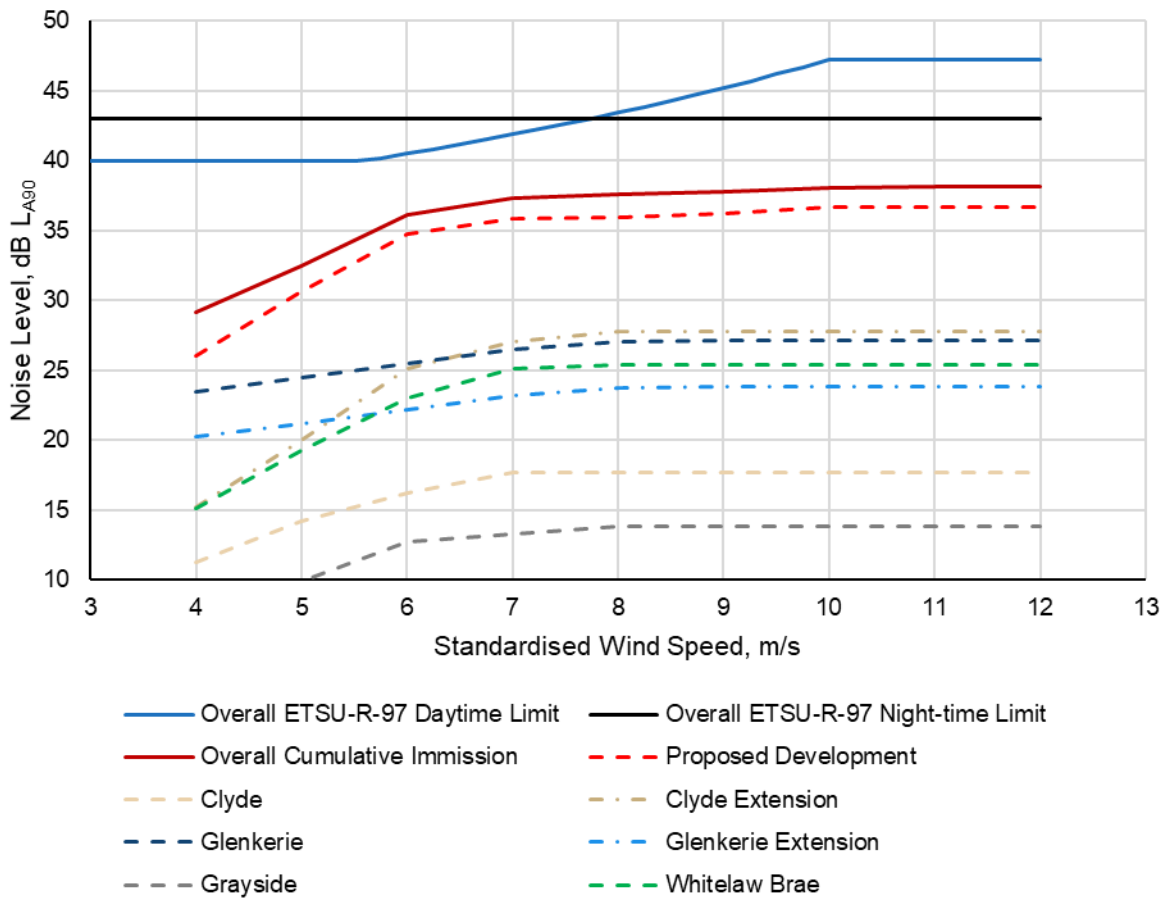


Table 3 – NSR03 Oliver Bank Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	29	32	36	37	38	38	38	38	38	
Proposed Development	26	31	35	36	36	36	37	37	37	
Clyde Wind Farm	11	14	16	18	18	18	18	18	18	
Clyde Wind Farm Extension	15	20	25	27	28	28	28	28	28	
Glenkerie Wind Farm	24	25	26	27	27	27	27	27	27	
Glenkerie Wind Farm Extension	20	21	22	23	24	24	24	24	24	
Grayside Wind Farm	5	10	13	13	14	14	14	14	14	
Whitelaw Brae Wind Farm	15	19	23	25	25	25	25	25	25	
Margin (Cumulative - ESTU-R-97) Day	-11	-8	-4	-4	-6	-7	-9	-9	-9	
Margin (Cumulative - ESTU-R-97) Night	-14	-11	-7	-6	-5	-5	-5	-5	-5	

2.4 NSR04 – The Toll House

Graph 4 – NSR04 The Toll House Assessment Graph

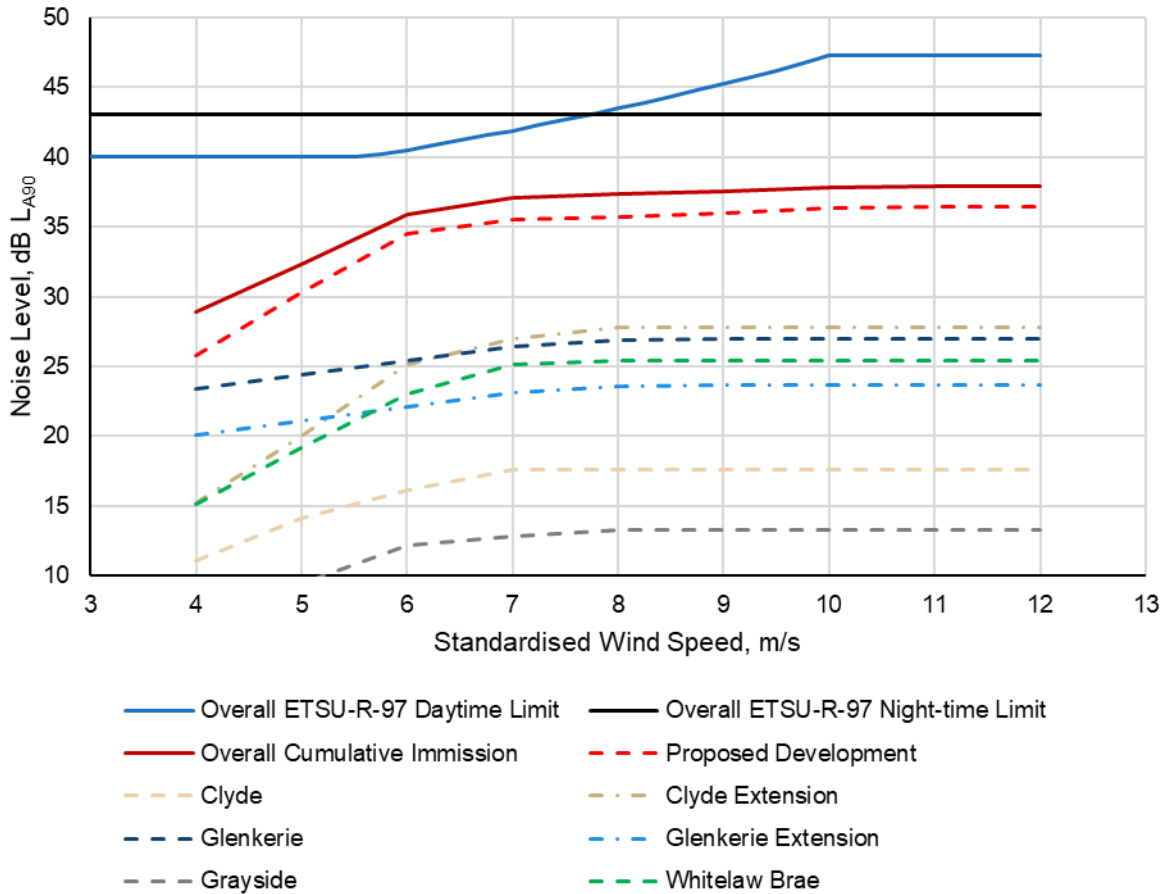


Table 4 – NSR04 The Toll House Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	29	32	36	37	37	38	38	38	38	
Proposed Development	26	30	34	36	36	36	36	36	36	
Clyde Wind Farm	11	14	16	18	18	18	18	18	18	
Clyde Wind Farm Extension	15	20	25	27	28	28	28	28	28	
Glenkerie Wind Farm	23	24	25	26	27	27	27	27	27	
Glenkerie Wind Farm Extension	20	21	22	23	24	24	24	24	24	
Grayside Wind Farm	5	9	12	13	13	13	13	13	13	
Whitelaw Brae Wind Farm	15	19	23	25	25	25	25	25	25	
Margin (Cumulative - ESTU-R-97) Day	-11	-8	-4	-5	-6	-8	-9	-9	-9	
Margin (Cumulative - ESTU-R-97) Night	-14	-11	-7	-6	-6	-5	-5	-5	-5	

2.5 NSR05 – Lilybank

Graph 5 – NSR05 Lilybank Assessment Graph

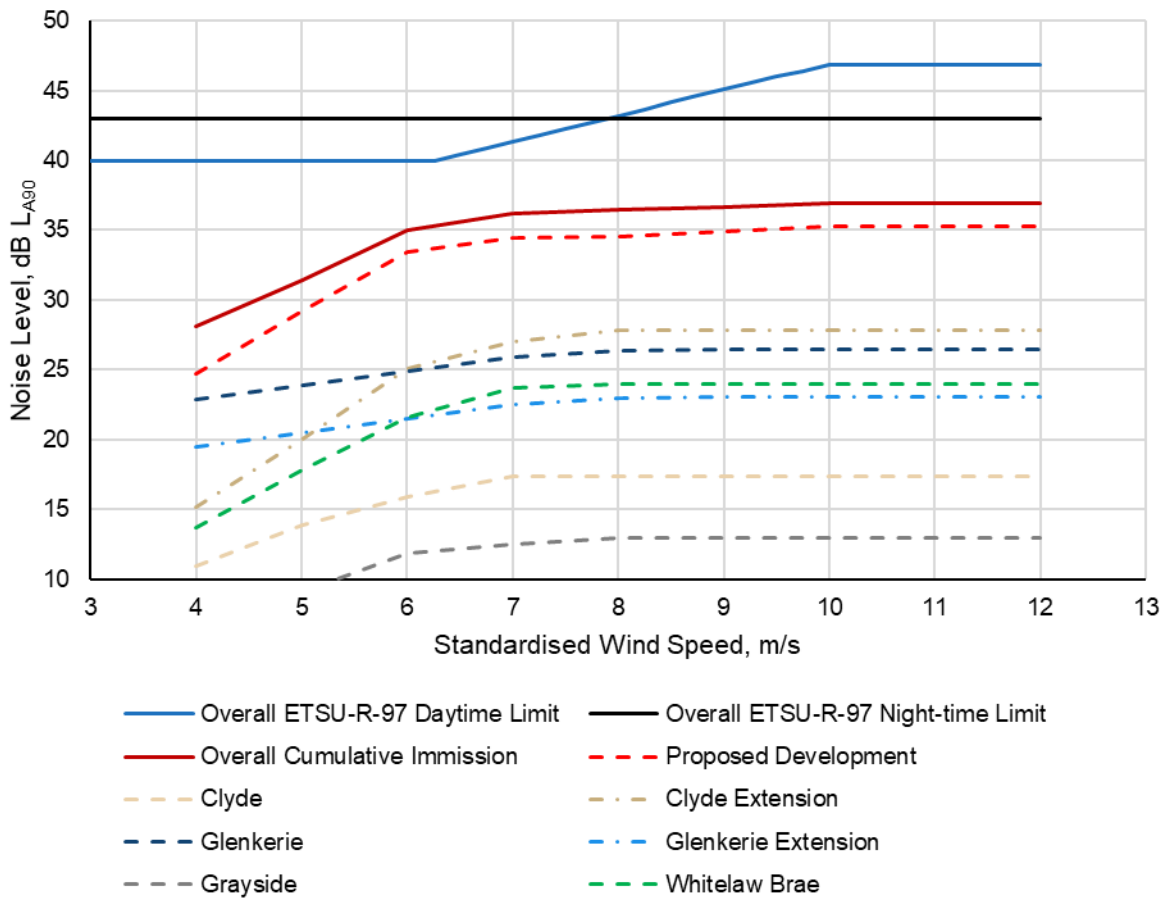


Table 5 – NSR05 Lilybank Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	40	41	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	28	31	35	36	36	37	37	37	37	
Proposed Development	25	29	33	34	35	35	35	35	35	
Clyde Wind Farm	11	14	16	17	17	17	17	17	17	
Clyde Wind Farm Extension	15	20	25	27	28	28	28	28	28	
Glenkerie Wind Farm	23	24	25	26	26	27	27	27	27	
Glenkerie Wind Farm Extension	20	21	22	23	23	23	23	23	23	
Grayside Wind Farm	5	9	12	13	13	13	13	13	13	
Whitelaw Brae Wind Farm	14	18	22	24	24	24	24	24	24	
Margin (Cumulative - ESTU-R-97) Day	-12	-9	-5	-5	-7	-8	-10	-10	-10	
Margin (Cumulative - ESTU-R-97) Night	-15	-12	-8	-7	-7	-6	-6	-6	-6	

2.6 NSR06 – Oliver House

Graph 6 – NSR06 Oliver House Assessment Graph

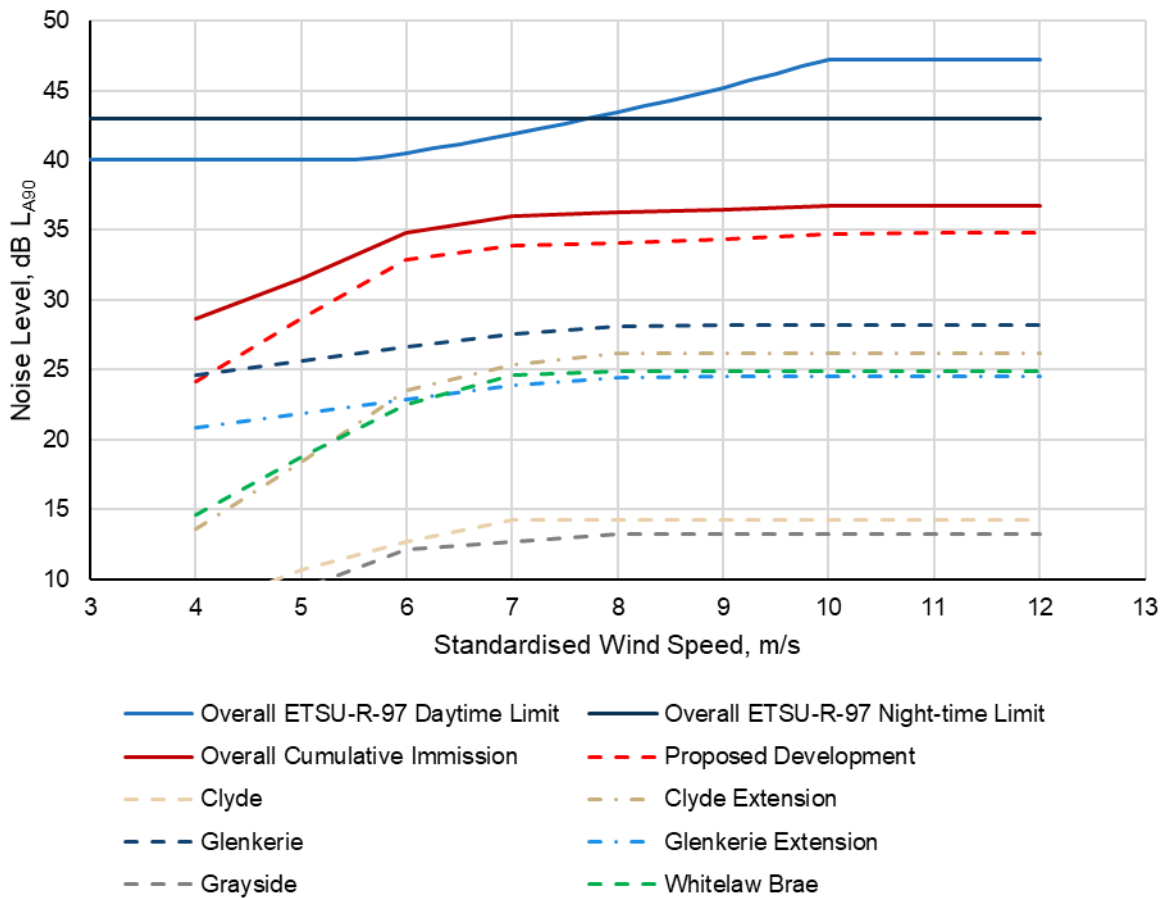


Table 6 – NSR06 Oliver House Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43
Overall Cumulative Immission	29	32	35	36	36	36	37	37	37
Proposed Development	24	29	33	34	34	34	35	35	35
Clyde Wind Farm	8	11	13	14	14	14	14	14	14
Clyde Wind Farm Extension	14	18	24	25	26	26	26	26	26
Glenkerie Wind Farm	25	26	27	28	28	28	28	28	28
Glenkerie Wind Farm Extension	21	22	23	24	24	25	25	25	25
Grayside Wind Farm	5	9	12	13	13	13	13	13	13
Whitelaw Brae Wind Farm	15	19	23	25	25	25	25	25	25
Margin (Cumulative - ESTU-R-97) Day	-11	-8	-6	-6	-7	-9	-11	-10	-10
Margin (Cumulative - ESTU-R-97) Night	-14	-11	-8	-7	-7	-7	-6	-6	-6

2.7 NSR07 – The Bield

Graph 7 – NSR07 The Bield Assessment Graph

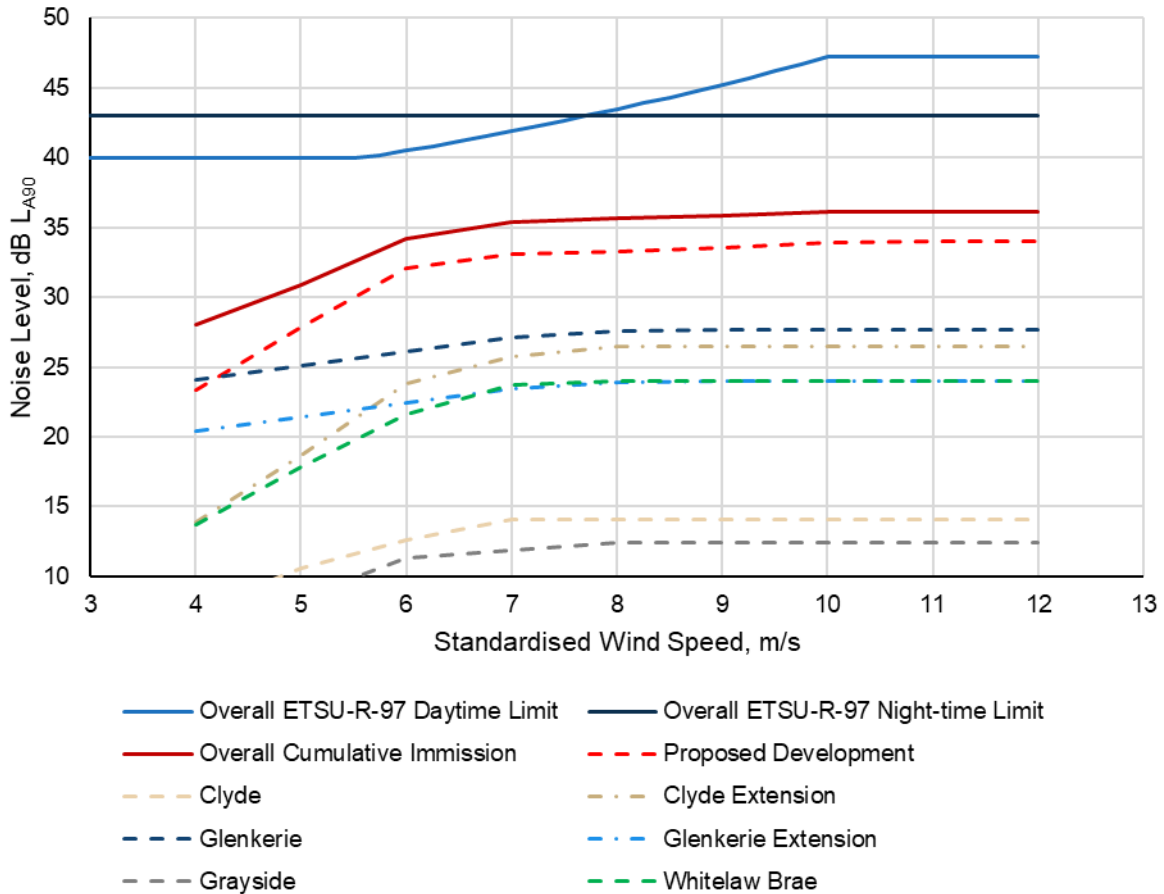


Table 7 – NSR07 The Bield Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	28	31	34	35	36	36	36	36	36	
Proposed Development	23	28	32	33	33	34	34	34	34	
Clyde Wind Farm	8	11	13	14	14	14	14	14	14	
Clyde Wind Farm Extension	14	19	24	26	27	27	27	27	27	
Glenkerie Wind Farm	24	25	26	27	28	28	28	28	28	
Glenkerie Wind Farm Extension	20	21	22	23	24	24	24	24	24	
Grayside Wind Farm	4	9	11	12	12	12	12	12	12	
Whitelaw Brae Wind Farm	14	18	22	24	24	24	24	24	24	
Margin (Cumulative - ESTU-R-97) Day	-12	-9	-6	-7	-8	-9	-11	-11	-11	
Margin (Cumulative - ESTU-R-97) Night	-15	-12	-9	-8	-7	-7	-7	-7	-7	

2.8 NSR08 – Riverview

Graph 8 – NSR08 Riverview Assessment Graph

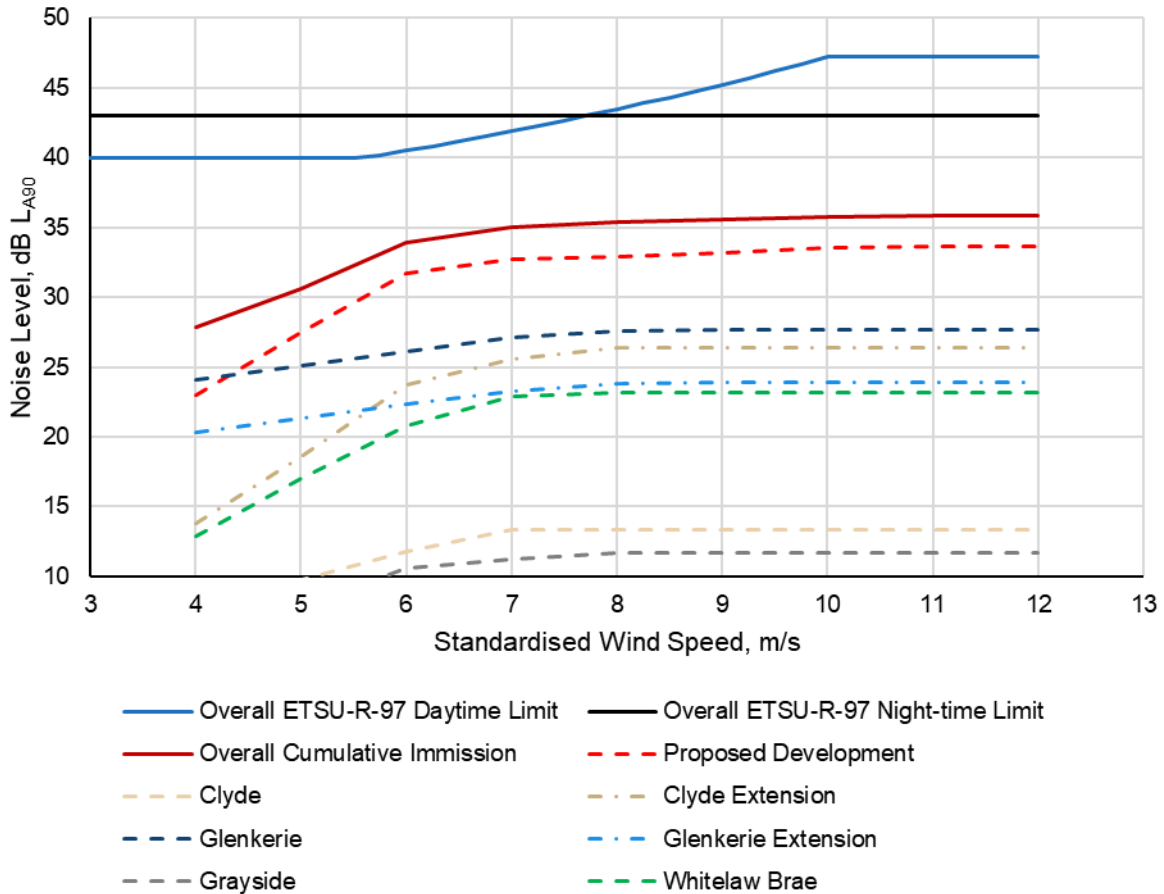


Table 8 – NSR08 Riverview Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	28	31	34	35	35	36	36	36	36	
Proposed Development	23	27	32	33	33	33	34	34	34	
Clyde Wind Farm	7	10	12	13	13	13	13	13	13	
Clyde Wind Farm Extension	14	19	24	26	26	26	26	26	26	
Glenkerie Wind Farm	24	25	26	27	28	28	28	28	28	
Glenkerie Wind Farm Extension	20	21	22	23	24	24	24	24	24	
Grayside Wind Farm	3	8	11	11	12	12	12	12	12	
Whitelaw Brae Wind Farm	13	17	21	23	23	23	23	23	23	
Margin (Cumulative - ESTU-R-97) Day	-12	-9	-7	-7	-8	-10	-11	-11	-11	
Margin (Cumulative - ESTU-R-97) Night	-15	-12	-9	-8	-8	-7	-7	-7	-7	

2.9 NSR09 – Tweedholm Cottage

Graph 9 – NSR09 Tweedholm Cottage Assessment Graph

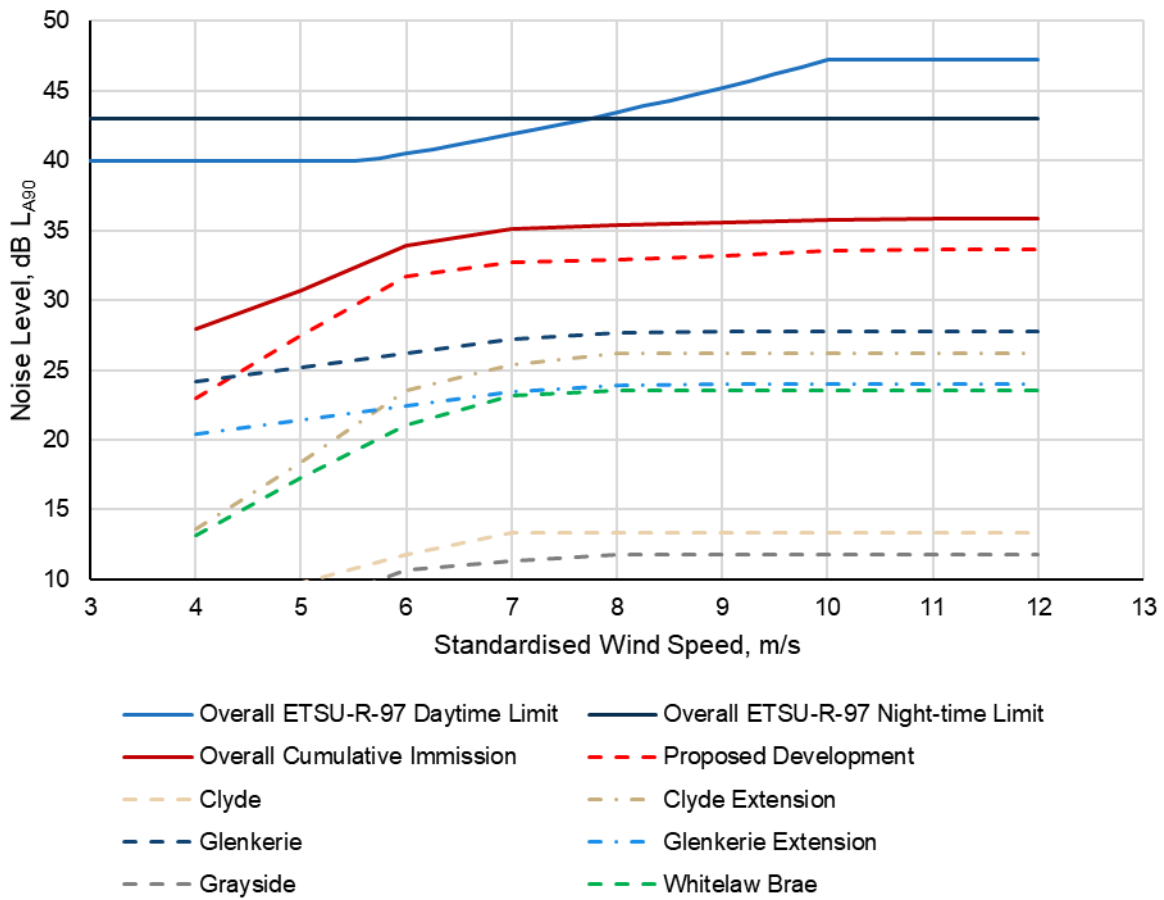


Table 9 – NSR09 Tweedholm Cottage Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43
Overall Cumulative Immission	28	31	34	35	35	36	36	36	36
Proposed Development	23	27	32	33	33	33	34	34	34
Clyde Wind Farm	7	10	12	13	13	13	13	13	13
Clyde Wind Farm Extension	14	18	24	25	26	26	26	26	26
Glenkerie Wind Farm	24	25	26	27	28	28	28	28	28
Glenkerie Wind Farm Extension	20	21	22	23	24	24	24	24	24
Grayside Wind Farm	3	8	11	11	12	12	12	12	12
Whitelaw Brae Wind Farm	13	17	21	23	24	24	24	24	24
Margin (Cumulative - ESTU-R-97) Day	-12	-9	-7	-7	-8	-10	-11	-11	-11
Margin (Cumulative - ESTU-R-97) Night	-15	-12	-9	-8	-8	-7	-7	-7	-7

2.10 NSR10 – Carngorm

Graph 10 – NSR10 Carngorm Assessment Graph

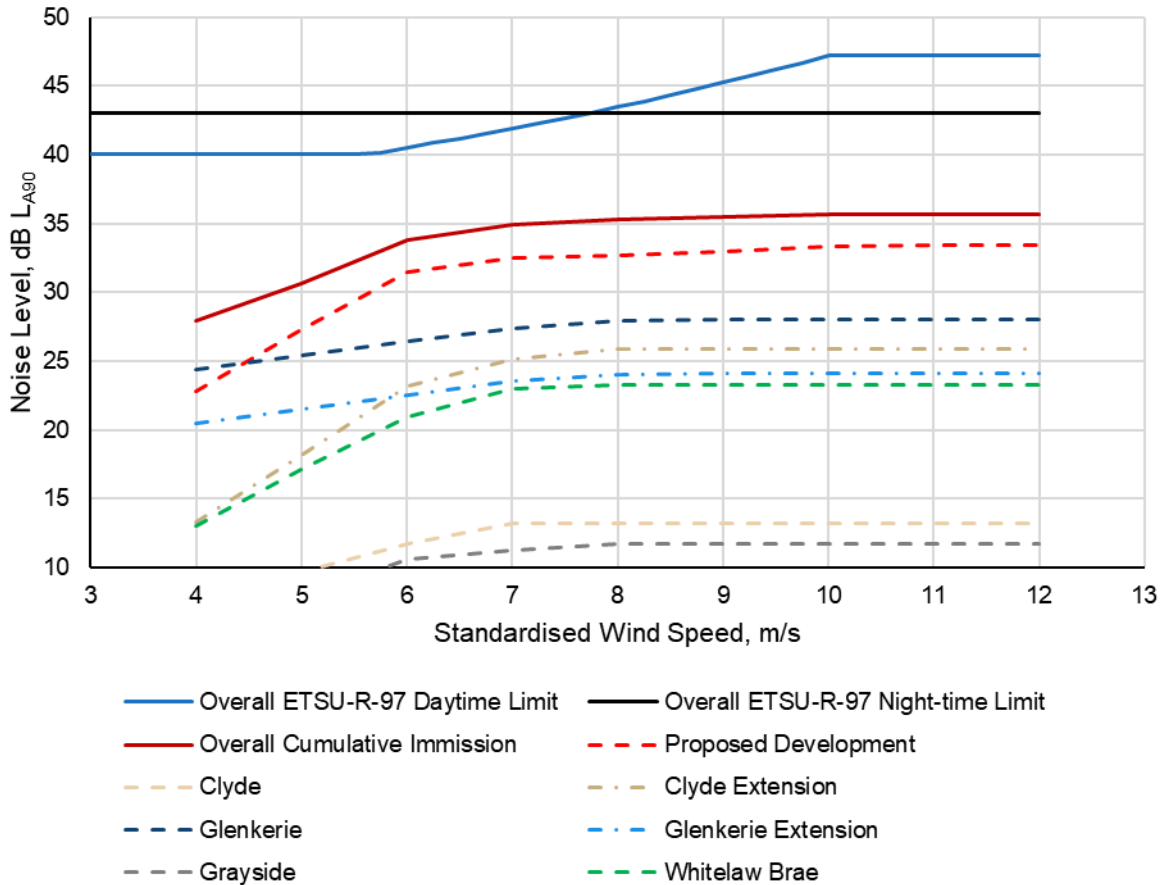


Table 10 – NSR10 Carngorm Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
Overall ETSU-R-97 Limit - Day	40	40	41	42	43	45	47	47	47
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43
Overall Cumulative Immission	28	31	34	35	35	35	36	36	36
Proposed Development	23	27	31	33	33	33	33	33	33
Clyde Wind Farm	7	10	12	13	13	13	13	13	13
Clyde Wind Farm Extension	13	18	23	25	26	26	26	26	26
Glenkerie Wind Farm	24	25	26	27	28	28	28	28	28
Glenkerie Wind Farm Extension	21	22	23	24	24	24	24	24	24
Grayside Wind Farm	3	8	11	11	12	12	12	12	12
Whitelaw Brae Wind Farm	13	17	21	23	23	23	23	23	23
Margin (Cumulative - ESTU-R-97) Day	-12	-9	-7	-7	-8	-10	-12	-12	-12
Margin (Cumulative - ESTU-R-97) Night	-15	-12	-9	-8	-8	-8	-7	-7	-7

2.11 NSR11 – Glenbrek

Graph 11 – NSR11 Glenbrek Assessment Graph

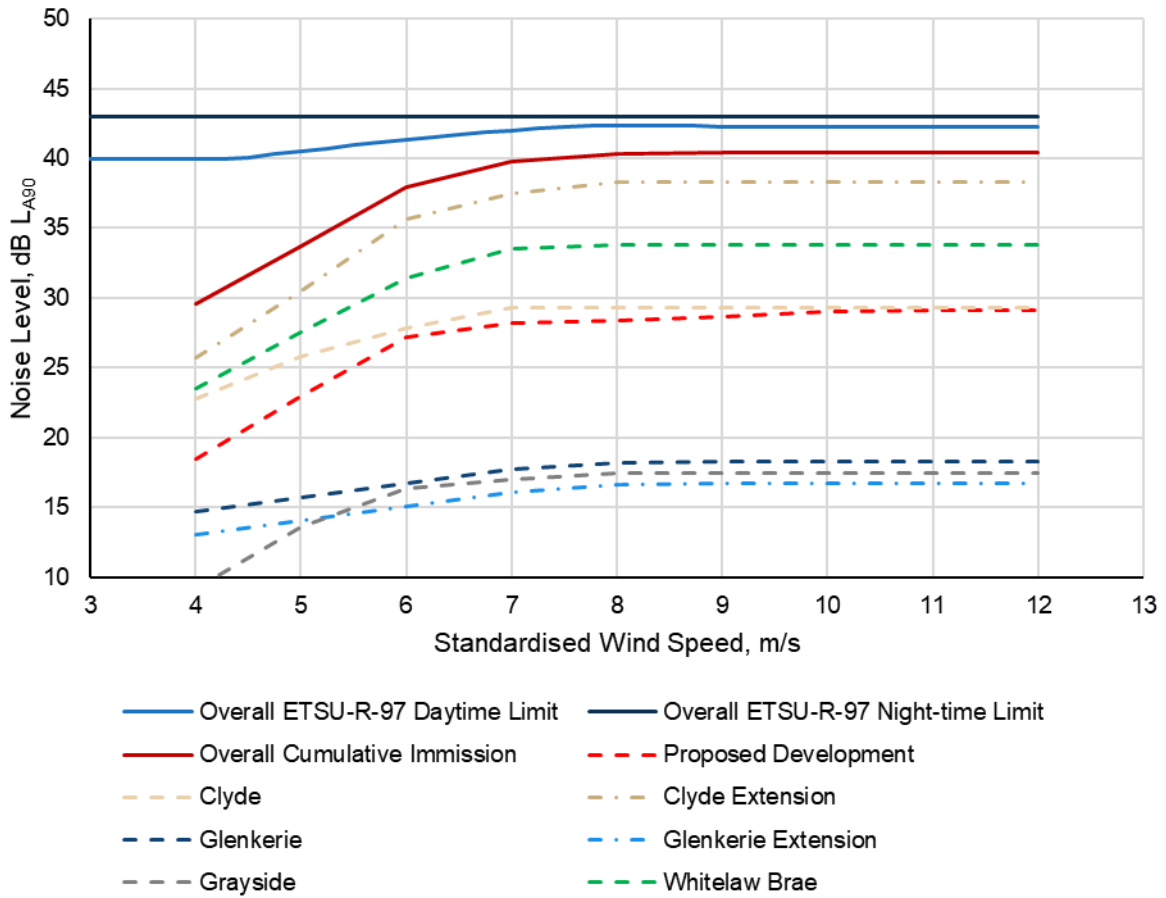


Table 11 – NSR11 Glenbrek Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	41	41	42	42	42	42	42	42	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	30	34	38	40	40	40	40	40	40	
Proposed Development	18	23	27	28	28	29	29	29	29	
Clyde Wind Farm	23	26	28	29	29	29	29	29	29	
Clyde Wind Farm Extension	26	31	36	38	38	38	38	38	38	
Glenkerie Wind Farm	15	16	17	18	18	18	18	18	18	
Glenkerie Wind Farm Extension	13	14	15	16	17	17	17	17	17	
Grayside Wind Farm	9	14	16	17	18	18	18	18	18	
Whitelaw Brae Wind Farm	24	28	31	34	34	34	34	34	34	
Margin (Cumulative - ESTU-R-97) Day	-10	-7	-3	-2	-2	-2	-2	-2	-2	
Margin (Cumulative - ESTU-R-97) Night	-13	-9	-5	-3	-3	-3	-3	-3	-3	

2.12 NSR12 – Hawkshaw

Graph 12 – NSR12 Hawkshaw Assessment Graph

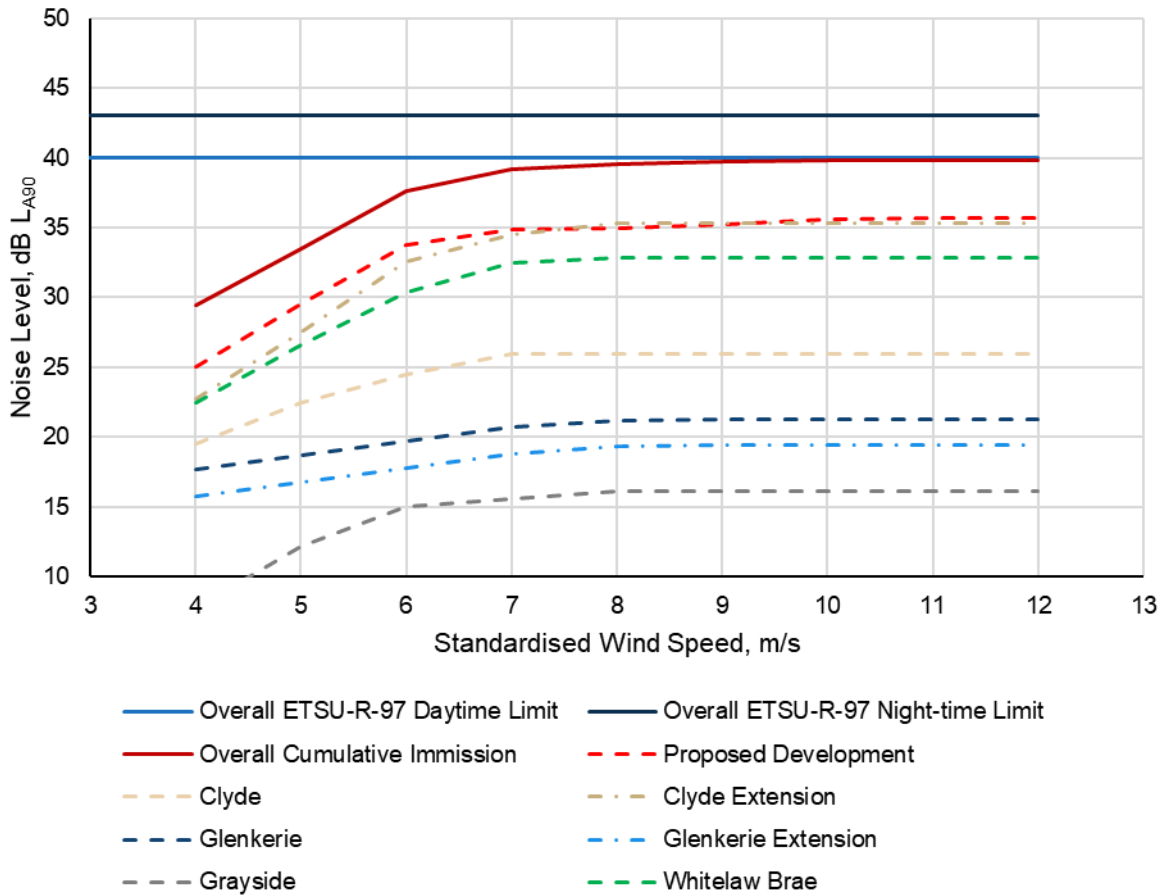


Table 12 – NSR12 Hawkshaw Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	40	40	40	40	40	40	40	
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	
Overall Cumulative Immission	29	34	38	39	40	40	40	40	40	
Proposed Development	25	30	34	35	35	35	36	36	36	
Clyde Wind Farm	20	23	25	26	26	26	26	26	26	
Clyde Wind Farm Extension	23	28	33	35	35	35	35	35	35	
Glenkerie Wind Farm	18	19	20	21	21	21	21	21	21	
Glenkerie Wind Farm Extension	16	17	18	19	19	19	19	19	19	
Grayside Wind Farm	8	12	15	16	16	16	16	16	16	
Whitelaw Brae Wind Farm	23	27	30	33	33	33	33	33	33	
Margin (Cumulative - ESTU-R-97) Day	-11	-6	-2	-1	0	0	0	0	0	
Margin (Cumulative - ESTU-R-97) Night	-14	-9	-5	-4	-3	-3	-3	-3	-3	

2.13 NSR13 – Craiglaw

Graph 13 – NSR13 Craiglaw Assessment Graph

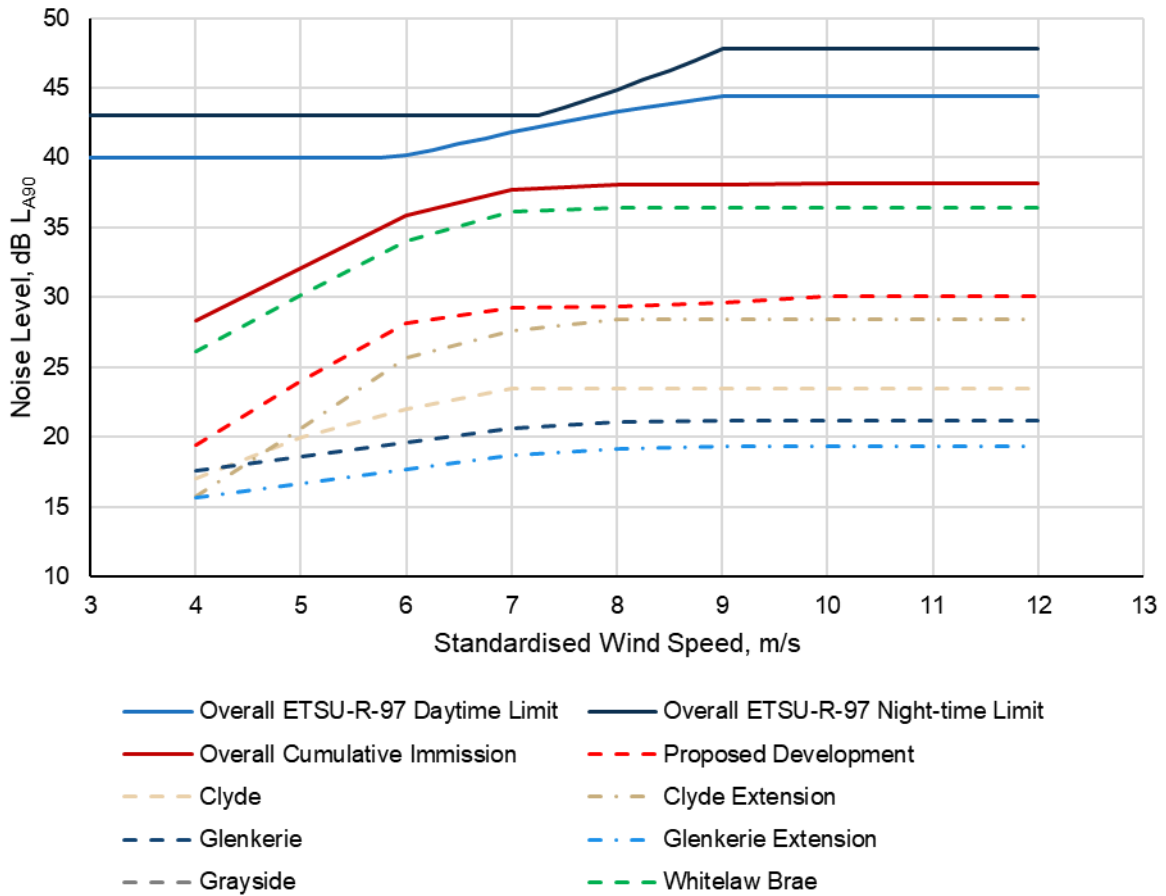


Table 13 – NSR13 Craiglaw Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	40	40	40	42	43	44	44	44	44	
Overall ETSU-R-97 Limit - Night	43	43	43	43	45	48	48	48	48	
Overall Cumulative Immission	28	32	36	38	38	38	38	38	38	
Proposed Development	19	24	28	29	29	30	30	30	30	
Clyde Wind Farm	17	20	22	24	24	24	24	24	24	
Clyde Wind Farm Extension	16	21	26	28	28	28	28	28	28	
Glenkerie Wind Farm	18	19	20	21	21	21	21	21	21	
Glenkerie Wind Farm Extension	16	17	18	19	19	19	19	19	19	
Grayside Wind Farm	-	5	8	8	9	9	9	9	9	
Whitelaw Brae Wind Farm	26	30	34	36	36	36	36	36	36	
Margin (Cumulative - ESTU-R-97) Day	-12	-8	-4	-4	-5	-6	-6	-6	-6	
Margin (Cumulative - ESTU-R-97) Night	-15	-11	-7	-5	-7	-10	-10	-10	-10	

2.14 NSR14 – Hopehead

Graph 14 – NSR14 Hopehead Assessment Graph

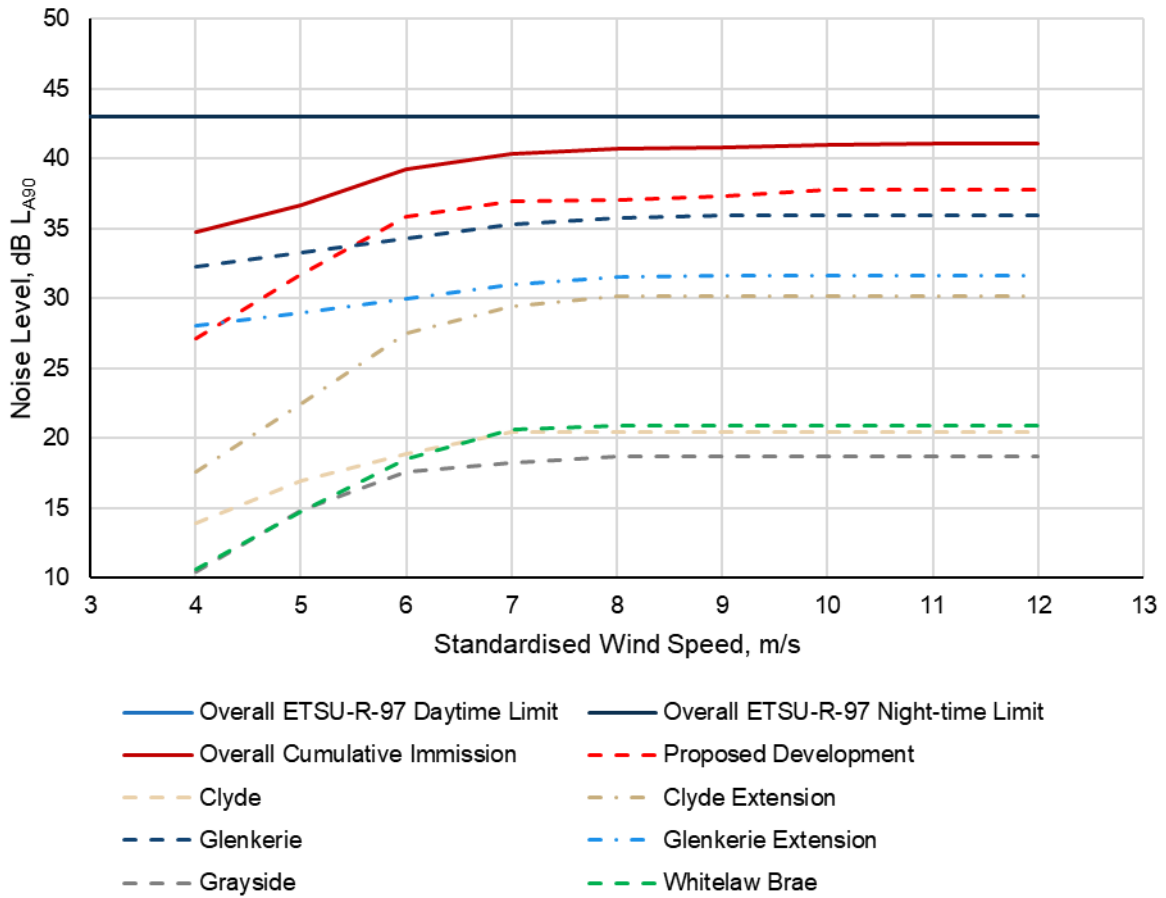


Table 14 – NSR14 Hopehead Assessment Table, dB LA90

Detail	Noise Level, dB LA90 for Standardised Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	
Overall ETSU-R-97 Limit - Day	43	43	43	43	43	43	43	43	43	43
Overall ETSU-R-97 Limit - Night	43	43	43	43	43	43	43	43	43	43
Overall Cumulative Immission	35	37	39	40	41	41	41	41	41	41
Proposed Development	27	32	36	37	37	37	38	38	38	38
Clyde Wind Farm	14	17	19	20	20	20	20	20	20	20
Clyde Wind Farm Extension	18	22	28	29	30	30	30	30	30	30
Glenkerie Wind Farm	32	33	34	35	36	36	36	36	36	36
Glenkerie Wind Farm Extension	28	29	30	31	32	32	32	32	32	32
Grayside Wind Farm	10	15	18	18	19	19	19	19	19	19
Whitelaw Brae Wind Farm	11	15	19	21	21	21	21	21	21	21
Margin (Cumulative - ESTU-R-97) Day	-8	-6	-4	-3	-2	-2	-2	-2	-2	-2
Margin (Cumulative - ESTU-R-97) Night	-8	-6	-4	-3	-2	-2	-2	-2	-2	-2