



REPORT REFERENCE:

IMP4640 – Version 4

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

British Standard 8233:2014

WHO Guidelines

Assessment of Play Area at Caversham Preparatory School.

CLIENT:

Caversham Preparatory School

SITE:

Caversham Preparatory School

(Longitude: 51.28'21.98"N, Latitude:0.58'04.82"W)

SURVEY DATES:

19th – 21st October 2015

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1 Executive Summary

1.1 Instruction

Impact Acoustics have been instructed to provide a noise impact assessment to WHO Guidelines and British Standard 8233:2014 to determine the impact of existing play areas at Caversham Prep School on adjacent residential amenity.

1.2 Scope of Report

The report aims to determine the impact of the play areas on the external noise environment at the nearby residential properties by measuring the existing noise climate, calculating the external noise levels and assessing in accordance with British Standard 8233:2014 and WHO Guidelines.

1.3 Executive Summary

1.3.1 Summary of Criterion

Source	Location	07:00 to 23:00	23:00 to 07:00
WHO Guidelines	External (Garden)	L _{Aeq, 16 hour} 55 dB	--
BS8233:2014	External (Garden)	Upper Limit L _{Aeq, 16 hour} 55 dB	--

1.3.2 Measurements

Background noise measurements were undertaken at two representative positions at the play area and the equipment area over a 3 day period. Measurements were undertaken from 19th to 21st October 2015 to establish the existing underlying background noise levels and source levels. The modal background levels (taken 1 hour before and after play times) was 44 dB LA90,1hour.

1.3.3 Source Levels

The Average of the 3 'play times' (morning play, lunchtime and infant play) have been assessed over the 3 day period. Source measurements were taken at the boundary 5m from source. The worst case average came from morning play at 71dB. This figure was used in the modelling of the impact of the playtimes on residential amenity.

	LAeq	LAFMax
Morning Play	71.0	92.6
Lunch	69.0	90.1
Infant Play	66.4	88.3

1.3.4 Proposed Residential Façade Noise Levels

A detailed noise map, calibrated to the measured levels and indicated that the average external noise levels that are likely to be present at the proposed residential external garden areas were at worst case 67dB. It was therefore recommended that noise mitigation measures should be adopted to reduce external noise levels in line with WHO Guidelines and BS8233:2014.

1.3.5 Acoustic Fence

It is recommended that a 3m acoustic fence should be installed at the southern the boundary line, following the ground height. The fence should have a minimum superficial mass of 28kgm² and have no holes or gaps. On installation of the fencing the external levels are at 62dB worst case (5dB insertion loss).

1.3.6 Further mitigation into reduction of pupils using space at any one time

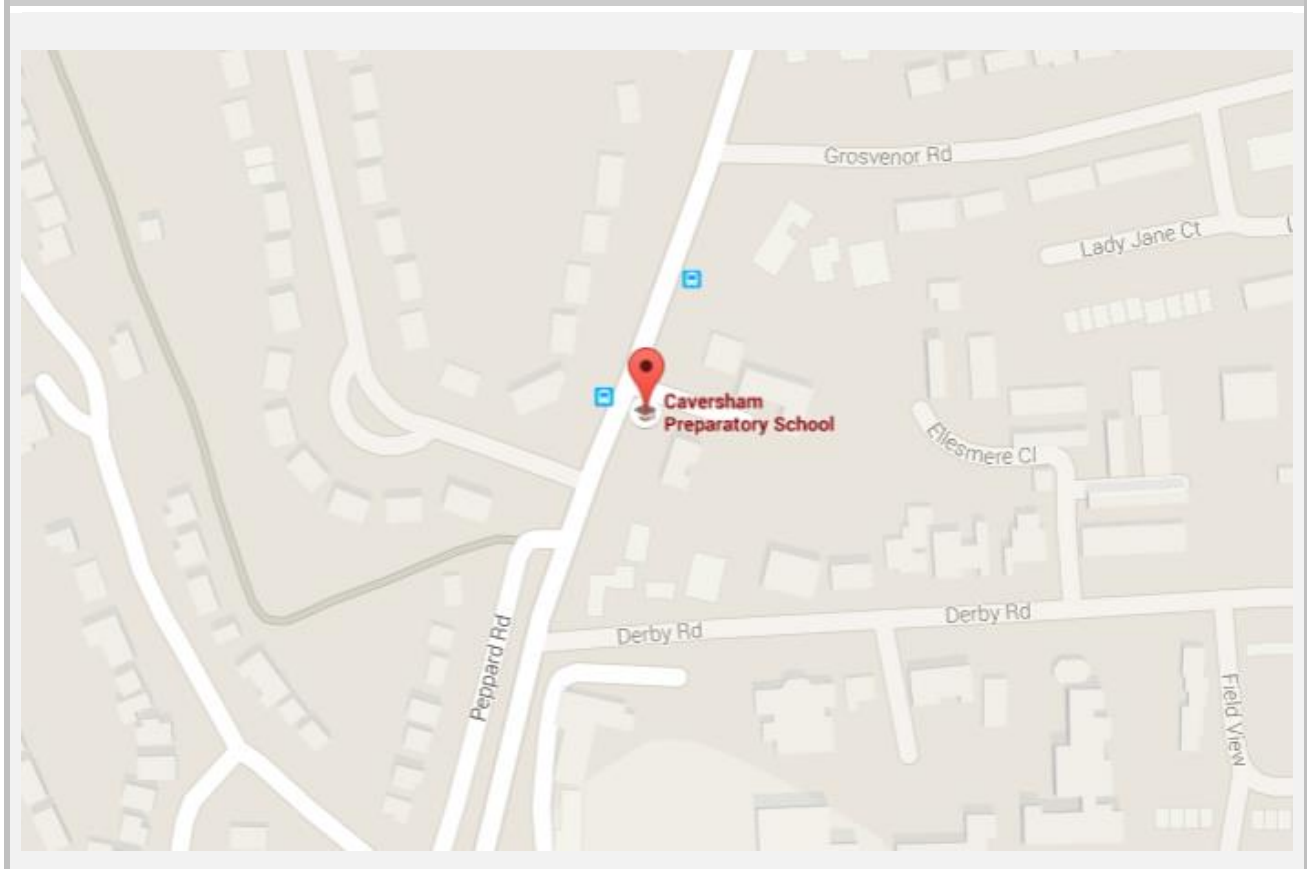
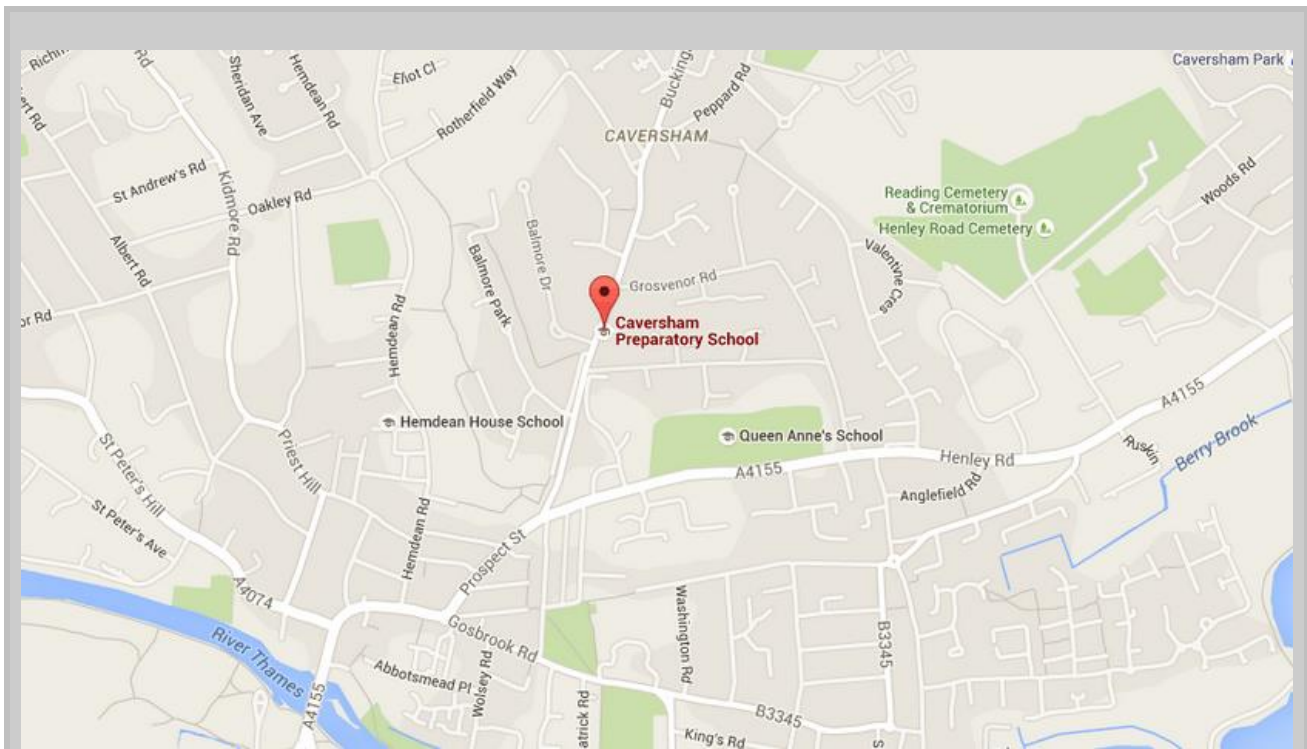
The sound data has been taken on the basis of a distributed noise level over 1 hour of differing types of voices (normal to shouting) on the basis of 50 children (capacity is for 95 children and on the basis that 50% will be operational at any one time (more typically this would be 30%)). This is further reinforced when assessing the noise impact from raised voices; Impact Acoustics have used the values indicated in (Handbook of Acoustical Measurements and Noise Control, Harris, Cyril.). Standard principles and calculations show that that in order to get a 3dB reduction on impact; the amount of students using the space would be halved, however, the onset of this is the time period of noise from the school would be doubled.

1.4 Conclusions

The impact of the usage of the schools play areas have been measured and assessed over a 3 day period. The existing worst case impact in external amenity is 67dB LAeq,(playground usage). It has been recommended to reduce the impact; a 3m acoustic fence should be erected at the site boundary line.

2 Site Location

2.1 Position of Site in the Wider Area Road Network

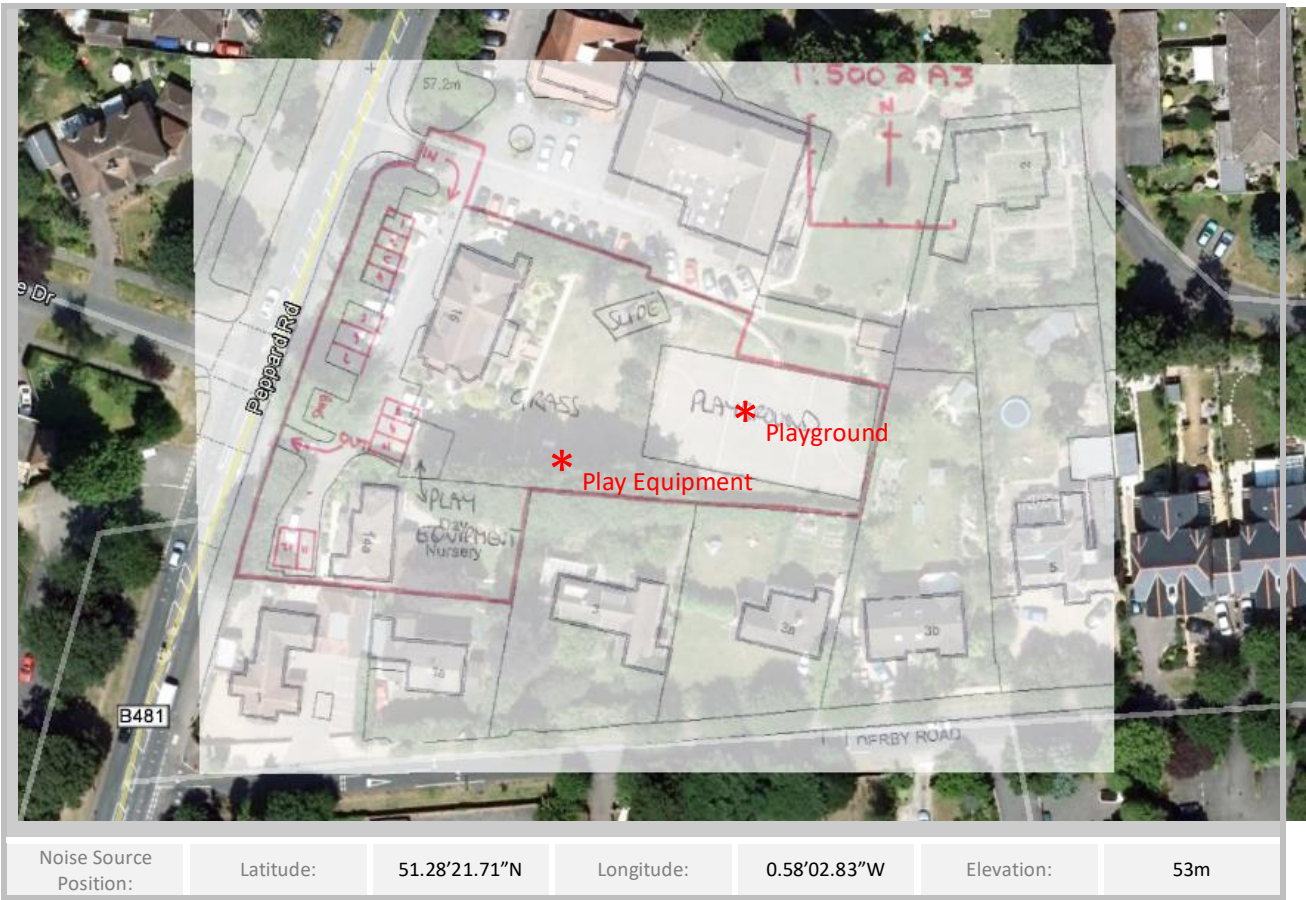


2.2 Position of the Site in the Wider Built-up Area

The site is located in Caversham, Reading. The area around the site is mostly made up of residential properties. The dominant noise source outside play area usage is road traffic noise.

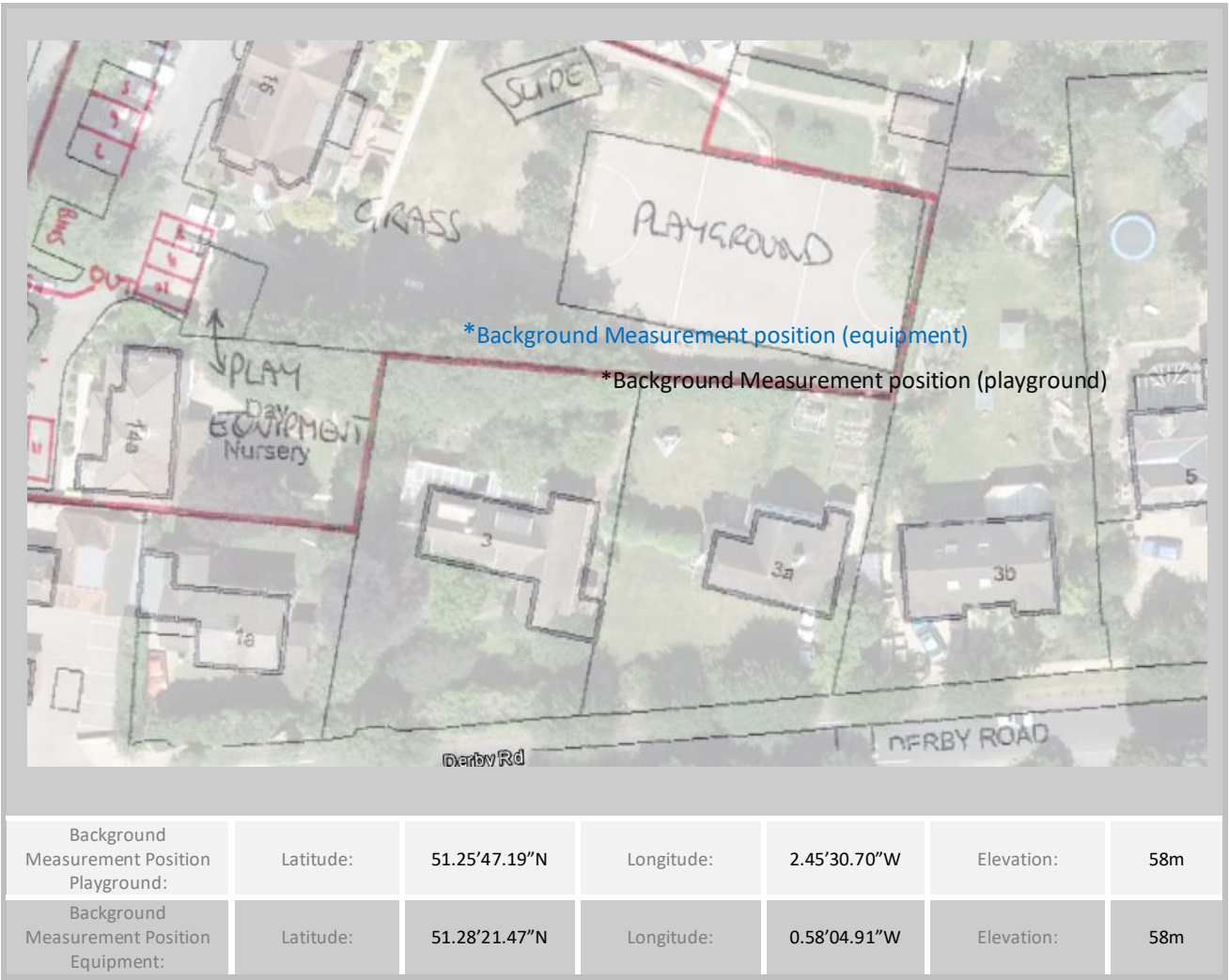
2.3 Position of the Noise Source

The noise source under assessment play areas at Caversham Prep School shown below in annotated plan. The source is approximately 14m away from the nearest noise sensitive premises at its closest point (3a to playground).



3 Background Noise Levels

3.1 Location of Measurements



The background noise levels were assessed by positioning 2 environmental noise monitoring stations as labelled above at the site. The detailed results are contained within Appendix A of the report and the results of the average levels are summarised below.

3.2 Background Noise Levels

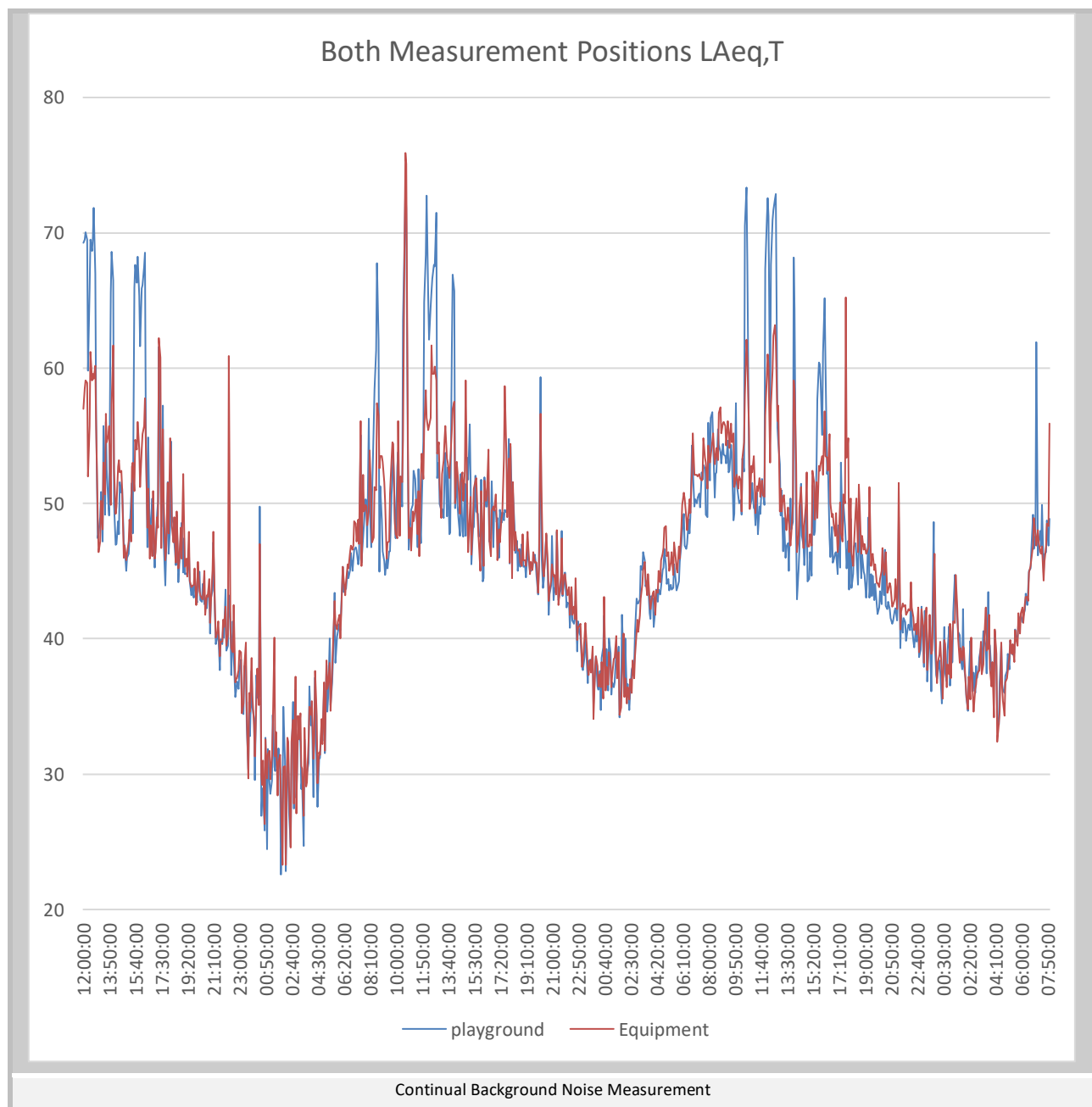
Full Background measurements shown in Appendix A

3.2.1 Discussion of Results

It can be seen from the results in Appendix A that the highest level of noise emission from the usage of the play areas is morning play from the playground.

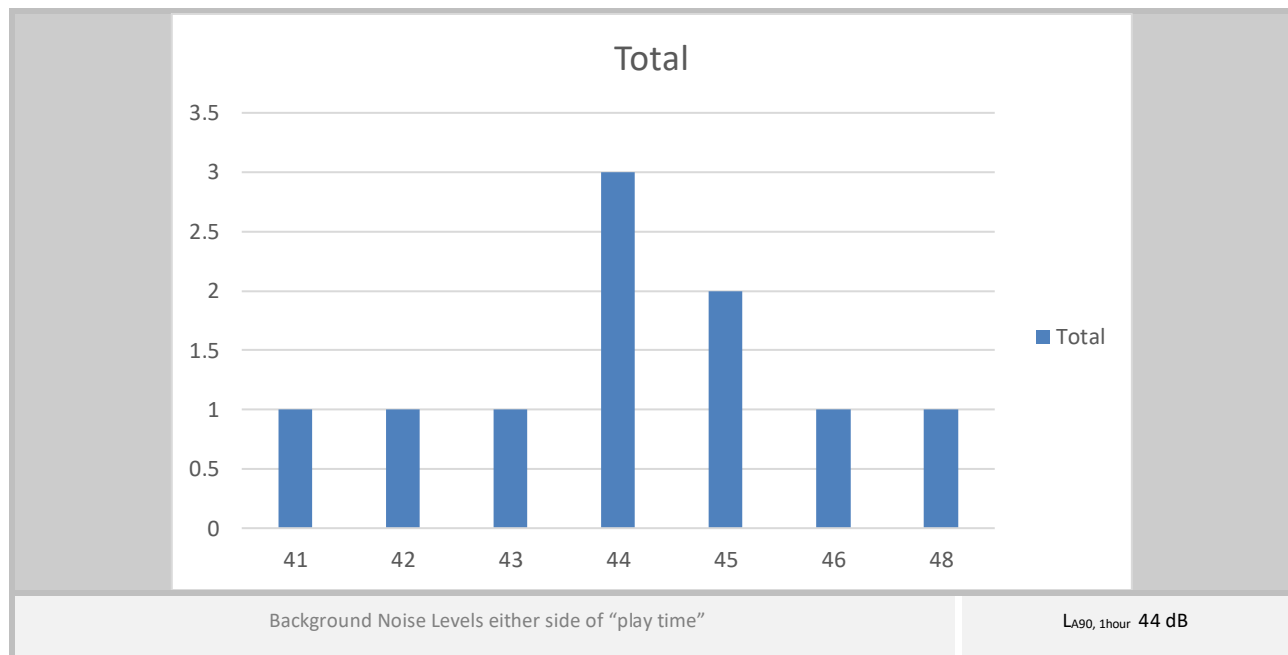
3.2.2 Background Noise Measurement Summary

	L _{Aeq}	L _{AFMax}	L ₉₀
Morning Play	71.0	92.6	63.0
Lunch	69.0	90.1	60.8
Infant Play	66.4	88.3	53.9

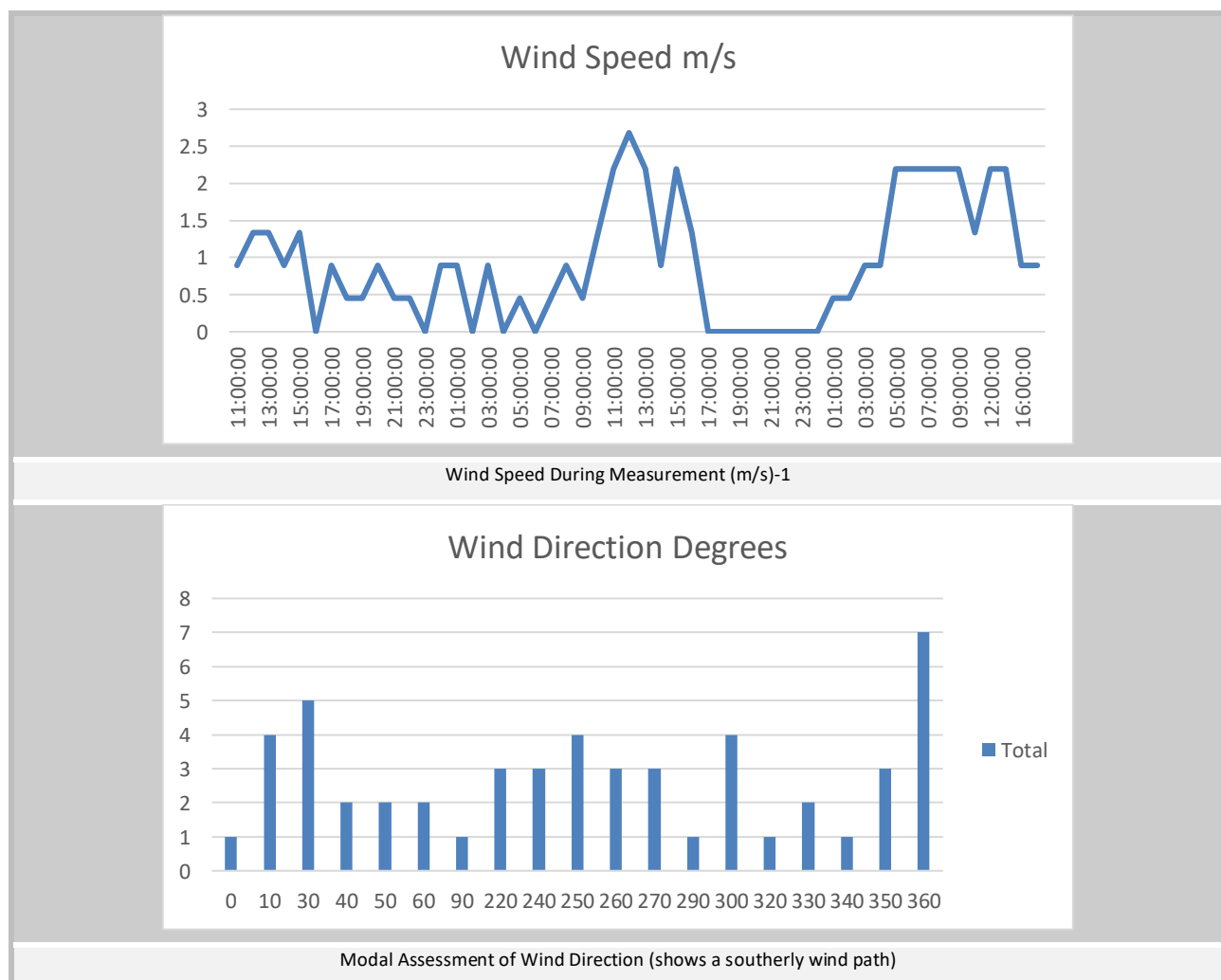


3.2.3 Modal Analysis

The background levels 1 hour either side of the play area usage have summarised below in a modal assessment.



3.2.4 Weather Summary



3.3 Usage of the Play Area during measurement

Time	Activity
10.30	Playtime
12:00	1 st lunch (Infants), Junior playtime
12.30	2 nd lunch (Juniors), Infant playtime
2:00	Infant playtime

3.3.1 Morning Play time

		Leq (LAeq)	Max (LAFMax)
Playground	20/10/2015	70.8	92.62
Playground	21/10/2015	71.1	89.72
Equipment	20/10/2015	73.1	92.2
Equipment	21/10/2015	60.6	76.7

3.3.2 Lunch Time

		Leq (LAeq)	Max (LAFMax)
Playground	19/10/2015	68.6	89.3
Playground	20/10/2015	68.0	89.3
Playground	21/10/2015	70.0	90.1
Equipment	19/10/2015	58.6	82.5
Equipment	20/10/2015	58.5	80.0
Equipment	21/10/2015	59.9	78.1

3.3.3 Infant Play Time

		Leq (LAeq)	Max (LAFMax)
Playground	19/10/2015	67.1	88.3
Playground	20/10/2015	65.2	84.2
Playground	21/10/2015	66.7	85.0
Equipment	19/10/2015	58.5	82.6
Equipment	20/10/2015	56.7	77.5
Equipment	21/10/2015	58.8	76.4

4 NOISE CRITERION

4.1 British Standard 8233: 2014 (“BS8233”)

4.1.1 Scope of Document

British Standard 8233:2014 provides guidance on the sound insulation and the reduction of noise in and around buildings and replaced the original 1999 standard in February 2014.

“This British Standard provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings.....”

4.1.2 External Amenity Space

British Standard 8233:2014 provides guidance on the acceptable noise levels for external amenity and gardens

“For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed $L_{Aeq, T}$ 50 dB with an upper guideline value of $L_{Aeq, T}$ 55 dB which would be acceptable in noisier environment.... “In higher noise areas...a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met , might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.”

4.2 WHO Guidelines for Community Noise

4.2.1 World Health Organisation

At the beginning of the document published by the World Health Organisation entitled “Criteria for Community Noise” (“WHO”) there is the following statement.

The document describes guideline levels that are “essentially values for the onset of health effects from noise exposure”. A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure. The following is an extract from the Table 4.1: Guideline values for community noise in specific environments, as stated in the document.

Specific Environment	Critical Health Effect(s)	L _{Aeq} (dB)	Time Base (hours)	L _{Amax,F} (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

Guideline values for community noise in specific environments

5 CALCULATION FOR OVERALL IMPACT

5.1 Calculation Formulas - ISO 9613:1996

The following are the main parameters formed in the modelling and prediction of noise emissions.

5.1.1 Source Directivity (D_c)

A correction is made to account for the location of the source and the effect of additional reflective surfaces excluding the ground and is contained within section 6 of ISO 9613 - Part 2:1996.

Number of Surfaces	Correction in dB (D_c)
No Reflective Surfaces	+0 dB
1 Reflective Surface	+3 dB
2 Reflective Surfaces	+6 dB
3 Reflective Surfaces	+9 dB

5.1.2 Geometric Divergence (A_{div})

A correction is made for the distance between the source and assessment position using the following formula defined in section 7.1 of ISO 9613-Part 2:1996.

Formula	Symbols
$A_{div} = 20 \cdot \log_{10} (d/d_0) + 11$	A_{div} = Reduction due to Geometric Divergence (dB) d = Distance from source to receiver (m) d_0 = reference distance (1m)

5.1.3 Ground Absorption (A_{gr})

A correction is made for the effect of the ground between the source and receiver depending on whether it is considered hard or soft ground.

Type of ground	Correction in dB (A_{gr})
Hard Ground	+ 3 dB
Soft Ground	+ 0 dB

5.1.4 Atmospheric Absorption (A_{atm})

As the source was less than 100m from the receiver position (assessment position) no correction was made for atmospheric absorption.

5.1.5 Barrier Effect (A_{bar})

A correction is made for any barrier in the direct line of site between the source and the assessment position and is detailed in section 7.4 of ISO 9613-Part 2:1996. For clarity the K_{met} meteorological correction has been ignored and C_2 equals 40 and C_3 equals 1.

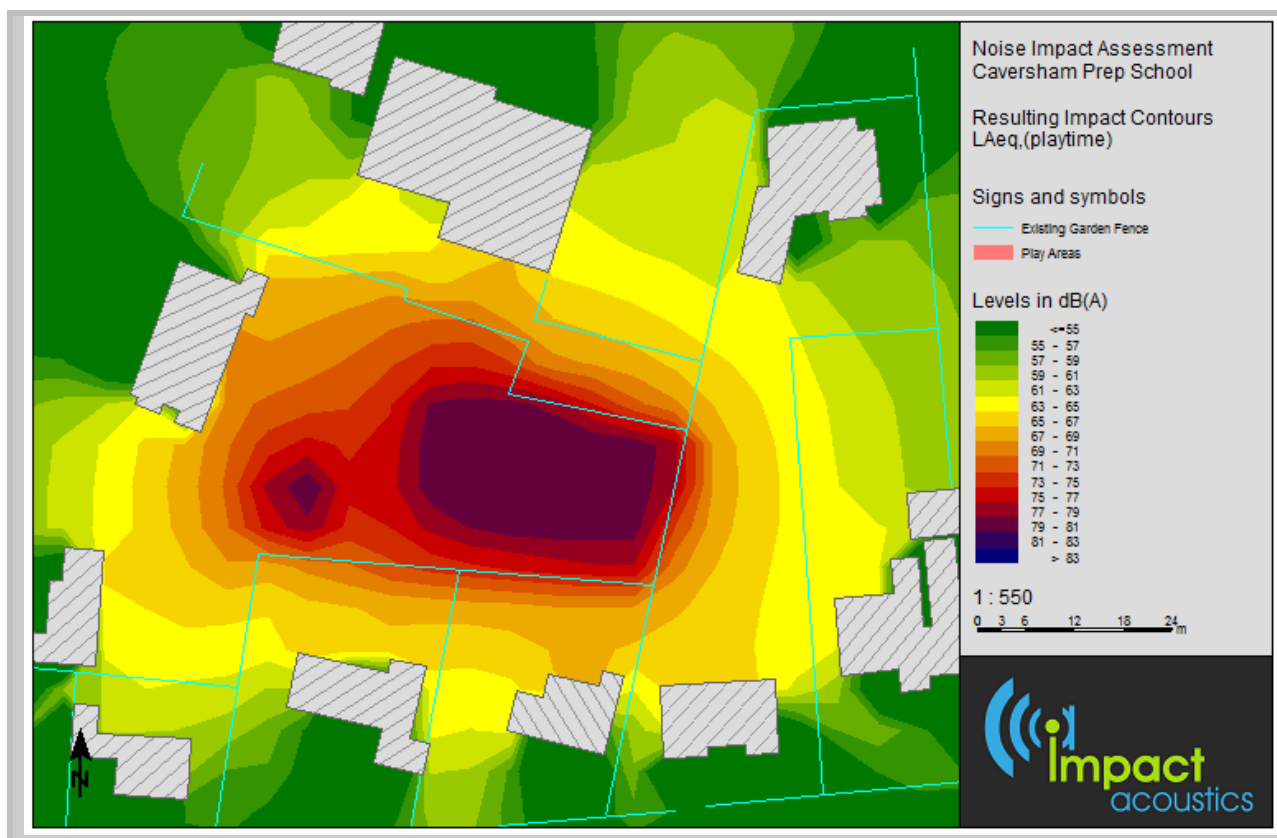
Formula	Symbols
$A_{bar} = 10 \cdot \log_{10} [3 + (40 \cdot \delta / \lambda) - A_g]$ *Note1 where $\delta = a + b - r$ and $\lambda = c / f$	A_{bar} = Effective barrier attenuation (dB) A_g = Total Ground Absorption (dB) *Note 1: Only apply the A_g correction if $A_g > 0$ δ = Path difference (m) a = Distance from source to barrier head (m) b = Distance from barrier head to assessment position (m) r = Distance from source to assessment position (m) λ = Wavelength of sound (m) c = Speed of sound – Assumed to be 342 ms^{-1} f = Octave band centre frequency (Hz)

5.2 3D Noise Mapping

All noise mapping was undertaken using SoundPLAN in accordance with ISO9613-2. All sources have been input following calibration with measured levels and spot measurements. All properties have been considered.



3D Noise Map of Resulting Levels.



5.3 Resulting Levels

Receiver Name	Assessment Orientation	Floor Level	Resulting Level
1	North	GF	58.9
1	North	1.FI	60.6
1 a Garden		GF	61.5
2	South	GF	61.3
2	South	1.FI	63
3	North	GF	63.9
3	North	1.FI	67.3
3 Garden		GF	66.5
3a	North	GF	64.6
3a	North	1.FI	68.4
3 a Garden		GF	67.3
3 b	North	GF	63.1
3 b	North	1.FI	65.8
3 b Garden		GF	65.3
5	West	GF	60.3
5	West	1.FI	62.4
5 Garden		GF	62.2
18	South	GF	56.4
18	South	1.FI	58.7

5.4 Discussion of Results

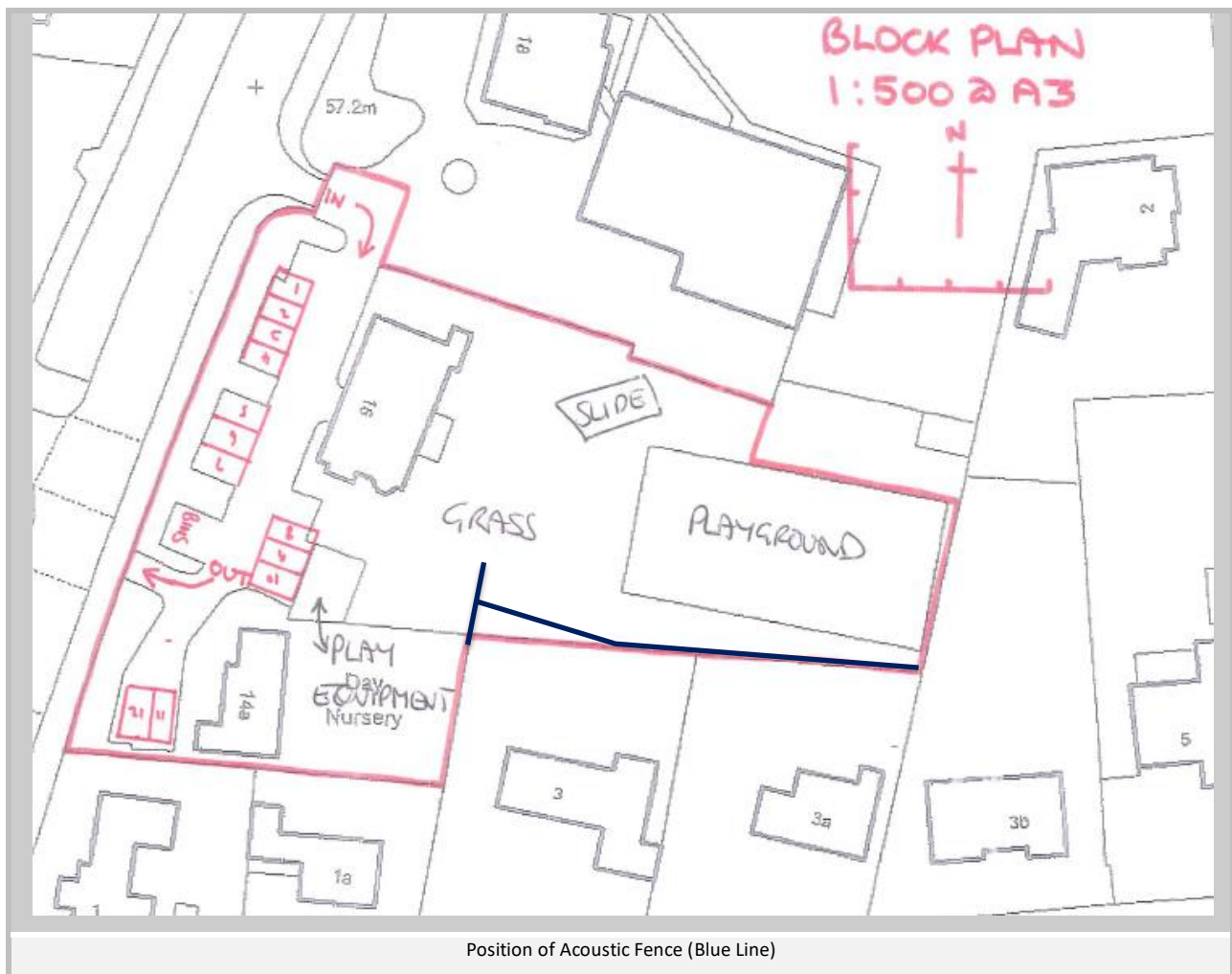
It can be seen from the resulting levels that the highest conflict to external amenity area is at unit 3a. It is therefore recommended that appropriate noise control measure are to be adopted to reduce the overall average noise emissions

6 MITIGATION ASSESSMENT

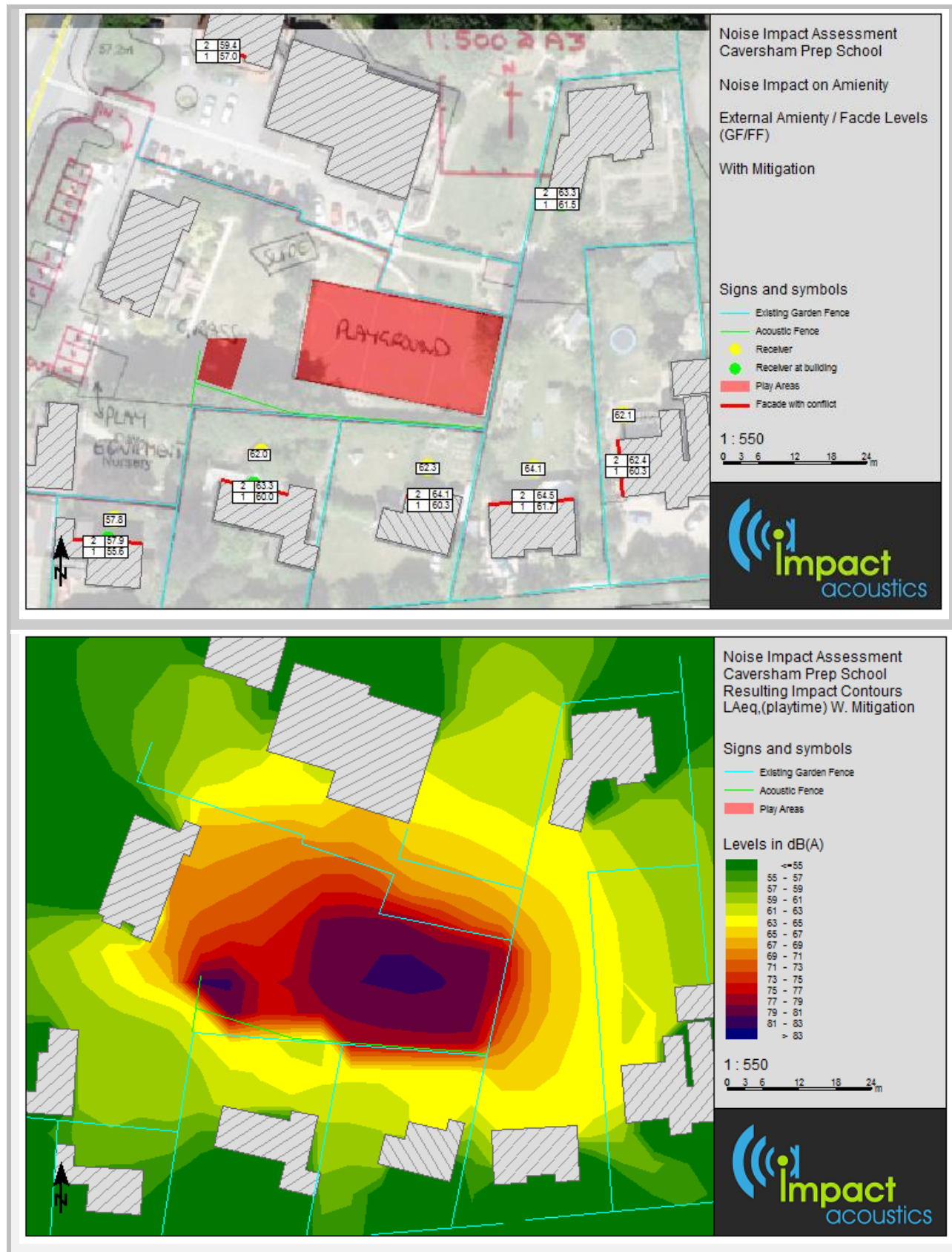
It is recommended that in order to reduce the resulting noise emissions from the play area; a 3m acoustic fence should be installed at the southern boundary line. The fence should follow the ground height. The fence should have the following properties:

- Be 3m in height so that the line of sight between usage of the garden space and playground is blocked.
- Have no holes or gaps
- Have a minimum superficial mass of 25Kg/m²

The fence boundary line (yellow) is as follows:



6.1 3D Noise Map Post Mitigation



6.2 Resulting LAeq, Playtime

Receiver Name	Assessment Orientation	Floor Level	Resulting Level	Level with mitigation	Difference
1	North	GF	61.1	55.6	-3.3
1	North	1.FI	64.3	57.9	-2.7
1 a Garden		GF	62.9	57.8	-3.7
2	South	GF	61.1	61.5	0.2
2	South	1.FI	62.7	63.3	0.3
3	North	GF	63.2	60	-3.9
3	North	1.FI	66.3	63.3	-4
3 Garden		GF	65.5	62	-4.5
3a	North	GF	64.5	60.3	-4.3
3a	North	1.FI	68.3	64.1	-4.3
3 a Garden		GF	67.2	62.3	-5
3 b	North	GF	63.1	61.7	-1.4
3 b	North	1.FI	65.7	64.5	-1.3
3 b Garden		GF	65.2	64.1	-1.2
5	West	GF	60.2	60.3	0
5	West	1.FI	62.2	62.4	0
5 Garden		GF	62.1	62.1	-0.1
18	South	GF	55.3	57	0.6
18	South	1.FI	57.5	59.4	0.7

6.3 Discussion of Results

It can be seen from the resulting levels that with the recommended mitigation measures the highest conflict to external amenity area has now been reduced to 62 (insertion loss of 5dB). The resulting external amenity areas are now typically 58-63dB LAeq,playtimes.

6.4 Further Mitigation Analysis

Further mitigation has been assessed in the form of reduction of pupils attending “playtimes”. The sound data has been taken on the basis of a distributed noise level over 1 hour of differing types of voices (normal to shouting) on the basis of 50 children (capacity is for 95 children and on the basis that 50% will be operational at any one time (more typically this would be 30%)). This is further reinforced when assessing the noise impact from raised voices; Impact Acoustics have used the values indicated in (Handbook of Acoustical Measurements and Noise Control, Harris, Cyril.). Calculations have then been normalised to 5m to line with the source/background measurement position.

Type of Voice	SPL @ 1m dB(A)	Estimated Time Spent (mins in 1 hour)	Resultant Sound Level 1 hour average
Casual	53	12	46.0
Normal	58	20	53.2
Raised	65	20	60.2
Loud	74	7	64.7
Shout	82	1	64.2
1 hour average for 1 child at 1m		68.4	
1 hour average for 50 children at 1m		85.4	
(From $68.4 + 10\log(50)$)			
1 hour average for 50 children at 5m		71.4	
(From $85.4 - 20\log(5)$)			

Standard principles and calculations show that that in order to get a 3dB reduction on impact; the amount of students using the space would be halved, however, the onset of this is the period of noise from the school would be doubled.

1 hour average for 1 child at 1m	68.4
1 hour average for 25 children at 1m	82.4
(From $68.4 + 10\log(25)$)	
1 hour average for 25 children at 5m	68.4
(From $82.4 - 20\log(5)$)	
Change in Level	-3dB

7 CONCLUSION

7.1 Summary of Criterion

Source	Location	07:00 to 23:00	23:00 to 07:00
WHO Guidelines	External (Garden)	$L_{Aeq, 16 \text{ hour}}$ 55 dB	--
BS8233:2014	External (Garden)	Upper Limit $L_{Aeq, 16 \text{ hour}}$ 55 dB	--

7.2 Measurements

Background noise measurements were undertaken at two representative positions at the play area and the equipment area over a 3 day period. Measurements were undertaken from 19th to 21st October 2015 to establish the existing underlying background noise levels and source levels. The modal background levels (taken 1 hour before and after play times) was 45dBLA90,1hour.

7.3 Source Levels

The Average of the 3 'play times' (morning play, lunchtime and infant play) have been assessed over the 3 day period. Source measurements were taken at the boundary 5m from source. The worst case average came from morning play at 71dB. This figure was used in the modelling of the impact of the playtimes on residential amenity.

	L_{Aeq}	L_{AFMax}
Morning Play	71.0	92.6
Lunch	69.0	90.1
Infant Play	66.4	88.3

7.4 Proposed Residential Façade Noise Levels

A detailed noise map, calibrated to the measured levels and indicated that the average external noise levels that are likely to be present at the proposed residential external garden areas were at worst case 67dB. It was therefore recommended that noise mitigation measures should be adopted to reduce external noise levels in line with WHO Guidelines and BS8233:2014.

7.5 Acoustic Fence

It is recommended that a 3m acoustic fence should be installed at the boundary line, following the ground height. The fence should have a minimum superficial mass of 28kgm² and have no holes or gaps. On installation of the fencing the external levels are at 62dB worst case (5dB insertion loss).

7.6 Further mitigation into reduction of pupils using space at any one time

The sound data has been taken on the basis of a distributed noise level over 1 hour of differing types of voices (normal to shouting) on the basis of 50 children (capacity is for 95 children and on the basis that 50% will be operational at any one time (more typically this would be 30%)). This is further reinforced when assessing the noise impact from raised voices; Impact Acoustics have used the values indicated in (Handbook of Acoustical Measurements and Noise Control, Harris, Cyril.). Standard principles and calculations show that that in order to get a 3dB reduction on impact; the amount of students using the space would be halved, however, the onset of this is the period of noise from the school would be doubled.

7.7 Conclusions

The impact of the usage of the schools play areas have been measured and assessed over a 3 day period. The existing worst case impact in external amenity is 67dB LAeq,(playground usage). It has been recommended to reduce the impact; a 3m acoustic fence should be erected at the site boundary line.

7.8 Uncertainty

The resulting assessment expanded uncertainty with a confidence limit of 95% and assuming a convergence of $k=2$ is likely to be ± 4.6 dB. Uncertainty, in this instance has been minimised by undertaking longer background noise measurements over a 3 day period.

8 APPENDIX A – BACKGROUND NOISE LEVELS

8.1 Playground

Date	Time	Leq (LAeq)	Max (LAFMax)	L90 (LAeq)
19/10/2015	12:00:00	69.28	89.32	59.3
19/10/2015	12:05:00	69.49	84.51	63
19/10/2015	12:10:00	70.04	88.34	61.5
19/10/2015	12:15:00	69.52	88.14	61.1
19/10/2015	12:20:00	59.8	79.84	47.5
19/10/2015	12:25:00	65.83	82.3	59.5
19/10/2015	12:30:00	69.48	86.55	62
19/10/2015	12:35:00	68.63	82.55	60.7
19/10/2015	12:40:00	69.65	84.42	63.3
19/10/2015	12:45:00	71.83	86.36	65.4
19/10/2015	12:50:00	66.97	79.3	60.1
19/10/2015	12:55:00	56.34	69.02	48.3
19/10/2015	13:00:00	47.41	60.62	42.8
19/10/2015	13:05:00	47.76	60.44	43.7
19/10/2015	13:10:00	49.01	59.79	44.3
19/10/2015	13:15:00	50.84	63.19	43.7
19/10/2015	13:20:00	47.19	63.52	42.9
19/10/2015	13:25:00	55.74	74.61	45.6
19/10/2015	13:30:00	49.15	60.38	45.3
19/10/2015	13:35:00	56	69.1	44.8
19/10/2015	13:40:00	52.51	64.59	46.8
19/10/2015	13:45:00	50.01	60.91	45.2
19/10/2015	13:50:00	49.11	64.18	43.5
19/10/2015	13:55:00	65.56	85.31	46.6
19/10/2015	14:00:00	68.6	86.42	58.2
19/10/2015	14:05:00	66.52	88.25	50.8
19/10/2015	14:10:00	49.97	60.03	45.9
19/10/2015	14:15:00	46.95	58.69	43.6
19/10/2015	14:20:00	47.03	57.38	43.8
19/10/2015	14:25:00	48.68	59.3	44.4
19/10/2015	14:30:00	47.71	63.75	43
19/10/2015	14:35:00	51.55	78.48	43.6
19/10/2015	14:40:00	50.81	76.08	43.7
19/10/2015	14:45:00	51.11	63.89	44.7
19/10/2015	14:50:00	47.08	64.6	44.4
19/10/2015	14:55:00	46.88	64.87	42.6
19/10/2015	15:00:00	45.03	55.5	39.9
19/10/2015	15:05:00	46	56.58	42.8
19/10/2015	15:10:00	46.3	67.48	43.1

19/10/2015	15:15:00	47.53	58.35	42.8
19/10/2015	15:20:00	50.4	72.53	43.5
19/10/2015	15:25:00	51.54	70.79	43.4
19/10/2015	15:30:00	47.78	62.09	42.7
19/10/2015	15:35:00	65.94	86.13	50.4
19/10/2015	15:40:00	67.61	86.67	57.8
19/10/2015	15:45:00	66.33	83.95	57
19/10/2015	15:50:00	68.21	83.01	58.6
19/10/2015	15:55:00	65.33	81.38	54.5
19/10/2015	16:00:00	61.59	81.05	48.4
19/10/2015	16:05:00	65.9	79.19	52.8
19/10/2015	16:10:00	66.16	83.29	53.9
19/10/2015	16:15:00	67.51	86.57	55.4
19/10/2015	16:20:00	68.52	86.01	55.3
19/10/2015	16:25:00	56.09	76.92	43.5
19/10/2015	16:30:00	46.79	57.9	41.8
19/10/2015	16:35:00	54.91	75.42	42.6
19/10/2015	16:40:00	46.75	64.74	42.5
19/10/2015	16:45:00	48.25	66.17	43.8
19/10/2015	16:50:00	50.35	65.27	42
19/10/2015	16:55:00	48.05	62.03	41.8
19/10/2015	17:00:00	45.28	64.54	40.4
20/10/2015	09:00:00	48.79	60.85	42.6
20/10/2015	09:05:00	46.46	59.66	40.6
20/10/2015	09:10:00	45.74	61.47	40.7
20/10/2015	09:15:00	44.69	59	39.9
20/10/2015	09:20:00	45.92	58.89	39.8
20/10/2015	09:25:00	45.2	58.87	40.4
20/10/2015	09:30:00	46.44	58.6	41.7
20/10/2015	09:35:00	46.45	62.92	41.5
20/10/2015	09:40:00	50.68	63.03	41.9
20/10/2015	09:45:00	52.43	67.55	42.9
20/10/2015	09:50:00	53.54	68.42	42.4
20/10/2015	09:55:00	48.84	59.27	43.2
20/10/2015	10:00:00	47.44	61.37	43.9
20/10/2015	10:05:00	52.74	74.29	42
20/10/2015	10:10:00	53.81	72.57	43.5
20/10/2015	10:15:00	47.86	60.33	41.6
20/10/2015	10:20:00	52.02	64.56	44.2
20/10/2015	10:25:00	49.79	62.34	43.9
20/10/2015	10:30:00	63.56	79.55	50.1
20/10/2015	10:35:00	69.65	85.67	62.6

20/10/2015	10:40:00	73.41	92.62	65.6
20/10/2015	10:45:00	71.8	87.16	65
20/10/2015	10:50:00	52.97	69.31	47.3
20/10/2015	10:55:00	46.58	56.82	43.2
20/10/2015	11:00:00	48.46	59.77	43.6
20/10/2015	11:05:00	49.55	57.75	46.1
20/10/2015	11:10:00	49.89	60.4	44.2
20/10/2015	11:15:00	52.43	72.28	47
20/10/2015	11:20:00	51.79	71.98	45.4
20/10/2015	11:25:00	50.49	61.35	44.1
20/10/2015	11:30:00	46.79	57.79	43.3
20/10/2015	11:35:00	52.54	66.05	45.3
20/10/2015	11:40:00	49.65	62.99	42.8
20/10/2015	11:45:00	47.05	60.38	43.2
20/10/2015	11:50:00	49.9	59.37	45.6
20/10/2015	11:55:00	54.61	71.4	43.5
20/10/2015	12:00:00	64.84	80.38	56.5
20/10/2015	12:05:00	68.38	84.08	60.6
20/10/2015	12:10:00	72.72	88.92	62.8
20/10/2015	12:15:00	65.1	82.06	48.1
20/10/2015	12:20:00	62.12	79.51	52.2
20/10/2015	12:25:00	64.54	81.59	56.7
20/10/2015	12:30:00	65.65	81.58	58.9
20/10/2015	12:35:00	66.61	84.67	58.7
20/10/2015	12:40:00	67.62	80.26	60.4
20/10/2015	12:45:00	67.49	80.95	60.1
20/10/2015	12:50:00	71.46	89.29	62.8
20/10/2015	12:55:00	51.88	65.89	46.3
20/10/2015	13:00:00	53.01	66.01	45
20/10/2015	13:05:00	49.93	65.97	44.8
20/10/2015	13:10:00	49.54	63.78	44.6
20/10/2015	13:15:00	49.57	63.53	45.3
20/10/2015	13:20:00	48.95	60.17	44
20/10/2015	13:25:00	52.26	68.66	45.3
20/10/2015	13:30:00	53.74	67.14	47.8
20/10/2015	13:35:00	49.07	63.79	44.5
20/10/2015	13:40:00	52.68	66.05	44.1
20/10/2015	13:45:00	47.75	58.14	44.6
20/10/2015	13:50:00	47.87	57.98	44.2
20/10/2015	13:55:00	61.4	80.07	49.4
20/10/2015	14:00:00	66.89	84.12	58.3
20/10/2015	14:05:00	65.69	84.17	46.8
20/10/2015	14:10:00	49.68	73.8	43

20/10/2015	14:15:00	52.15	68.14	43.7
20/10/2015	14:20:00	49.85	72.02	44.2
20/10/2015	14:25:00	48.96	59.78	42.2
20/10/2015	14:30:00	47.61	59.64	41.4
20/10/2015	14:35:00	52.15	62.6	42.5
20/10/2015	14:40:00	47.98	61.65	42.9
20/10/2015	14:45:00	47.56	65.01	43.8
20/10/2015	14:50:00	51.48	63.34	45.3
20/10/2015	14:55:00	47.61	61.21	41.9
20/10/2015	15:00:00	53.39	68.56	46.3
20/10/2015	15:05:00	51.77	67.72	45.4
20/10/2015	15:10:00	55.86	76.5	48.4
20/10/2015	15:15:00	51.87	67.88	42.3
20/10/2015	15:20:00	45.49	55.67	42
20/10/2015	15:25:00	48.16	60.21	43.3
20/10/2015	15:30:00	48.27	60.83	41.2
20/10/2015	15:35:00	52.07	67.2	39.6
20/10/2015	15:40:00	49.41	63.31	42.5
20/10/2015	15:45:00	49.24	61.98	40.7
20/10/2015	15:50:00	47.53	63.24	42.1
20/10/2015	15:55:00	47.65	61.33	40.3
20/10/2015	16:00:00	51.73	64.04	42.3
21/10/2015	09:00:00	54.43	64.44	52.4
21/10/2015	09:05:00	53.6	61.98	51.7
21/10/2015	09:10:00	53.5	62.5	51
21/10/2015	09:15:00	52.96	60.32	51
21/10/2015	09:20:00	54.63	58.9	52.8
21/10/2015	09:25:00	52.3	57.24	50.4
21/10/2015	09:30:00	52.41	64.17	50.4
21/10/2015	09:35:00	54.37	63.57	51.2
21/10/2015	09:40:00	53.62	70.91	47.9
21/10/2015	09:45:00	48.73	54.29	46.5
21/10/2015	09:50:00	49.24	55.62	47.2
21/10/2015	09:55:00	57.38	76.5	49.1
21/10/2015	10:00:00	51.46	66.02	47.8
21/10/2015	10:05:00	50.52	61.03	46.8
21/10/2015	10:10:00	49.99	62.04	45.8
21/10/2015	10:15:00	50.25	63.28	46.2
21/10/2015	10:20:00	49.14	61.03	45
21/10/2015	10:25:00	53.32	66.51	47.1
21/10/2015	10:30:00	52.35	65.64	46
21/10/2015	10:35:00	70.5	89.72	54.3

21/10/2015	10:40:00	73.34	86.42	67.1
21/10/2015	10:45:00	67.95	83.7	51
21/10/2015	10:50:00	53.95	66.43	46.4
21/10/2015	10:55:00	49.73	62.32	45.5
21/10/2015	11:00:00	50.18	60.49	46.2
21/10/2015	11:05:00	51.52	61.88	46.4
21/10/2015	11:10:00	49.65	60.97	45.4
21/10/2015	11:15:00	49.67	60.61	44.2
21/10/2015	11:20:00	48.4	65.3	45.2
21/10/2015	11:25:00	50.79	63	46
21/10/2015	11:30:00	47.74	59.41	44.3
21/10/2015	11:35:00	49.75	59.25	45.5
21/10/2015	11:40:00	49.26	60.55	45.5
21/10/2015	11:45:00	51.79	63.27	45.9
21/10/2015	11:50:00	50.96	69.73	44.4
21/10/2015	11:55:00	49.9	63.71	45.2
21/10/2015	12:00:00	67.35	82.47	57.6
21/10/2015	12:05:00	70.98	84.81	64.2
21/10/2015	12:10:00	72.57	85.23	65.3
21/10/2015	12:15:00	71.25	86.82	55.8
21/10/2015	12:20:00	56.53	79.88	44.8
21/10/2015	12:25:00	67.61	82.23	59.4
21/10/2015	12:30:00	70.94	85.11	61.8
21/10/2015	12:35:00	71.68	84.14	63.7
21/10/2015	12:40:00	72.49	87.59	63.4
21/10/2015	12:45:00	72.84	90.09	63.8
21/10/2015	12:50:00	55.58	70.73	47.3
21/10/2015	12:55:00	54.51	68.5	42.9
21/10/2015	13:00:00	52.89	77.28	42.8
21/10/2015	13:05:00	49.1	69.42	42.4
21/10/2015	13:10:00	51	66.49	44
21/10/2015	13:15:00	46.47	54.69	43.4
21/10/2015	13:20:00	48.92	67.27	41.9
21/10/2015	13:25:00	45.97	55.78	40.7
21/10/2015	13:30:00	46.84	57.61	43.3
21/10/2015	13:35:00	47.08	57.89	44.1
21/10/2015	13:40:00	44.99	58.38	41.9
21/10/2015	13:45:00	50.37	68.52	41.7
21/10/2015	13:50:00	48.07	64.81	41.6
21/10/2015	13:55:00	48.62	67.85	41.6
21/10/2015	14:00:00	68.19	85.03	55
21/10/2015	14:05:00	64.39	81.92	47.4
21/10/2015	14:10:00	47.49	62.03	41.6

21/10/2015	14:15:00	42.9	52.78	40.6
21/10/2015	14:20:00	45.12	56.4	40.8
21/10/2015	14:25:00	46.66	65.39	41.3
21/10/2015	14:30:00	51.44	78.5	41.3
21/10/2015	14:35:00	47.62	74.68	41.3
21/10/2015	14:40:00	46.9	69.21	40.3
21/10/2015	14:45:00	45.43	56.35	42.5
21/10/2015	14:50:00	48.05	60.85	42.4
21/10/2015	14:55:00	49.91	63.11	40.7
21/10/2015	15:00:00	44.25	53.62	38.9
21/10/2015	15:05:00	44.41	62.45	41.5
21/10/2015	15:10:00	46.42	65.3	41
21/10/2015	15:15:00	44.67	55.99	41.9
21/10/2015	15:20:00	51.33	71.34	42.8
21/10/2015	15:25:00	47.67	64.09	43.1
21/10/2015	15:30:00	47.95	67.35	40.5
21/10/2015	15:35:00	52.63	68.59	44
21/10/2015	15:40:00	57.74	74.08	49.5
21/10/2015	15:45:00	60.42	79.47	51.5
21/10/2015	15:50:00	60.28	77.87	48.7
21/10/2015	15:55:00	59.1	77.28	48.8

8.2 Equipment

Date	Time	Leq (LAeq)	Max (LAFMax)	L90 (LAeq)
19/10/2015	12:00	57.00	75.70	46.90
19/10/2015	12:05	58.50	72.10	50.70
19/10/2015	12:10	59.10	78.40	51.20
19/10/2015	12:15	58.90	76.90	50.10
19/10/2015	12:20	52.00	67.60	45.40
19/10/2015	12:25	55.70	69.30	49.50
19/10/2015	12:30	61.20	76.60	52.10
19/10/2015	12:35	59.10	73.40	50.70
19/10/2015	12:40	59.60	75.90	53.10
19/10/2015	12:45	59.20	73.20	53.40
19/10/2015	12:50	60.20	82.50	51.20
19/10/2015	12:55	55.70	67.00	49.30
19/10/2015	13:00	49.00	68.40	40.00
19/10/2015	13:05	46.40	56.40	40.60
19/10/2015	13:10	47.20	57.90	42.20
19/10/2015	13:15	50.20	62.20	41.00
19/10/2015	13:20	48.10	62.10	42.40
19/10/2015	13:25	53.00	68.10	45.60

19/10/2015	13:30	50.70	65.10	45.30
19/10/2015	13:35	56.60	70.50	45.20
19/10/2015	13:40	54.50	72.40	46.10
19/10/2015	13:45	55.00	76.40	44.60
19/10/2015	13:50	55.70	75.90	44.70
19/10/2015	13:55	49.90	63.80	43.90
19/10/2015	14:00	57.30	75.30	49.20
19/10/2015	14:05	61.70	82.60	46.50
19/10/2015	14:10	52.50	68.00	44.90
19/10/2015	14:15	49.20	64.80	43.70
19/10/2015	14:20	49.80	68.40	43.20
19/10/2015	14:25	52.70	66.10	45.20
19/10/2015	14:30	53.20	72.60	44.50
19/10/2015	14:35	52.30	65.60	44.70
19/10/2015	14:40	52.40	69.20	45.30
19/10/2015	14:45	51.00	66.60	45.40
19/10/2015	14:50	46.00	54.30	43.10
19/10/2015	14:55	46.90	58.40	43.50
19/10/2015	15:00	45.80	57.90	39.40
19/10/2015	15:05	46.30	52.50	43.10
19/10/2015	15:10	47.20	61.00	42.80
19/10/2015	15:15	48.80	58.50	43.90
19/10/2015	15:20	47.20	69.70	42.00
19/10/2015	15:25	52.70	75.70	43.80
19/10/2015	15:30	53.00	76.70	42.70
19/10/2015	15:35	50.90	68.90	44.40
19/10/2015	15:40	54.70	70.40	45.30
19/10/2015	15:45	54.00	71.70	46.20
19/10/2015	15:50	56.00	72.90	47.30
19/10/2015	15:55	54.00	72.00	46.50
20/10/2015	09:00	53.50	72.00	43.00
20/10/2015	09:05	53.10	73.90	41.00
20/10/2015	09:10	51.60	69.90	40.30
20/10/2015	09:15	50.20	74.20	38.80
20/10/2015	09:20	45.90	60.40	39.80
20/10/2015	09:25	47.10	58.90	40.30
20/10/2015	09:30	47.20	67.30	41.50
20/10/2015	09:35	50.70	70.30	41.20
20/10/2015	09:40	53.30	72.10	42.20
20/10/2015	09:45	54.50	66.70	44.50
20/10/2015	09:50	54.40	68.00	42.10
20/10/2015	09:55	48.50	59.30	42.30

20/10/2015	10:00	47.70	55.30	44.50
20/10/2015	10:05	47.40	59.80	41.90
20/10/2015	10:10	56.10	74.60	44.30
20/10/2015	10:15	47.60	64.70	41.50
20/10/2015	10:20	52.00	64.00	43.60
20/10/2015	10:25	51.60	69.70	44.70
20/10/2015	10:30	54.70	67.20	47.40
20/10/2015	10:35	69.80	87.30	54.50
20/10/2015	10:40	75.90	89.70	63.30
20/10/2015	10:45	75.10	92.20	59.40
20/10/2015	10:50	54.70	68.50	48.10
20/10/2015	10:55	47.40	61.70	43.00
20/10/2015	11:00	48.20	60.60	41.40
20/10/2015	11:05	46.50	55.60	42.90
20/10/2015	11:10	49.40	62.20	43.20
20/10/2015	11:15	48.70	62.90	43.10
20/10/2015	11:20	49.60	60.30	43.80
20/10/2015	11:25	50.30	64.20	41.90
20/10/2015	11:30	47.70	55.60	41.60
20/10/2015	11:35	50.90	64.80	42.00
20/10/2015	11:40	46.10	54.20	42.20
20/10/2015	11:45	51.90	65.60	45.40
20/10/2015	11:50	53.70	69.10	46.80
20/10/2015	11:55	51.80	67.00	44.60
20/10/2015	12:00	55.50	71.60	49.10
20/10/2015	12:05	58.40	74.50	50.70
20/10/2015	12:10	56.30	71.00	49.30
20/10/2015	12:15	55.40	69.50	48.20
20/10/2015	12:20	55.70	73.90	46.80
20/10/2015	12:25	56.30	74.60	49.20
20/10/2015	12:30	61.70	80.00	51.50
20/10/2015	12:35	59.60	76.40	50.90
20/10/2015	12:40	59.60	74.70	50.40
20/10/2015	12:45	60.10	75.40	52.40
20/10/2015	12:50	59.10	71.80	52.00
20/10/2015	12:55	53.70	68.80	43.50
20/10/2015	13:00	54.50	71.40	44.40
20/10/2015	13:05	51.50	64.10	43.60
20/10/2015	13:10	48.90	63.80	43.10
20/10/2015	13:15	52.20	69.50	44.50
20/10/2015	13:20	53.20	68.80	45.50
20/10/2015	13:25	54.70	67.10	45.60
20/10/2015	13:30	55.70	76.10	48.00

20/10/2015	13:35	53.30	71.60	45.20
20/10/2015	13:40	53.00	66.60	44.30
20/10/2015	13:45	51.90	68.70	44.70
20/10/2015	13:50	53.00	67.90	44.00
20/10/2015	13:55	55.40	71.90	47.70
20/10/2015	14:00	57.00	72.10	50.20
20/10/2015	14:05	57.50	77.50	45.30
20/10/2015	14:10	50.00	66.20	43.60
20/10/2015	14:15	53.10	69.50	45.50
20/10/2015	14:20	52.30	69.20	45.00
20/10/2015	14:25	51.50	65.20	45.70
20/10/2015	14:30	49.20	64.40	42.40
20/10/2015	14:35	51.60	68.00	43.80
20/10/2015	14:40	52.30	67.20	44.20
20/10/2015	14:45	50.20	65.40	45.50
20/10/2015	14:50	52.40	72.80	45.50
20/10/2015	14:55	59.10	81.30	44.00
20/10/2015	15:00	49.80	63.40	43.50
20/10/2015	15:05	46.40	55.20	42.40
20/10/2015	15:10	49.20	62.30	43.90
20/10/2015	15:15	50.50	69.60	44.70
20/10/2015	15:20	46.20	58.80	42.20
20/10/2015	15:25	48.90	61.60	42.90
20/10/2015	15:30	51.10	65.00	42.50
20/10/2015	15:35	51.70	69.50	40.40
20/10/2015	15:40	51.90	64.20	42.60
20/10/2015	15:45	48.50	60.40	41.30
20/10/2015	15:50	47.30	66.60	40.10
20/10/2015	15:55	45.00	55.00	39.90
21/10/2015	09:00	55.90	63.20	53.60
21/10/2015	09:05	56.00	63.00	53.80
21/10/2015	09:10	55.70	64.00	53.20
21/10/2015	09:15	54.30	65.00	51.80
21/10/2015	09:20	56.10	63.60	54.20
21/10/2015	09:25	55.40	67.10	53.00
21/10/2015	09:30	54.10	63.80	52.00
21/10/2015	09:35	55.90	68.00	53.60
21/10/2015	09:40	54.50	61.90	50.90
21/10/2015	09:45	55.20	75.70	48.20
21/10/2015	09:50	51.20	59.30	48.60
21/10/2015	09:55	51.90	61.20	49.50
21/10/2015	10:00	52.10	61.90	49.30

21/10/2015	10:05	51.10	60.60	47.60
21/10/2015	10:10	52.00	67.70	47.70
21/10/2015	10:15	51.70	69.10	46.80
21/10/2015	10:20	49.40	60.30	45.80
21/10/2015	10:25	53.40	67.20	47.70
21/10/2015	10:30	54.50	73.80	46.90
21/10/2015	10:35	58.00	71.80	49.40
21/10/2015	10:40	62.10	75.70	56.40
21/10/2015	10:45	60.80	76.70	51.00
21/10/2015	10:50	55.50	67.70	47.90
21/10/2015	10:55	49.60	60.30	46.30
21/10/2015	11:00	52.80	62.00	47.50
21/10/2015	11:05	52.30	62.50	47.60
21/10/2015	11:10	53.50	66.70	46.70
21/10/2015	11:15	51.70	63.50	45.90
21/10/2015	11:20	49.30	60.20	45.60
21/10/2015	11:25	51.30	65.60	46.80
21/10/2015	11:30	50.90	64.40	45.40
21/10/2015	11:35	51.90	62.10	46.80
21/10/2015	11:40	50.50	57.80	47.30
21/10/2015	11:45	51.70	62.90	45.80
21/10/2015	11:50	50.60	63.40	45.70
21/10/2015	11:55	50.50	65.90	45.40
21/10/2015	12:00	56.50	67.90	49.30
21/10/2015	12:05	59.40	70.30	53.60
21/10/2015	12:10	61.00	73.00	53.70
21/10/2015	12:15	60.20	75.90	53.70
21/10/2015	12:20	53.00	67.20	45.80
21/10/2015	12:25	57.20	71.10	50.30
21/10/2015	12:30	59.80	73.00	51.90
21/10/2015	12:35	62.40	76.90	54.30
21/10/2015	12:40	63.20	78.10	54.80
21/10/2015	12:45	62.00	76.40	54.30
21/10/2015	12:50	56.10	73.00	47.60
21/10/2015	12:55	57.20	70.40	46.70
21/10/2015	13:00	49.40	62.10	44.00
21/10/2015	13:05	51.10	69.30	44.60
21/10/2015	13:10	49.40	59.60	44.40
21/10/2015	13:15	50.50	60.80	45.80
21/10/2015	13:20	50.60	63.00	42.70
21/10/2015	13:25	48.70	63.30	44.20
21/10/2015	13:30	48.00	55.90	43.20
21/10/2015	13:35	49.70	64.70	45.50

21/10/2015	13:40	48.70	70.50	44.70
21/10/2015	13:45	46.90	54.80	42.70
21/10/2015	13:50	47.70	56.00	44.20
21/10/2015	13:55	49.90	68.70	41.90
21/10/2015	14:00	59.10	76.40	51.20
21/10/2015	14:05	58.50	73.40	48.70
21/10/2015	14:10	52.90	70.10	43.70
21/10/2015	14:15	46.40	52.40	43.20
21/10/2015	14:20	47.60	60.80	43.40
21/10/2015	14:25	49.70	61.60	43.90
21/10/2015	14:30	51.20	66.30	43.60
21/10/2015	14:35	49.60	63.50	43.00
21/10/2015	14:40	46.70	58.50	42.30
21/10/2015	14:45	48.40	58.00	45.20
21/10/2015	14:50	50.00	61.90	44.60
21/10/2015	14:55	52.30	64.40	44.50
21/10/2015	15:00	46.80	55.50	40.70
21/10/2015	15:05	46.80	59.50	43.60
21/10/2015	15:10	47.70	58.60	43.50
21/10/2015	15:15	46.90	55.70	44.20
21/10/2015	15:20	52.40	64.30	45.20
21/10/2015	15:25	51.60	69.90	46.10
21/10/2015	15:30	48.80	62.80	42.70
21/10/2015	15:35	51.60	72.10	45.40
21/10/2015	15:40	48.90	61.60	45.20
21/10/2015	15:45	52.80	67.70	46.50
21/10/2015	15:50	52.40	64.70	46.20
21/10/2015	15:55	52.90	69.40	46.90

9 APPENDIX B – WEATHER DATA

Report Date / Time	Wind Direction Deg	Wind Speed mph	Air Temperature C
19/10/2015 11:00	45	2	11.72
19/10/2015 12:00	29	3	12.94
19/10/2015 13:00	10	3	13.11
19/10/2015 14:00	325	2	14
19/10/2015 15:00	60	3	13.11
19/10/2015 16:00	54	0	12.28
20/10/2015 09:00	23	1	9.39
20/10/2015 10:00	26	3	10.89
20/10/2015 11:00	353	4.9	12.5
20/10/2015 12:00	28	6	14.39
20/10/2015 13:00	330	4.9	13.28
20/10/2015 14:00	8	2	15.33
20/10/2015 15:00	35	4.9	15.67
20/10/2015 16:00	300	3	14.22
21/10/2015 09:00	246	4.9	9.78
21/10/2015 10:00	265	3	10.22
21/10/2015 12:00	262	4.9	11.5
21/10/2015 14:00	256	4.9	14.06
21/10/2015 16:00	237	2	14.78
21/10/2015 17:00	264	2	14.72

10 APPENDIX C – INFORMATION TO BE REPORTED

10.1 a) Competency

Ian Broom hold as a Bachelor of Science Degree with honours from the University of Derby and has a Post Graduate Diploma in Acoustics and Noise Control from the IoA. and is an associate member of the Institute of Acoustics.

10.2 b) Source

10.2.1 1) Description of Source	Play Area
10.2.2 2) Hours of Operation	10:30 morning Playtime 12:00 Lunchtime 14:00 Infant Playtime
10.2.3 3) Mode of Operation	Continuously as above
10.2.4 4) Operational Rates	Not applicable
10.2.5 5) Description of Premises	School

10.3 c) Subjective Impressions

10.3.1 Dominance and Audibility	The source is dominant during usage
10.3.2 Residual Sound	During the hours of operation the residual sound consists mainly of local traffic noise.

10.4 d) Context of the Site

Described within the body of the report

10.5 e) Measurement Locations

The background measurements were undertaken at two locations 5m from source as in report. The background measurement position was chosen as it was at the rear of the property and was not affected by the noise from the adjoining residential properties. It is believed that this level is representative of the existing noise climate in the garden areas without school operating.

10.6 f) Sound Measuring Systems

10.6.1 1) Type and Model	The meter, pre-amplifier and microphone used to undertake the measurements comply with the requirements of class 1 as defined within IEC 61672 – Part 1: 2002. The meter model number is CR:171C.
10.6.2 2) Manufacturer	The meter, pre-amplifier and microphone were manufactured by Cirrus
10.6.3 3) Serial Number	The meter serial number is G067012, the pre-amplifier serial number is 1893453 and the microphone serial number is 613843.
10.6.4 4) Details of Last Verification	The meter, pre-amplifier and microphone were all calibrated by Cirrus Instruments on August 2015 under certificate number 214051.

10.7 g) Operational Tests

10.7.1 1) Reference Level of Calibrator	The reference level of the calibrator is 94.0 dB.
10.7.2 2) Meter Reading	When the reference calibrator was applied to the meter it read 94.0 dB before and after the tests.

10.8 h) Weather Conditions

10.8.1 1) Wind Speed and Direction	Within the report.
10.8.2 2) Temperature Inversion	The distance between the source and receiver or other significant background sources are unlikely to be affected by temperature inversion.
10.8.3 3) Precipitation	There was no precipitation during the background noise measurements.
10.8.4 4) Fog	There was no fog during the background noise measurements.
10.8.5 5) Wet Ground	The ground was dry during the background noise measurements.
10.8.6 6) Frozen Ground or Snow Coverage	The ground was neither frozen nor covered in snow during the background noise measurements.
10.8.7 7) Temperature	Within the report.
10.8.8 8) Cloud Cover	Not recorded.

10.9 i) Dates and Times of Measurements

Within Report

10.10 j) Measurement Time Interval

The background measurements were undertaken as 100ms-1 measurements and converted to various time bases.

10.11 k) Reference Time Interval

The reference time interval for the day time assessments was 16 hour.

10.12 q) Uncertainty

Uncertainty will not change the impact of the source.

Uncertainty is greatly reduced due to the prolonged measurement period.

11 APPENDIX D – UNCERTAINTY BUDGET

Sources of Uncertainty	Uncertainty Notes	Commentary	Value / (half Width)	Confidence Level	Convert to Same Units (dB)	Standardise Confidence level to 68%	Distribution Divisor			Standard Uncertainty (u) dB	Ref
							Normal	Rectangle	Gaussian		
Source											
Source level	Variation	Estimated From Source to SLM (lunch / playground)	5.1						s/Vn	0.87	
	Variation	Estimated From Source to SLM (lunch /equipment)	2.6						s/Vn	0.44	
Position of Source	Distance from source to measurement positions (equipment)	Estimated from 0.5m in 4m			1.2			rect(v/3)		0.67	
	Distance from source to measurement positions (equipment)	Estimated from 1m in 5m			0.9			rect(v/3)		0.53	
Operating Condition	Duration on/off (typical cycles)	on/off									
Characteristic of Source	steady state / Impulsive / Tonal	Source intermittent light perception of impulsivity									
Barriers	Magnitude of Screening	No Screening at Source Measurement	0.5				Notmal(1)			0.50	
Type of Propagation	Spherical / hemi	Point Source at Distance									
	point / line										
	near / far										
	directional / Omni										
Environmental Effects	wind	Small Effect	0.5					rect(v/3)		0.29	
	Temperature										
Transmission Path											
Weather	Propagation of source	20m downwind	1.0					rect(v/3)		0.58	
	wind speed	From weather data calculated Standard deviation									
	wind direction										
	temperature gradient										
Ground Reflection	Magnitude of ground dip,	Flat Ground Reflections applied									
	variability of surface										

Barriers	Magnitude of shielding / screening	Screening uncertainty Wind Direction and Temperature	1.0				Notmal(1)			1.00	
	Uncertainty of source to screening	Screening uncertainty estimated proximity 9m to 10m			0.9			rect(v/3)		0.53	
Receiver											
Measurement Position	Choice of position, ,	1m in 20m			0.4			rect(v/3)		0.26	
	height above ground level	Uncertainty in height location (First Floor)	0.7				Notmal(1)			0.70	
	microphone orientation	Type 1 0 - 30deg	0.4				Notmal(1)			0.50	
Façade Reflections	Distance to Façade	1m from façade	1.0				Notmal(1)			1.00	
	Size of Façade										
	Type of Façade (windows etc.)										
Other Reflections	Distance to Surface										
	Size of Surface										
	Type of Surface										
Instrumentation	Calibration	Calibration Drift	0.1				Notmal(1)			0.10	
	Accuracy and precision (type 1)	Type 1 practical	1.9					rect(v/3)		0.50	
	Windshield										
	Environmental influence										
Background Noise Level	Timing of Measurement										
	Background Measurement Source off	Calculated Standard Deviation	0.5						s/Vn	0.15	
	Choice of Measurement Position	NSP First Floor Window									
Combined Uncertainty (root sum of squares)										2.35	
Expanded Uncertainty U = Kuc (95% Confidence K =2)										4.70	
Final Answer Expressed as Value +/- U dB with a confidence Level of 95%											
REFERENCE: Uncertainty Budget Calculated in line with M3003: The Expression of Uncertainty and Confidence in Measurement Edition 3, November 2012 and A Good Practice Guide on the Sources and Magnitude of Uncertainty Arising in the Practical Measurement of Environmental Noise N J Craven, G Kerry Edition 1a – May 2007.											

12 REFERENCES

12.1 International Standard Organisation 9613 – Part 1: 1993

Acoustics – Attenuation of sound propagation outdoors.

Part 1 - Part 1: Calculation of the absorption of sound by the atmosphere.

12.2 International Standard Organisation 9613 – Part 2: 1996

Acoustics – Attenuation of sound during propagation outdoors.

12.3 World Health Organisation Guidelines for Community noise: 1999

Published by Birgitta Berglund, Thomas Lindvall, Dietrich Schwela and Kee-Tai Goh.

12.4 World Health Organisation Europe Night Noise Guidelines 2009

End of Report