Land adjacent 64 Chantry Avenue (former Hubbell site), Kempston

Noise Impact Assessment for Proposed Residential Development

Addendum to MAS report dated 30th March 2016 (ref: CAKemp160330)

MAS Environmental Ltd - 11th July 2017

1.0 Introduction

1.1 MAS Environmental Ltd ("MAS") were appointed by Aragon Land and Planning to provide a noise impact assessment for residential development at land adjacent to 64 Chantry Avenue, Kempston. This assessment was provided in March 2016 and provided a summary of an environmental noise survey at the site, plans of the layout of the proposed development and an assessment of noise impact in relation to relevant guidance and standards. In addition to the March 2016 report an addendum report was provided in July 2016 clarifying and quantifying the planning gain to existing housing afforded by development of the site.

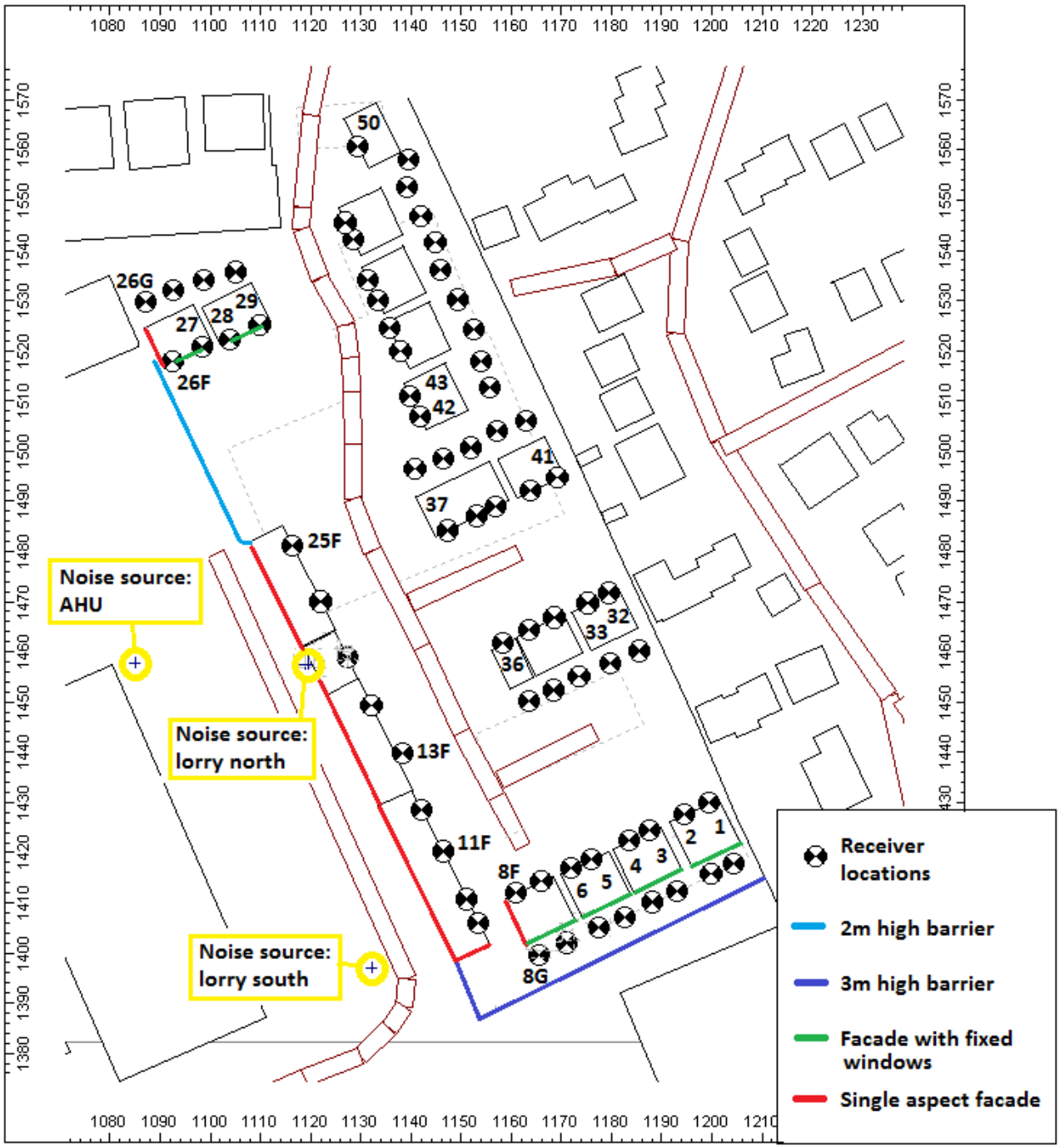
1.2 A revised layout of the site has been proposed and this (July 2017) addendum report provides an update to the MAS March 2016 report with regard to noise impact. A revised site plan and revised predicted noise levels have been provided below. Figure 1 below shows the revised site layout.

Figure 1: Revised site layout

2.0 Predicted noise levels and noise impact assessment

2.1 The potential for adverse impact from commercial and industrial units at the proposed development site was highlighted at an early stage. The design of the site and predicted noise impact has undergone several revisions in order to achieve the best layout in terms of noise impact and other planning considerations. Additional mitigation is afforded at the development by using boundary screening with barriers and single aspect facades. In some cases fixed windows have been recommended. The layout of the noise model and proposed mitigation is shown in figure 2 below.

Figure 2: Noise model layout



2.2 Three main noise source locations and two main noise sources, lorries and the AHU, were used corresponding with observations. All source heights have been modelled at 1m. Daytime impact is predicted at 1.5m receiver height and night time at 4.5m and 7.5m receiver height. A change from the previous layout includes plots 1-8 and 26-29 becoming 3 storey dwellings that have opening windows with the potential to be affected by noise. As such predicted noise levels at 7.5m height (representative of 3rd storey windows) have been provided for these plots. Whilst there are other 3 storey dwellings in the development there are no opening windows with a direct line of site to the industrial / commercial units and as such predictions at this height have not been made for these plots. The receiver grid spacing is 2m and hard reflective ground (G=0.0) with 2nd order reflections has been assumed in the model.

2.3 Appropriate criteria for assessing impact was discussed in detail in the March 2016 MAS report. Due to the nature of the noise, impact was considered best assessed in accordance with BS4142:2014. During daytime an hour period of impact is considered in accordance with BS4142:2014 and compared to a background noise level of 38dB LA90 1 hour. This is considered representative of the lower background noise levels found in evenings. At night time a time period of 15 minutes is used and compared to a background noise level of 35dB LA90 15 minutes. Maximum noise levels have also been predicted and compared to the sleep disturbance criterion of 42dB LAmax inside.

2.4 The predicted noise levels are shown in figures 3 - 7 below. For brevity only the night time noise maps are shown at 4.5m height.[1] The results are tabulated and provided in appendix B. These tables show the predicted noise levels from each source and where appropriate give the difference between the rated predicted sound level and the background sound level. A character penalty of +9dB has been assumed for lorry events and +7dB for the AHU noise. This corresponds with the typical worst case examples provided in the March 2016 MAS report.

2.5 As a further comparison the change in predicted noise levels from the MAS March 2016 noise impact assessment to those predicted and summarised in this report, resulting from the new revised layout, have been provided in appendix C.

[1] Daytime noise maps can be provided on request as can predicted noise levels at 7.5m height.

Figure 3: Predicted noise level at 4.5m - lorry north

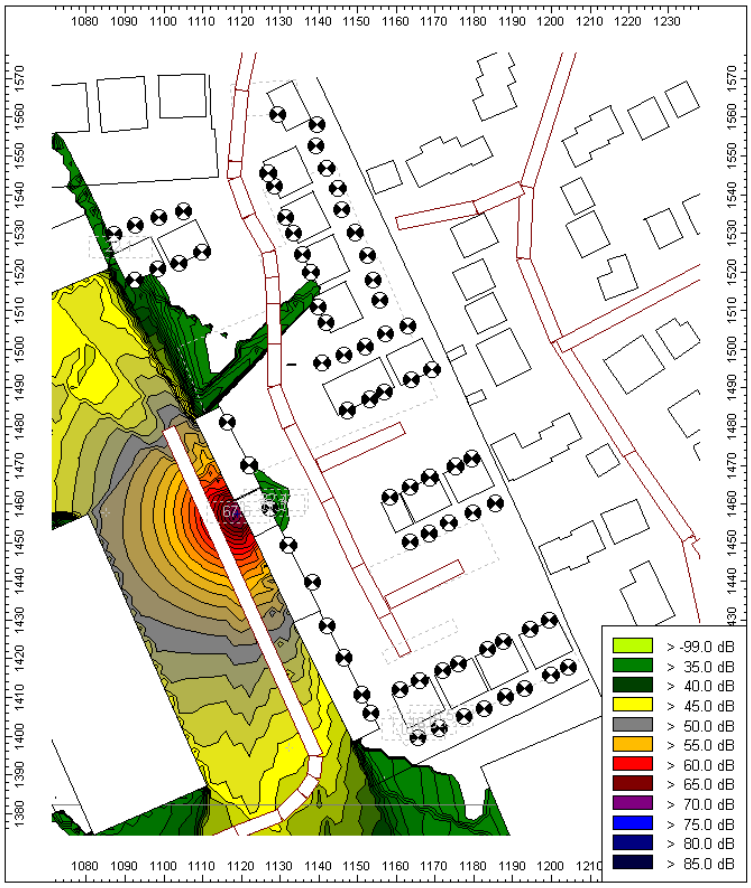


Figure 4: Predicted noise level at 4.5m - lorry south

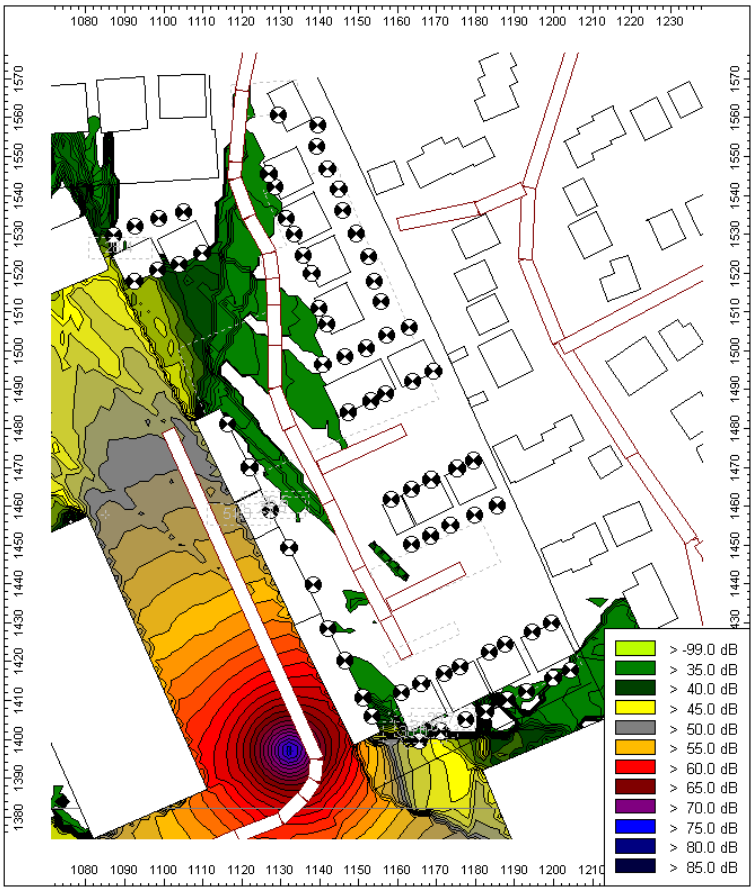


Figure 5: Predicted noise level at 4.5m - AHU

Figure 6: Predicted noise level at 4.5m - lorry north LAmax

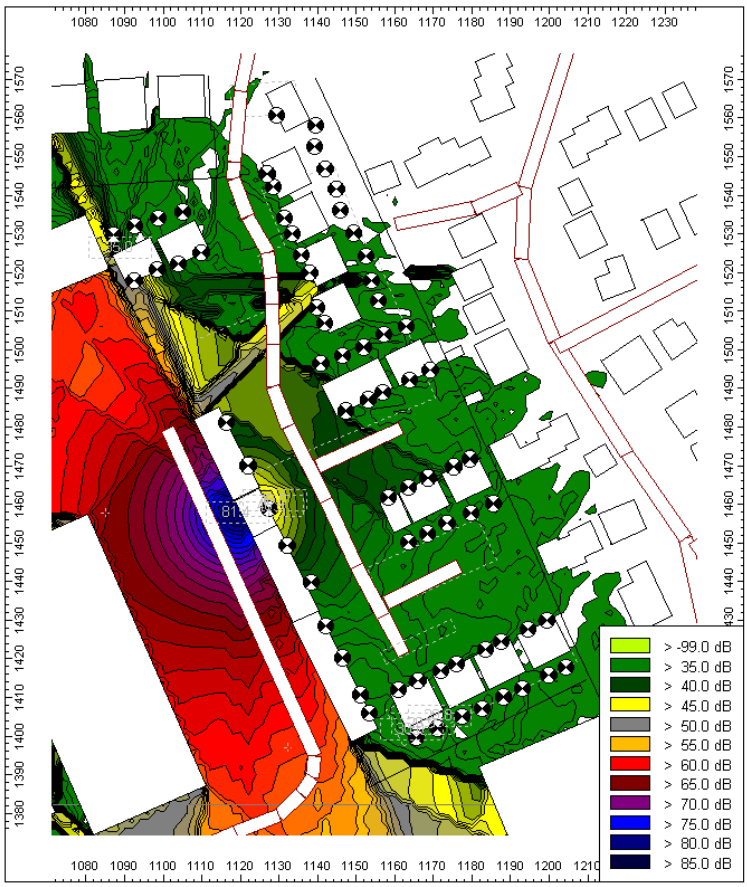
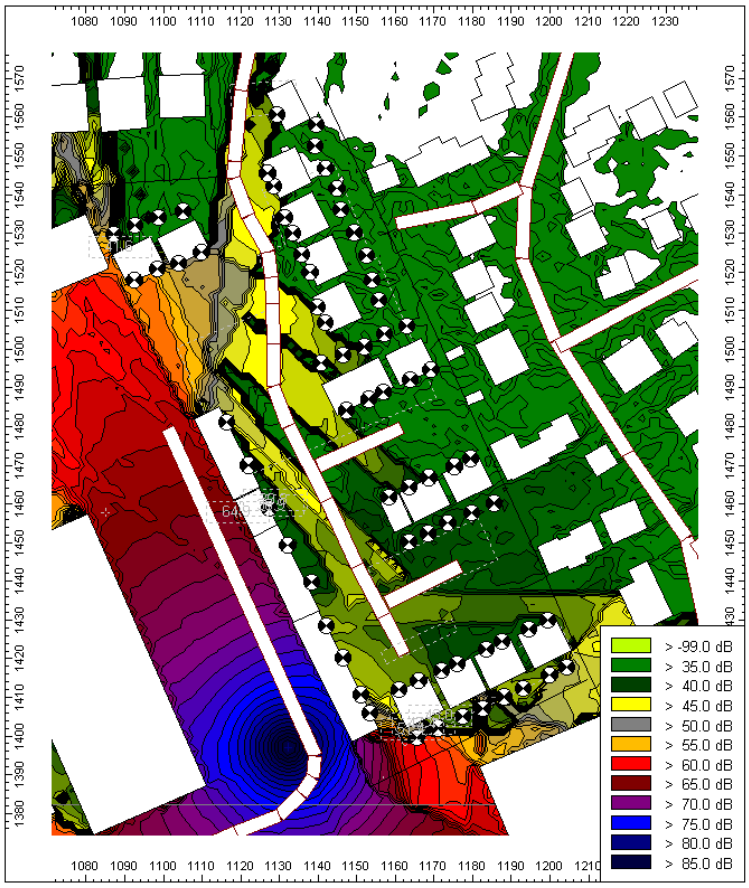


Figure 7: Predicted noise level at 4.5m - lorry south LAmax



2.6 In general there is very little change in noise impact across the site. Whilst there are increases and decreases in impact these balance out and in the vast majority of cases have little impact on the acceptability criteria or acceptability of the site.

2.7 Appendix C gives comparison tables showing how the predicted noise levels increase and decrease at each receiver location. The tables are highlighted to show increases and decreases in predicted noise levels of approximately 2dB or more. In many cases an improvement (decrease in impact, see green highlighted cells) to the predicted noise level is observed. Where there is an increase in impact indicated (see yellow highlighted cells) the majority of receiver locations all still have a difference between the BS4142 rating level and background sound level of less than 0. In a minority of cases there is an increase of impact that results in a difference between the BS4142 rating level and background sound level of 0-5dB but this remains within the acceptable criteria.

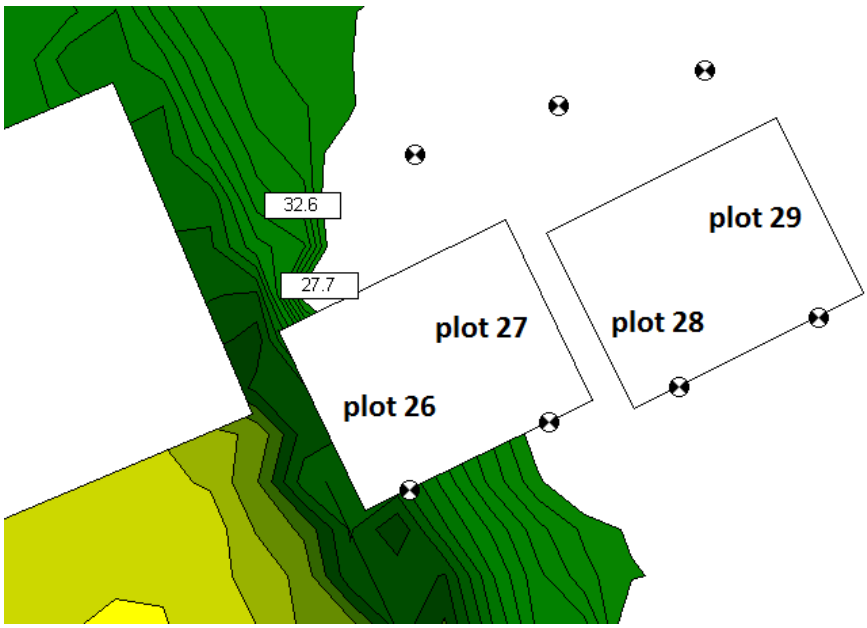
2.8 At plots 26-29 impact is changed significantly but this is largely a result of the orientation of the plots being changed so that receivers previously marked as a garden location are now a front facade location. These plots are discussed further below.

2.9 Predicted noise levels at the front facade of plots 26-29 (i.e. facing south) are higher than the sought criteria; however, with reference to figure 2 above it is proposed that these plots have fixed windows on this facade. This includes up to third storey height. As such noise impact is not an issue at these receiver locations. Predicted noise levels

in the gardens of these dwellings are within proposed criteria with the exception of plot 26 at 7.5m height using the BS4142 night time lorry north and south sources.

2.10 The noise map below shows a close up of the predicted noise level at 7.5m height at plot 26 with the night time lorry north source. The free field receiver location gives a predicted noise level of 32.6dB(A). However, 1m from the facade of the dwelling the predicted noise level is 27.7dB(A). At this level and with the appropriate character penalty the noise level is acceptable.[2] As impact at 7.5m assesses impact on residents within the dwelling, a facade level is considered representative of internal impact. The noise level predicted closer to the facade and therefore incident on the window is lower and within acceptable levels. As such impact is considered acceptable at this location.

Figure 8: Predicted noise levels in garden of plot 26



2.11 Night time impact has been predicted at plots 1-8 and 26-29 at 7.5m height, see tables 2 and 4. The maximum predicted noise levels are all within acceptable criterion with the exception of receiver 8G (the garden of plot 8). With reference to figure 2 above this rear facing facade will have fixed windows and as such impact here is not a concern.

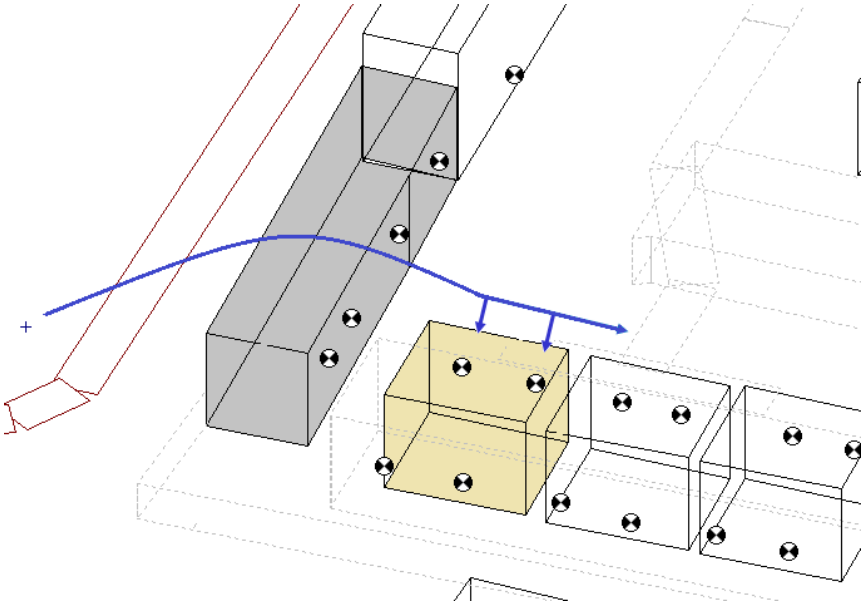
2.12 Night time impact at 7.5m height using the BS4142 night time sources exceeds criterion at plots 1-8 in the garden (rear facing facade) and at plots 26-29 on the front facade (facing south). These plots are shown in figure 2 to have fixed windows and as such noise impact on these facades is not a concern. Fixed windows should also be installed at third storey height.

2.13 Night time impact in the garden of plot 26 is discussed above and found to be acceptable. The only remaining plots where criterion levels are exceeded are plots 7 and 8 on the front facade, i.e. facing north and towards the centre of the development site. The exceedance in criterion level is caused largely by diffracted noise over the top of the adjacent building (plots 9-11).

[2] The difference between the rated noise level and background sound level is 1.7dB(A).

2.14 The directionality of sound waves travelling was discussed in section 5 of the MAS March 2016 report. A similar situation arises on the front facades of plots 7 and 8 (receivers 7F and 8F) where predicted noise levels indicate that criterion is exceeded, but the likelihood of adverse impact actually arising is low. Figure 8 below shows the noise source and direction of travel of sound waves that impact on receiver locations 7F and 8F.

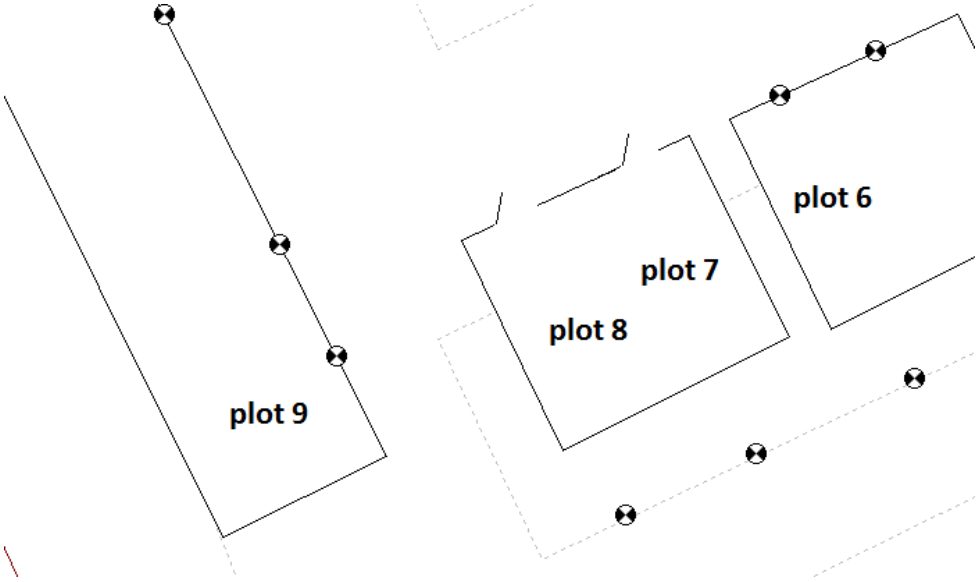
Figure 9: Example of sound paths affected plots 7 and 8



2.15 The primary sound path is over the top of the grey building (plots 9-11).[3] The direction of travel of the sound waves diffracting over the top of the building is at 90° to the windows on the affected facade. Thus the sound would need to change direction or be reflected to directly face the windows to be a concern. As this is unlikely to occur in reality and given the relatively low sound energy levels being considered[4] these receiver locations are considered subject to acceptable noise levels and should not have fixed windows. It is recommended that to further improve reduction of sound windows should open away from the industrial site as shown in figure 9 below. It is further recommended that these third storey rooms have additional means of ventilation so that residents can choose between having windows open and shut but still be provided will sufficient means of heating, cooling and ventilation.

[3] If the building height of plots 9-11 is increased in the noise model predicted noise levels significantly decrease.
[4] It is noted that the assessment includes a 9dB character penalty.

Figure 10: Example of window orientation plots 7 and 8



2.16 At all other locations impact remains unchanged from the previous MAS 2016 report and as such conclusions regarding acceptability remain unchanged.

3.0 Summary and conclusions

3.1 This addendum report provides revised predicted noise levels at the proposed development site following revisions to the site layout. Noise impact has been reconsidered and predicted noise levels are found to be of a similar magnitude as those predicted from the previously approved site layout. Where impact is predicted to increase noise levels, the vast majority of locations are within or below acceptable criteria.

3.2 Third storey dwellings are now proposed at plots 1-8 and plots 26-29. Predicted noise levels have been provided accordingly, at 7.5m height. Predicted noise impact at these dwellings meets the acceptable criteria and where levels are exceeded mitigation measures have been recommended such as fixed windows and additional ventilation.

3.3 The predicted noise levels indicate that at the majority of plots across the site rated commercial / industrial sound will be at or below the existing background sound level. In a few cases predicted levels are higher and fixed windows or other means of mitigation have been recommended.

3.4 It is noted that the development still provides a planning gain to existing housing and will form a significant barrier between existing housing and the industrial estate.

3.5 The development site will still largely fall within the lowest observed adverse effect level. Noise from road traffic and commercial / industrial sources will be audible at the site and at times within dwellings when windows are open. With reference to planning practice guidance, the appropriate action is to mitigate and reduce noise impact to a minimum. The implementation of the recommendations for noise mitigation as outlined above indicates noise affecting the development site will be at a level that can be heard but does not cause any significant change in quality of life or behaviour.

Sarah Large **11th July 2017**

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Appendix A – Glossary & Explanation of Terms

'A' Weighting - This is a function which attempts to simulate the characteristics of human hearing. Hence a dB(A) reading is a subjective value of what we actually hear for quiet sounds whereas dB(LIN), {dB(C) on simpler instruments}, is an objective reading of what is actually physically present. However, for louder and low frequency sounds dB(C) correlates better to the human ear.

dB(A) has been proven not to be so effective in weighting for human hearing at low frequencies.

Ambient – Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation – The loss in energy level of the sound usually used in relation to the loss due to sound passing through a structure or enclosure.

Background Noise Level – The underlying level of noise in the absence of the source. Usually measured as an LA90 as that will exclude most short duration noises. It is the residual noise level in circumstances where the source does not contribute to the residual noise. See LA90 below.

"Influenced" background noise level. In many situations the background noise level can be measured either when the source or premises from which noise emanates or is associated with is not operating. Alternatively the intermittency of the source means that it does not have any appreciable effect on the background level, which is a statistical level based on mainly noise that continues without any breaks. Where this is not the case, the measured level will be increased and thus influenced.

"Uninfluenced" background noise level. This refers to any measurement of background level that has not been increased due to noise connected with the source.

Broad band Noise – This is noise covering the whole of the audible frequency range. Compare to narrow band noise which is noise made up of only a very narrow band of frequencies. It will normally exhibit tonality.

'C' Weighting – See 'A' Weighting above.

Decibel (dB): a unit or level, derived from the logarithm of the ratio between the value of a noise energy quantity and a reference value. For sound pressure level the reference quantity is 20µPa, the threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain / instantaneous damage. A change of 1 dB is only perceptible under special conditions.

dB(A): (See A weighting below) This is decibels measured on a sound level meter weighted by a scale which is designed to reflect the weighting placed on

noise by the human ear. A noise meter incorporates a frequency weighting device to create this differentiation. The dB(A) scale is now widely accepted.

Measurements in dB(A) broadly agree with people's assessment of loudness for broadband noise. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

Filtering - Octaves & 1/3 Octaves - In general most noise is broad band i.e. it contains energy in virtually all the frequencies across the audio range in different combinations so that it has certain recognisable characteristics. To determine the frequencies at which most of the energy is concentrated, a sound signal is filtered into bands, commonly Octave and 1/3 Octave bands Information from such filtering, is widely used for diagnostic work, and to determine noise control measures.

Frequency – This is the number of air vibrations or pressure fluctuations per second. The unit is the hertz (Hz).

Hertz (Hz) – See Frequency above.

Impulse Noise - Single or repeated noise of short duration such as a bang or shot. It has an abrupt start and the noise level rises rapidly.

LA90: The A weighted noise level exceeded for 90% of the specified measurement period. It is a statistical measurement. In BS 4142: 1997 and now generally it is used to define background noise level. Thus if it was measured for 1 minute it would equate to the quietest 6 seconds. In one hour it would be the quietest 10% of time or 6 minutes. Thus if a machine run continuously without a reduction in noise for 54 minutes and then stopped it would represent the quiet 6 minutes but if it run for 55 minutes it would represent the quietest period of machine noise.

LA10: This is the statistical noise level exceeded for 10% of the time. It represents the noisiest part of any time period.

LAeq: The equivalent continuous sound level - the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. LAeq is used to describe many types of noise and can be measured directly with an integrating sound level meter.

It is obtained by continuously integrating ('adding up the energy of') a fluctuating sound signal and dividing by the elapsed time, to give the true mathematical average of any time varying signal.

An Leq reading must always be related to a time period, it should not be read as an instantaneous value of sound pressure.

LAmax: The highest A weighted noise level recorded during a noise event. The time weighting used (F or S) should be stated. All measurements were 'Fast' in this survey.

Ln - PERCENTAGE / STATISTICAL LEVEL. Another way of assessing the variation of noise with time is to sample it at frequent intervals and then to classify the data obtained into different fractions of decibel. Then the level which is exceeded for a certain percentage of the time can be calculated e.g. L10 is the level which is exceeded 10% of the time and therefore relates to the higher levels of noise, whereas L90 relates more to the background level or noise which is generally remaining when the nearer noisier sources are removed.

A one minute L90 would represent the quietest 6 seconds.

Lnight,outside – the long term A-weighted average sound level as defined in ISO 1996-2: 1987 established over all the night periods of a year. The reference to 'outside' is used in the WHO guidelines for night time noise (2009) to prevent confusion with inside noise levels.

Logarithmic – A scale where the exponent indicating the power to which a fixed number, the base, must be raised to produce a given number. The base used in acoustics is 10. Thus the logarithm of 10 = 1, the logarithm of 100 = 2 and the logarithm of 1000 = 3. In terms of sound energy, an increase of 10 decibels equates to a 10 fold increase.

Loudness – An observer's auditory impression of the strength of a sound. It is a subjective effect which is a function of the ear and brain as well as the amplitude and frequency of the sound.

Low Frequency Noise – This is normally considered to be noise ranging from 20 hertz (pressure fluctuations per second) to 200 Hertz. In music it is the bass region as opposed to Alto and soprano.

Masking – The process by which the threshold of hearing of one sound is raised due to the presence of another.

Meter response and time weightings - Most practical sound sources cause fluctuating readings. If the level fluctuates too rapidly, an analogue pointer may move so erratically that it will not be possible to obtain a meaningful reading, or with impulsive sound the meter may not respond quickly enough to obtain an authentic reading. Sound Level Meters are therefore provided with a variable time response control with settings:-

'S' Slow; 'F' Fast; 'I' Impulse; 'P' Peak.

'S' Slow - meter response is over damped with a time constant of approx 1 sec or 1000ms. The setting tends to average out fluctuations in the readings.

'F' Fast - permits the instrument to follow and indicate levels that do not fluctuate too rapidly; the time constant response is 125ms.

'I' Impulse - uses a special electrical circuit with a time constant of about 35ms (of the same order as the response time of the human ear) to permit a very rapid response for investigating very sudden, short duration - impulsive - sounds. This setting incorporates a detector which in effect stores the signal for sufficient time to allow it to be displayed.

Also a slow decay rate is incorporated with time response of approx 1500ms to allow more easy reading of the maximum value as the indicator moves back relatively slowly.

'P' Peak - higher grade meters often incorporate this setting which enables the **absolute peak** (as opposed to the rms) value of an impulsive waveform to be measured. A time constant of the order of 20 - 50 micro seconds is now involved to permit the following of very sharp impulsive events. Evidently electrical signal storage is also required to permit the meter to register the peak of such very fast events.

Pitch – Frequency is an objective measure whereas the term pitch is subjective, and although mainly dependent on frequency is also affected by intensity.

Rating Level – The specific noise level of a source when measured at a receiver location (usually averaged over a time interval) plus any adjustment (penalty or weighting) for the characteristic features of the noise. It is used in BS4142 to rate the likelihood of complaints.

Spectogram - A visual representation of sound and how its level and frequency content varies with time. Typically shown as a coloured plot with time along the x axis, frequency on the y axis and intensity expressed as a function of colour.

Tonality & tonal – A tonal sound is one which gives a definite pitch sensation. It usually occurs where the noise energy in a narrow range of frequencies is greater than those either side of that narrow range. It will appear as a peak on a graph of noise energy shown in decibels versus the audible spectrum. It can often be shown by comparing adjoining 1/3rd octave spectra (see in the glossary above). Where one 1/3rd octave band is more than 5dB above those either side, the noise contains a tone.

Appendix B - Predicted noise levels (tables)

Table 1: Predicted noise levels at night time (BS4142 sources) 4.5m height

Night time BS4142 15 min period. Receiver height 4.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate a difference of 0-5dB. Pink highlighted cells indicate a difference greater than 5dB.							
Receiver	**BGSL**	**Predicted noise level lorry to north**	**Diff**	**Predicted noise level lorry to south**	**Diff**	**Predicted noise level AHU**	**Diff**
1G	35	17.4	-8.6	35.1	9.1	6.7	-21.3
2G	35	18.1	-7.9	30.2	4.2	6.9	-21.1
3G	35	18.9	-7.1	30.1	4.1	9.4	-18.6
4G	35	17.2	-8.8	30.8	4.8	10.1	-17.9
5G	35	17.1	-8.9	39.4	13.4	13.5	-14.5
6G	35	17.1	-8.9	27.9	1.9	14.1	-13.9
7G	35	17.2	-8.8	30.1	4.1	12.8	-15.2
8G	35	17.6	-8.4	47	21	11	-17
26G	35	24.7	-1.3	27.9	1.9	26.6	-1.4
27G	35	18.4	-7.6	22.4	-3.6	15.4	-12.6
28G	35	17.9	-8.1	21.1	-4.9	13.2	-14.8
29G	35	18.4	-7.6	20.7	-5.3	18.7	-9.3
32G	35	17.6	-8.4	25.7	-0.3	12	-16
33G	35	19.1	-6.9	26.6	0.6	12.4	-15.6
34G	35	19.2	-6.8	26.6	0.6	12	-16
35G	35	20	-6	26.9	0.9	10.5	-17.5
36G	35	20.5	-5.5	26.7	0.7	8.4	-19.6
37G	35	20.8	-5.2	22.5	-3.5	20	-8
38G	35	18.9	-7.1	28.6	2.6	20.8	-7.2
39G	35	19.5	-6.5	21.5	-4.5	17	-11
40G	35	19	-7	21.9	-4.1	12.3	-15.7
41G	35	17.9	-8.1	19.4	-6.6	12.1	-15.9
42G	35	16.6	-9.4	20.9	-5.1	15.1	-12.9
43G	35	18.2	-7.8	19.8	-6.2	15.6	-12.4
44G	35	16.7	-9.3	19.7	-6.3	17.5	-10.5
45G	35	16.6	-9.4	18.2	-7.8	10.3	-17.7
46G	35	14.9	-11.1	19.5	-6.5	7.6	-20.4
47G	35	14.2	-11.8	17.3	-8.7	9	-19
48G	35	14.1	-11.9	16.4	-9.6	7.8	-20.2
49G	35	15.8	-10.2	18	-8	7.9	-20.1
50G	35	15	-11	19.6	-6.4	10	-18
1F	35	17.9	-8.1	23.9	-2.1	6.7	-21.3
2F	35	17.6	-8.4	24	-2	6.9	-21.1
3F	35	18.5	-7.5	24.7	-1.3	13.3	-14.7
4F	35	18.8	-7.2	25.6	-0.4	13.5	-14.5
5F	35	19.2	-6.8	27.3	1.3	8.6	-19.4
6F	35	19.2	-6.8	27.1	1.1	7.8	-20.2
7F	35	19.2	-6.8	29	3	9.2	-18.8
8F	35	18.3	-7.7	29.6	3.6	9.9	-18.1
9F	35	17.4	-8.6	37.8	11.8	7.9	-20.1
10F	35	17.6	-8.4	32.7	6.7	8	-20

Night time BS4142 15 min period. Receiver height 4.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate a difference of 0-5dB. Pink highlighted cells indicate a difference greater than 5dB.							
Receiver	**BGSL**	**Predicted noise level lorry to north**	**Diff**	**Predicted noise level lorry to south**	**Diff**	**Predicted noise level AHU**	**Diff**
11F	35	19.1	-6.9	30.3	4.3	7.9	-20.1
12F	35	21.2	-4.8	30.1	4.1	9.6	-18.4
13F	35	24.1	-1.9	25.9	-0.1	12	-16
18F	35	28.8	2.8	25	-1	10.4	-17.6
19F	35	33.8	7.8	25.2	-0.8	15.7	-12.3
20F	35	29.6	3.6	23.6	-2.4	15.9	-12.1
25F	35	25.9	-0.1	21.5	-4.5	14.7	-13.3
26F	35	37.1	11.1	41.3	15.3	30.6	2.6
27F	35	28.6	2.6	40.2	14.2	30.1	2.1
28F	35	24.5	-1.5	38.5	12.5	29.8	1.8
29F	35	21.6	-4.4	37.3	11.3	28.3	0.3
32F	35	19.5	-6.5	19.9	-6.1	10.2	-17.8
33F	35	19.5	-6.5	21.5	-4.5	10.8	-17.2
34F	35	23.1	-2.9	21.1	-4.9	16.4	-11.6
35F	35	23.9	-2.1	26.9	0.9	11.4	-16.6
36F	35	25	-1	20.9	-5.1	11.3	-16.7
37F	35	20.1	-5.9	24.6	-1.4	7.8	-20.2
38F	35	19.1	-6.9	21.6	-4.4	6.9	-21.1
39F	35	18.8	-7.2	22.5	-3.5	7	-21
40F	35	17.9	-8.1	20.8	-5.2	5.7	-22.3
41F	35	17.4	-8.6	21.1	-4.9	6.4	-21.6
42F	35	20.5	-5.5	29.5	3.5	22.5	-5.5
43F	35	20.4	-5.6	29.5	3.5	24.9	-3.1
44F	35	18.8	-7.2	19.9	-6.1	23.4	-4.6
45F	35	18.6	-7.4	19.1	-6.9	23.1	-4.9
46F	35	18.5	-7.5	19.9	-6.1	22.8	-5.2
47F	35	17.9	-8.1	20	-6	22.6	-5.4
48F	35	16.1	-9.9	30.5	4.5	21.9	-6.1
49F	35	15.8	-10.2	30.4	4.4	21.6	-6.4
50F	35	14	-12	28.4	2.4	21	-7

Table 2: Predicted noise levels at night time (BS4142 sources) 7.5m height

Night time BS4142 15 min period. Receiver height 7.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate a difference of 0-5dB. Pink highlighted cells indicate a difference greater than 5dB.							
Receiver	**BGSL**	**Predicted noise level lorry to north**	**Diff**	**Predicted noise level lorry to south**	**Diff**	**Predicted noise level AHU**	**Diff**
1G	35	21.3	-4.7	38.4	12.4	6.5	-21.5
2G	35	21.9	-4.1	35.6	9.6	7.4	-20.6
3G	35	22.5	-3.5	36.3	10.3	13.6	-14.4
4G	35	19.9	-6.1	36.9	10.9	15.5	-12.5
5G	35	20.5	-5.5	42.3	16.3	18.8	-9.2
6G	35	21	-5	41.4	15.4	18	-10
7G	35	22.3	-3.7	46.4	20.4	13.5	-14.5
8G	35	23.1	-2.9	51.6	25.6	15.9	-12.1
26G	35	32.6	6.6	32.6	6.6	27.5	-0.5
27G	35	25.2	-0.8	31	5	19.1	-8.9
28G	35	21.7	-4.3	28.8	2.8	19.6	-8.4
29G	35	21.7	-4.3	27.4	1.4	21.9	-6.1
1F	35	20.8	-5.2	27	1	8.2	-19.8
2F	35	20.2	-5.8	27.3	1.3	10	-18
3F	35	21.1	-4.9	27.8	1.8	15.5	-12.5
4F	35	21.5	-4.5	28.6	2.6	16.1	-11.9
5F	35	22.6	-3.4	30.7	4.7	11.8	-16.2
6F	35	22.8	-3.2	30.6	4.6	11.1	-16.9
7F	35	23.3	-2.7	32.3	6.3	13.9	-14.1
8F	35	23.3	-2.7	33.3	7.3	15.9	-12.1
26F	35	37.1	11.1	41.3	15.3	30.6	2.6
27F	35	28.5	2.5	40.2	14.2	30.2	2.2
28F	35	24.3	-1.7	38.5	12.5	30.1	2.1
29F	35	21.5	-4.5	37.3	11.3	29.5	1.5

Table 3: Predicted noise levels at night time (maximum noise) at 4.5m height

Night time maximum noise level (LAmax). Receiver height 4.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate an LAmax greater than 54dB.				
Receiver	**Predicted noise level lorry to north**	**Diff between 54dB Lamax**	**Predicted noise level lorry to south**	**Diff between 54dB LAmax**
1G	30.7	-23.3	48.2	-5.8
2G	31.3	-22.7	43.2	-10.8
3G	32.3	-21.7	43.2	-10.8
4G	30.5	-23.5	43.8	-10.2
5G	30.4	-23.6	53	-1
6G	30.4	-23.6	41	-13
7G	30.3	-23.7	42.8	-11.2
8G	30.6	-23.4	60.6	6.6
26G	37.4	-16.6	40.6	-13.4
27G	31.4	-22.6	35.3	-18.7
28G	31.2	-22.8	34	-20
29G	31.7	-22.3	33.7	-20.3
32G	31.1	-22.9	38.6	-15.4
33G	32.6	-21.4	39.5	-14.5
34G	32.7	-21.3	39.5	-14.5
35G	33.5	-20.5	39.7	-14.3
36G	33.9	-20.1	39.5	-14.5
37G	34.1	-19.9	35.3	-18.7
38G	32.1	-21.9	42.5	-11.5
39G	32.8	-21.2	34.7	-19.3
40G	32.4	-21.6	34.9	-19.1
41G	31.3	-22.7	32.5	-21.5
42G	29.9	-24.1	33.9	-20.1
43G	31.6	-22.4	32.7	-21.3
44G	30	-24	32.7	-21.3
45G	29.9	-24.1	31.2	-22.8
46G	28.3	-25.7	32.5	-21.5
47G	27.5	-26.5	30.4	-23.6
48G	27.6	-26.4	29.4	-24.6
49G	29.3	-24.7	31	-23
50G	28.3	-25.7	32.6	-21.4
1F	31	-23	37.3	-16.7
2F	30.6	-23.4	37.4	-16.6
3F	31.6	-22.4	38.2	-15.8
4F	31.8	-22.2	38.9	-15.1
5F	32.3	-21.7	40.5	-13.5
6F	32.4	-21.6	40.4	-13.6
7F	32.4	-21.6	42.2	-11.8
8F	31.5	-22.5	42.9	-11.1
9F	30.7	-23.3	51.4	-2.6
10F	31	-23	46	-8
11F	32.6	-21.4	43.9	-10.1
12F	34.7	-19.3	43.7	-10.3
13F	37.6	-16.4	39.5	-14.5
18F	42.3	-11.7	38.5	-15.5
19F	47.4	-6.6	38.7	-15.3

Night time maximum noise level (LAmax). Receiver height 4.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate an LAmax greater than 54dB.				
Receiver	**Predicted noise level lorry to north**	**Diff between 54dB Lamax**	**Predicted noise level lorry to south**	**Diff between 54dB LAmax**
20F	43.2	-10.8	36.9	-17.1
25F	39.4	-14.6	34.7	-19.3
26F	50.7	-3.3	54.9	0.9
27F	41.5	-12.5	53.8	-0.2
28F	37.4	-16.6	52.2	-1.8
29F	34.5	-19.5	51	-3
32F	32.6	-21.4	33.4	-20.6
33F	32.7	-21.3	34.8	-19.2
34F	36.8	-17.2	34.5	-19.5
35F	37.7	-16.3	40.8	-13.2
36F	38.8	-15.2	34.5	-19.5
37F	33.5	-20.5	37.7	-16.3
38F	32.5	-21.5	34.2	-19.8
39F	32.1	-21.9	35.3	-18.7
40F	31.2	-22.8	33.4	-20.6
41F	30.6	-23.4	33.9	-20.1
42F	33.7	-20.3	43.3	-10.7
43F	33.6	-20.4	43.4	-10.6
44F	32	-22	32.7	-21.3
45F	31.8	-22.2	31.9	-22.1
46F	31.7	-22.3	32.7	-21.3
47F	31.1	-22.9	32.8	-21.2
48F	29.3	-24.7	44.5	-9.5
49F	29	-25	44.4	-9.6
50F	27.2	-26.8	42.4	-11.6

Table 4: Predicted noise levels at night time (maximum noise) at 7.5m height

Night time maximum noise level (LAmax). Receiver height 7.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate an LAmax greater than 54dB.				
Receiver	Predicted noise level lorry to north	Diff between 54dB Lamax	Predicted noise level lorry to south	Diff between 54dB LAmax
1G	34.7	-19.3	51.8	-2.2
2G	35.2	-18.8	48.9	-5.1
3G	35.9	-18.1	49.7	-4.3
4G	32.8	-21.2	50.4	-3.6
5G	33.5	-20.5	55.6	1.6
6G	33.9	-20.1	54.4	0.4
7G	35.2	-18.8	59.7	5.7
8G	35.9	-18.1	65.3	11.3
26G	46.3	-7.7	45.7	-8.3
27G	38.6	-15.4	44.1	-9.9
28G	35.3	-18.7	42.1	-11.9
29G	35.3	-18.7	40.6	-13.4
1F	33.8	-20.2	40.1	-13.9
2F	33	-21	40.4	-13.6
3F	34.1	-19.9	40.9	-13.1
4F	34.4	-19.6	41.5	-12.5
5F	35.6	-18.4	43.5	-10.5
6F	35.8	-18.2	43.3	-10.7
7F	36.2	-17.8	45.1	-8.9
8F	36.2	-17.8	46.1	-7.9
26F	50.7	-3.3	54.9	0.9
27F	41.4	-12.6	53.8	-0.2
28F	37.2	-16.8	52.2	-1.8
29F	34.5	-19.5	51	-3

Table 5: Predicted noise levels at daytime (BS4142 sources) at 1.5m height.

Daytime BS4142 1 hour period. Receiver height 1.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate a difference of 0-5dB. Pink highlighted cells indicate a difference greater than 5dB.					
Receiver	**BGSL**	**Predicted noise level lorry to north**	**Diff**	**Predicted noise level lorry to south**	**Diff**
1G	38	13.2	-15.8	25.2	-3.8
2G	38	14	-15	25.3	-3.7
3G	38	15	-14	25.9	-3.1
4G	38	14	-15	31.4	2.4
5G	38	13.8	-15.2	32.6	3.6
6G	38	14.2	-14.8	33.6	4.6
7G	38	14.2	-14.8	34.7	5.7
8G	38	19.5	-9.5	38.3	9.3
26G	38	20.5	-8.5	25.7	-3.3
27G	38	14.6	-14.4	18.5	-10.5
28G	38	14	-15	17	-12
29G	38	14.5	-14.5	16.5	-12.5
32G	38	14.5	-14.5	21.2	-7.8
33G	38	16	-13	22	-7
34G	38	16.2	-12.8	24.6	-4.4
35G	38	17	-12	22.5	-6.5
36G	38	17.5	-11.5	21.7	-7.3
37G	38	17.7	-11.3	18.2	-10.8
38G	38	15.8	-13.2	23.8	-5.2
39G	38	16	-13	17.9	-11.1
40G	38	15.8	-13.2	18.1	-10.9
41G	38	14.7	-14.3	16.1	-12.9
42G	38	13.4	-15.6	17.3	-11.7
43G	38	14.9	-14.1	16.2	-12.8
44G	38	13.4	-15.6	16.1	-12.9
45G	38	13.5	-15.5	14.9	-14.1
46G	38	11.9	-17.1	16	-13
47G	38	11.4	-17.6	14.2	-14.8
48G	38	10.9	-18.1	12.7	-16.3
49G	38	12.5	-16.5	14.1	-14.9
50G	38	11.1	-17.9	15.1	-13.9
1F	38	14	-15	19.7	-9.3
2F	38	13.6	-15.4	20	-9
3F	38	14.4	-14.6	20.7	-8.3
4F	38	14.6	-14.4	21.2	-7.8
5F	38	15	-14	23.1	-5.9
6F	38	15.1	-13.9	23.3	-5.7
7F	38	15.2	-13.8	24.8	-4.2
8F	38	14.5	-14.5	25.6	-3.4
9F	38	14.4	-14.6	32.8	3.8
10F	38	14.6	-14.4	29.5	0.5
11F	38	16.2	-12.8	27.1	-1.9
12F	38	18.2	-10.8	26.6	-2.4
13F	38	21	-8	23.1	-5.9
18F	38	25.7	-3.3	21.9	-7.1

Daytime BS4142 1 hour period. Receiver height 1.5m. Assume façade levels = free field levels. Yellow highlighted cells indicate a difference of 0-5dB. Pink highlighted cells indicate a difference greater than 5dB.					
Receiver	**BGSL**	**Predicted noise level lorry to north**	**Diff**	**Predicted noise level lorry to south**	**Diff**
19F	38	31.3	2.3	22.1	-6.9
20F	38	26.8	-2.2	20.1	-8.9
25F	38	22.9	-6.1	18.7	-10.3
26F	38	21	-8	33.2	4.2
27F	38	13.2	-15.8	30.6	1.6
28F	38	14.3	-14.7	30.6	1.6
29F	38	13.5	-15.5	29.5	0.5
32F	38	15.4	-13.6	17.5	-11.5
33F	38	15.7	-13.3	18.4	-10.6
34F	38	19.2	-9.8	17.9	-11.1
35F	38	19.7	-9.3	23	-6
36F	38	20.5	-8.5	18.8	-10.2
37F	38	17.1	-11.9	21	-8
38F	38	16.1	-12.9	17.5	-11.5
39F	38	15.6	-13.4	18.3	-10.7
40F	38	14.6	-14.4	17.2	-11.8
41F	38	14	-15	17.5	-11.5
42F	38	17	-12	24.6	-4.4
43F	38	16.9	-12.1	24.6	-4.4
44F	38	15.3	-13.7	16.7	-12.3
45F	38	15.1	-13.9	15.9	-13.1
46F	38	15	-14	16.1	-12.9
47F	38	14.6	-14.4	16.2	-12.8
48F	38	11.4	-17.6	23.9	-5.1
49F	38	11.2	-17.8	23.8	-5.2
50F	38	8.9	-20.1	22.8	-6.2

Appendix C - Predicted noise levels (tables) - change in impact from 2016 report

Table 6: Change in predicted noise levels at night time (BS4142 sources) at 4.5m height

Change in night time (BS4142) impact Cells highlighted yellow indicate an increase in predicted noise from the 2016 report of 2dB or more Cells highlighted green indicate a decrease in predicted noise from the 2016 report of 2dB or more			
Receiver	**Predicted noise level lorry to north**	**Predicted noise level lorry to south**	**Predicted noise level AHU**
1G	0	0	-0.6
2G	0	-0.4	-0.8
3G	0	0	-0.2
4G	0	-1	-0.3
5G	0	0.1	4.1
6G	0	0.5	0
7G	-0.3	0.4	0.3
8G	-0.1	-0.1	0.1
26G	12.2	16.6	8.2
27G	16.7	15.9	20
28G	18.2	2.3	21.2
29G	17.2	3.2	13.7
30G	n/a	n/a	n/a
31G	n/a	n/a	n/a
32G	-0.3	-0.9	-3.2
33G	0.3	-0.2	-2.7
34G	0.1	-0.1	-4
35G	-0.6	-0.1	-1.7
36G	0.5	0.5	0.8
37G	-0.1	-2.8	3.2
38G	1.2	-8.6	3.2
39G	8.3	-1	2.3
40G	-0.4	-0.4	6.2
41G	0.1	0.1	-0.6
42G	0.6	0.1	2.1
43G	7.4	-1.4	4.2
44G	0.4	-0.7	-11.5
45G	-0.5	-0.2	-2.2
46G	0.6	-0.9	-0.5
47G	-0.6	-0.2	-0.3
48G	-0.1	1.6	-0.6
49G	-0.1	-0.2	-1.4
50G	-0.9	-0.2	-1.5
51G	n/a	n/a	n/a
52G	n/a	n/a	n/a
1F	0.3	-0.8	0.3
2F	0.6	-0.8	0.7
3F	0.2	-0.1	-5.6
4F	0	0.2	-4.6
5F	0	-0.1	0.6
6F	0	0	-0.1

Change in night time (BS4142) impact Cells highlighted yellow indicate an increase in predicted noise from the 2016 report of 2dB or more Cells highlighted green indicate a decrease in predicted noise from the 2016 report of 2dB or more			
Receiver	**Predicted noise level lorry to north**	**Predicted noise level lorry to south**	**Predicted noise level AHU**
7F	0.7	0	0
8F	0.7	-0.3	0.5
9F	0.7	0.8	0.7
10F	0.5	3.9	0.5
11F	-0.4	0	-1.1
12F	-1.4	-0.3	-1
13F	-0.9	1.3	-0.9
18F	-0.4	0.1	0.5
19F	0	0.5	2.6
20F	0.3	0.1	-3.3
25F	0.3	0	-0.2
26F	-7	-7.8	-3.9
27F	0.8	-11.4	-11.6
28F	4.7	-15.5	-12.5
29F	-1	-15.2	-11.3
30F	n/a	n/a	n/a
31F	n/a	n/a	n/a
32F	-0.6	0.1	-2
33F	-1.1	-0.8	-1.3
34F	-3.2	-0.1	-5.7
35F	-3.3	2.6	0.4
36F	-3.5	9.2	0.5
37F	0.3	-2.3	1.1
38F	0.3	-0.2	0.8
39F	0.2	-1	0.5
40F	0.3	-0.4	0.7
41F	0.4	0.3	-0.1
42F	-1	-7.9	-2.8
43F	-0.1	-9.9	-1.2
44F	-0.7	-0.5	0
45F	-1.7	-0.1	-3
46F	-1	-1.7	-7.9
47F	-1.3	-1.8	-8.7
48F	-1.1	-10.8	-8.5
49F	-1	-10.5	-7
50F	-0.6	-9.7	-5.5
51F	n/a	n/a	n/a
52F	n/a	n/a	n/a

Table 7: Change in predicted noise levels at night time (maximum sources) at 4.5m height

Change in night time (maximum) impact Cells highlighted yellow indicate an increase in predicted noise from the 2016 report of 2dB or more Cells highlighted green indicate a decrease in predicted noise from the 2016 report of 2dB or more		
Receiver	**Predicted noise level lorry to north**	**Predicted noise level lorry to south**
1G	-0.1	0
2G	0.1	-0.4
3G	0	0
4G	0	-0.9
5G	0	0
6G	-0.1	0.2
7G	-0.3	0.3
8G	-0.2	-0.1
26G	12.7	17.4
27G	17.3	16.6
28G	18.5	2.3
29G	17.5	3.1
30G	n/a	n/ a
31G	n/a	n/a
32G	-0.4	-0.7
33G	0.2	-0.1
34G	0.1	-0.2
35G	-0.7	0
36G	0.6	0.6
37G	-0.1	-2.6
38G	1.3	-9.6
39G	9	-1.1
40G	-0.4	-0.4
41G	0.1	0.1
42G	0.5	0.1
43G	7.9	-1.4
44G	0.4	-0.8
45G	-0.4	-0.2
46G	0.6	-0.9
47G	-0.5	-0.3
48G	-0.2	1.5
49G	-0.1	-0.2
50G	-0.8	-0.2
51G	n/a	n/ a
52G	n/a	n/a
1F	0.2	-0.7
2F	0.7	-0.7
3F	-0.1	-0.1
4F	0	0.1
5F	0.1	-0.1
6F	-0.1	0
7F	0.7	0
8F	0.7	-0.3
9F	0.8	0.6

Change in night time (maximum) impact Cells highlighted yellow indicate an increase in predicted noise from the 2016 report of 2dB or more Cells highlighted green indicate a decrease in predicted noise from the 2016 report of 2dB or more		
Receiver	**Predicted noise level lorry to north**	**Predicted noise level lorry to south**
10F	0.5	4.4
11F	-0.5	0
12F	-1.5	-0.3
13F	-0.9	1.1
18F	-0.4	0.1
19F	0.1	0.4
20F	0.3	0.1
25F	0.3	0.2
26F	-7.2	-7.7
27F	1.4	-11.3
28F	5.3	-16.1
29F	-0.6	-15.6
30F	n/a	n/ a
31F	n/a	n/a
32F	-0.8	0
33F	-0.8	-0.8
34F	-3.6	-0.1
35F	-3.7	2.7
36F	-3.8	9.6
37F	0.3	-2.5
38F	0.3	-0.3
39F	0.3	-1.3
40F	0.3	-0.4
41F	0.5	0.1
42F	-1	-8.9
43F	-0.2	-11
44F	-0.6	-0.4
45F	-1.5	-0.1
46F	-0.9	-1.8
47F	-1.1	-2
48F	-0.9	-12
49F	-0.8	-11.8
50F	-0.5	-10.6
51F	n/a	n/ a
52F	n/a	n/a

Table 8: Change in predicted noise levels at daytime (BS4142 sources) at 1.5m height

Change in daytime (BS4142) impact Cells highlighted yellow indicate an increase in predicted noise from the 2016 report of 2dB or more Cells highlighted green indicate a decrease in predicted noise from the 2016 report of 2dB or more		
Receiver	**Predicted noise level lorry to north**	**Predicted noise level lorry to south**
1G	0	1.5
2G	0	-0.1
3G	-0.1	0
4G	0	-0.1
5G	0.1	0.1
6G	-0.1	-0.9
7G	-0.2	0
8G	-0.1	-0.1
26G	1.9	9.2
27G	13.4	12.2
28G	14.5	3.3
29G	13.5	3.7
30G	n/a	n/ a
31G	n/a	n/a
32G	-0.5	-0.8
33G	0.2	-0.1
34G	-0.1	-2.7
35G	-0.9	-0.1
36G	0.5	0.8
37G	-0.2	-2.1
38G	1.1	-7.6
39G	5.8	-0.9
40G	-0.4	-0.3
41G	0	0.1
42G	0.5	-0.1
43G	5.9	-1.3
44G	-0.1	-1.2
45G	-0.9	-0.7
46G	0.4	-1.1
47G	-1.2	-0.7
48G	-0.1	1.5
49G	0.1	0
50G	-0.2	0
51G	n/a	n/ a
52G	n/a	n/a
1F	0.3	-0.3
2F	0.5	-0.2
3F	0.2	-0.1
4F	0.1	0.3
5F	0.1	0
6F	-0.1	0
7F	0.8	0
8F	0.8	-0.2
9F	0.8	-3

Change in daytime (BS4142) impact Cells highlighted yellow indicate an increase in predicted noise from the 2016 report of 2dB or more Cells highlighted green indicate a decrease in predicted noise from the 2016 report of 2dB or more		
Receiver	**Predicted noise level lorry to north**	**Predicted noise level lorry to south**
10F	0.5	1.3
11F	-0.5	-0.4
12F	-1.5	0.1
13F	-0.9	0.7
18F	-0.5	0.1
19F	0.1	0.4
20F	0.4	0.4
25F	0.3	0
26F	0.1	-6.8
27F	8.5	-5.9
28F	7.6	-12.2
29F	2.5	-11.8
30F	n/a	n/ a
31F	n/a	n/a
32F	-0.9	0.4
33F	-0.5	-0.3
34F	-2.7	0.5
35F	-2.3	1.8
36F	-2.2	6.2
37F	0.3	-2.8
38F	0.2	0
39F	0.2	-0.7
40F	0.3	-0.7
41F	0.5	0.5
42F	-0.7	-6.9
43F	-0.3	-8.5
44F	-0.6	-0.6
45F	-2.1	-0.7
46F	-1.6	-1.8
47F	-2	-2
48F	0	-9.1
49F	0	-8.9
50F	-0.1	-10
51F	n/a	n/ a
52F	n/a	n/a