Noise Assessment

Beaches Yard, Horton Road, West Drayton

September 2022

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Harvest Land Management

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1. Introduction

1.1 Phlorum Limited has been commissioned by Harvest Land Management to undertake a Noise Assessment for a warehouse development at Beaches Yard, Horton Road, West Drayton. The location of the site is shown in Figure 1.

1.2 The noise assessment is in support of a Planning Application for the redevelopment of a mixed-use storage and residential site into a warehouse development with ancillary office. The development proposes the construction of a 6847m^2 multi-level warehouse, 480m^2 office space, 717m^2 yard space, loading bays and a basement car park.

1.3 The noise climate at the site has been established by direct measurement and the suitability of the site for the proposed development considered against national and local planning policy, and guidelines on noise.

1.4 The noise assessment and associated traffic statement does not anticipate 24-hour working at the commercial units. Depending on the specific use, which is not known at this stage of the application, the operating hours are likely to be in the daytime and between 0700-2200 hours. On this basis, a night-time noise assessment has not been undertaken for the proposed warehouse development.

1.5 Whilst reasonable efforts have been made to produce a report that is easy to understand, it is technical in nature. To assist the reader, an introduction to noise, and an explanation of the terminology used in this report are contained in Appendix A.

Site Description

1.6 The site is bordered by Horton Road to the south and a private access road to the west and north, which is also used to access the site. The private road provides access to neighbouring commercial land uses and Uxbridge Football Club. To the north and east the site is bordered by Stockley Country Park.

1.7 The noise climate at the site is dominated by traffic noise from Horton Road and the nearest residential properties to the site are also located on Horton Road.

2. Policy and Guidance

National Planning Policy Framework

2.1 The Department for Communities and Local Government published the *National Planning Policy Framework* (NPPF) on 27th March 2012 and upon its publication, the majority of planning policy statements and guidance notes were withdrawn, including Planning Policy Guidance (PPG) 24 *Planning and Noise*, which until the emergence of the NPPF, set out the Government's position on how noise should be dealt with in the planning system.

2.2 The NPPF was revised on 24th July 2018, with the earlier 2012 version immediately withdrawn. A further update was published on 20th July 2021.

2.3 The general guiding principle in the NPPF is contained in Section 15 under the heading *Conserving and enhancing the natural environment*. Paragraph 174 states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;"

2.4 The noise planning policy is contained in paragraph 185, which also appears in Section 15 of the NPPF:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"

2.5 A footnote to paragraph 185(a) refers to the Explanatory Note of the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010), which defines both *"significant adverse impacts on health and quality of life"* and *"adverse impacts on health and quality of life*".

Planning Practice Guidance

2.6 In March 2014, the Government released Planning Practice Guidance (PPG) on noise, entitled 'Noise'. This document sets out a number of principles in the form of questions and answers, and reinforces the guidance set out in the NPPF and the NPSE. The Noise PPG was last updated in December 2014.

2.7 The Noise PPG notes that:

"Noise needs to be considered when new development may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."

2.8 The PPG goes on to state:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved."*

2.9 The Noise PPG broadly repeats the NPSE definitions of the NOEL, LOAEL and SOAEL and it provides a summary table to explain how the terms relate to each other and to typical human reactions to sound. The table is replicated below in Table 2.1.

Table 2.1: Planning Practice Guidance summary of noise exposure hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	No observed effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No observed adverse effect	No specific measures required
		Lowest observed adverse effect level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise.	Observed adverse effect	Mitigate and reduce to a minimum

Perception	Examples of Outcomes	Increasing Effect Level	Action
	Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.		
		Significant observed adverse effect level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep the windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting back to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant observed adverse effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable adverse effect	Prevent

2.10 It is noted that the text in paragraph 005 of the PPG for noise reiterates the point illustrated in Table 2.1, that there are degrees of adverse effect above the SOAEL. Table 2.1 defines two degrees of significant adverse effect: a significant observed adverse effect, which is deemed noticeable and disruptive, and an unacceptable adverse effect, which is deemed noticeable and very disruptive.

2.11 The distinction between these two degrees of significant adverse effect is expanded upon in the text in paragraph 005 of the PPG for noise:

"005 Increasing noise exposure will at some point cause the significant observed adverse effect level boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is above this level the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.

At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring."

2.12 The PPG, which is the most recent manifestation of Government advice on how noise should be treated within the planning system, as opposed to a policy position as stated in the more recent NPPF, is clear that a significant adverse effect, which lies above the SOAEL but below an unacceptable adverse effect, can be addressed (or 'avoided' in the terms of the PPG) through the provision of mitigation, including noise insulation; it is not until an unacceptable adverse effect is reached that the cause of the effect should be prevented.

2.13 The noise PPG provides advice on how to mitigate the effects of noise, noting that there are options to reduce noise at source, to optimise site layouts, to use planning conditions, and provide insulation within affected properties.

2.14 The noise PPG also notes that:

"The noise impact may be partially offset if the residents of those dwellings have access to:

- *a relatively quiet façade (containing windows to habitable rooms) as part of their dwelling, and/or*
- *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or*
- *a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)."*

British Standard 8233

2.15 The scope of British Standard (BS) 8233: 2014 *Guidance on sound insulation and noise reduction for buildings* is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate.

2.16 BS8233: 2014 suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 2.2.

Table 2.2: BS8233 recommended internal noise levels, dB

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

2.17 BS8233 contains the following relevant guidance in footnotes to the above information:

"Note 4: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,F, depending on the character and number of events per night. Sporadic noise events could require separate values.

Note 5: If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Note 7: Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

2.18 Although Note 4 above refers to setting a guideline value for maximum noise levels, BS8233: 2014 does not provide any guidance on a suitable criterion.

2.19 Since BS8233: 2014 allows for a 5dB relaxation in the guideline values in Table 2.2 (Note 7 above), it is considered that internal noise levels up to 5dB above the guideline values in Table 3.2 might still be acceptable.

Industrial/Commercial Noise

2.20 The noise from industrial and commercial premises should be considered against the guidance in BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'.

2.21 BS4142:2014+A1:2019 provides a methodology that determines the significance of adverse impact at dwellings potentially affected by noise of an industrial nature. BS 4142 refers specifically to sound from fixed installations which comprise mechanical and electrical plant and equipment; sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

2.22 The basis of the standard requires a comparison to be made between the 'background noise level' of the assessment area and the 'specific noise level' of the noise source under consideration. There are five key definitions relating to this relationship;

- Background Noise Level - LA90,T - this is defined in the Standard as 'the 'A' weighted sound pressure level of the residual noise at the assessment position which is exceeded for 90 % of the given time interval, T, measured using time weighting F and quoted to the nearest number of whole decibels.
- Specific Noise Level - LAeq,T - this is the equivalent continuous 'A' weighted sound pressure level over a given time interval.
- Residual Noise - this is defined as the ambient noise remaining in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.
- Ambient Noise - totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.
- Rating Level - LAeq,T - the specific noise level plus any adjustment made for the characteristic features of the noise.

2.23 The background level, wherever possible should be determined at the location where the assessment is to be made. Situations will arise where, due to circumstances which influence this level unduly, for example the specific noise level is operating continuously and thus the residual noise cannot be measured at this point, the background level may be determined in other ways. This may be, for example, by measuring at a different location or a different time which are nevertheless representative of the assessment position.

2.24 A further acoustic correction to the specific noise level is made if the sound has tonal or impulsive characteristics.

2.25 Once all necessary adjustments have been made, the background and the specific noise levels are compared. The standard states that the greater this difference is, the greater is the magnitude of the impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.26 The assessment should consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, reasonable practicable steps should be taken to reduce the level of uncertainty.

3. Environmental Surveys

3.1 A noise survey was undertaken to establish typical sound levels at the site on 8/9 September 2022. Noise measurements were taken at 3 locations that represent the nearest existing residential properties to the Development Site. The survey methods and results are set out below.

Sound Survey Method

3.2 The equipment used during the survey is summarised in Appendix B. The sound level meters were field-calibrated immediately before and after the measurements using the listed acoustic calibrator. No significant calibration drifts were found to have occurred.

3.3 The sound level meters had been laboratory-calibrated to a traceable standard within the two years preceding the survey. The acoustic calibrator had been laboratory-calibrated to a traceable standard within the year preceding the survey.

3.4 Measurements were carried out at representative locations, close to the nearest residential locations, as shown on Figure 2 and described as follows:

- Position 1: The microphone was located 6m from Horton Road to represent the nearest residential property to the proposed Development Site, which is located on the opposite side of the road and is also 6m from the road. The microphone was located in a free-field location, 1.5m above the ground.
- Position 2: The microphone was located on the boundary of a field and close to the rear gardens of properties on Whitethorn Avenue. The microphone was located in a free-field location, 1.5m above the ground
- Position 3: The microphone was located on the southern boundary of the industrial estate and at a similar distance to the railway lines as the residential properties located on the far side of the railway lines (no secure access was available at the residential properties). The microphone was located in a free-field location, 1.5m above the ground

Sound Survey Results

3.5 The weather during the survey was suitable for noise measurement, it being dry with wind speeds of less than 5m/s.

3.6 The dominant sound source position 1 was from road traffic on Horton Road with some contribution from the industrial units and local industrial roads. At position 2 the noise sources included distant industrial noise, road traffic, trains, aircraft and occasional pedestrians in the park. At site 3 the dominant noise sources was from frequent trains.

3.7 The sound survey results are summarised in Table 4.1 for Positions 1, 2 and 3, aggregated across the afternoon, evening and morning measurement periods. Full survey results are set out graphically in Appendix C.

Table 3.1 Summary of measured sound levels on 8/9 Sept 22, free-field dB

Measurement Location	Date	Period Hours	Duration, T	$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$
1	8/9 Sept 2022	1430-1900	4 hour, 30 mins	69.2	82.8	73.1	57.0
		1900-2200	3 hours	66.5	79.0	71.2	50.4
		0700-0900	2 hours	69.3	82.8	73.1	53.6
2	8/9 Sept 2022	1500-1900	4 hours	52.9	68.0	52.1	45.6
		1900-2200	3 hours	47.6	60.5	49.2	44.8
		0700-0915	2 hour, 15 mins	43.9	59.5	44.9	41.4
3	8/9 Sept 2022	1615-1900	2 hour, 45 mins	56.9	71.8	56.9	51.1
		1900-2200	3 hours	56.2	72.3	55.7	50.6
		0700-0845	1 hour, 45 mins	54.4	70.5	54.5	45.3

Note: (1) – The $L_{A90,T}$, L_{Amax} and $L_{A10,T}$ and values are the arithmetic means of the $L_{A90,T}$, L_{Amax} and $L_{A10,T}$ measurements for each period.

4. Assessment

Noise from the Proposed Development

4.1 The Transport Assessment (TA) provides traffic data for the development over the period 0700-2200 hours. The noise levels have therefore been assessed for the morning, afternoon and evening periods but a night-time assessment is not required.

4.2 The proposals for HGV's, as discussed in the TA, include four spaces for HGV's in the loading bay area and the scheme incorporates a turntable to enable HGV's to be rotated within the confines of the site (see Figure 3).

4.3 Traffic data, is provided by the traffic consultants ('Stuart Michael Associates Limited'). The trip generation for the proposed development is reproduced in Tables 4.1 and the net traffic impact of the development proposals when taking into account the existing use of the site is shown in Table 4.2.

Table 4.1: Trip Generation for the Proposed Development

Mode of Travel	Weekday Daily Movements (0700-2200 hrs)	
	Arr	Dep
OGVs	15	16
Cars	78	86

Table 4.2: Net Traffic Impact of Development Proposals

	Weekday Daily Movements (0700-2200 hrs)	
	Arr	Dep
Existing Site	109	104
Proposed Development	137	146
Development Impact	29	41

4.4 At this stage of the planning process, internal noise levels attributable to the land use class for the development is not available. Therefore, the noise assessment is based upon HGVs arriving and departing the site (e.g. one arrival and one departures occurring at the unit during any one hour) during the periods with the lowest measured background noise levels.

4.5 The following source data (from an internal database) has been utilised to calculate noise levels at the nearest residential locations.

Table 4.3: Source HGV Data

Source	Distance to Source, m	Noise Level, dB		
		SEL	SEL Sound Power	Sound Power Level (5-minute period)
HGV Arriving	10	77	105.0	80.2
HGV Reversing	10	82	110.0	85.2
HGV Door Open	5	69.9	91.9	67.1
HGV Door Slam	5	80.6	102.6	77.8
Roller Door Open	5	61.7	83.7	58.9
Unloading Pallets	2	98.8	112.8	88.0
Roller Door Close	5	61.7	83.7	58.9
HGV Door Open	5	69.9	91.9	67.1
HGV Door Slam	5	80.6	102.6	77.8
HGV Departing	10	76	104.0	79.2
Total: Sound Power Level 91.1 dB				

4.6 For the purposes of a BS4142 assessment, the above HGV noise contribution has been calculated at each of the nearest residential receptors. The noise predictions have taken distance attenuation, topography and acoustic screening into account. This includes the screening from the warehouse building as the loading/unloading will be undertaken within a covered area with an opening for HGV arrivals and departures on the west elevation at the north end of the site, as shown on Figure 3.

4.7 As shown in Table 3.1 the lowest background noise levels (L_{90}) were either measured in the morning or evening periods. For the benefit of the noise assessment the lowest measured background noise levels for any period have been used in the noise assessment and it is assumed that there will be 1 HGV arrival and 1 HGV departure in these quiet periods.

4.8 The assessment considers that the intermittency of HGV movements and loading activities may be readily distinctive against the residual acoustic environment and a +3 dB correction has therefore been included in the assessment

4.9 The BS4142 assessment is presented in Table 4.4.

Table 4.4: BS4142 Assessment for Typical HGV Arrival/unloading/Departure

BS4142 Assessment	Receptor Locations		
	1	2	3
Specific Noise Level	$L_{Aeq,T}$ 41 dB	$L_{Aeq,T}$ 34 dB	$L_{Aeq,T}$ 25 dB
Background Noise level	$L_{A90,T}$ 50 dB (evening)	$L_{A90,T}$ 41 dB (morning)	$L_{A90,T}$ 45 dB (morning)
Acoustic Correction (intermittency may be readily distinctive against the residual acoustic environment)	+3 dB	+3 dB	+3 dB
Rating Level	(41+3) = 44 dB	(34+3) = 37 dB	(25+3) = 28 dB
Excess of rating over background level	(44-50) = -6 dB	(37-41) = -4 dB	(28-45) = -17 dB

Note: The BS4142 Uncertainty Assessment is presented in Appendix D.

4.10 BS4142 notes that '*The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*'. In terms of the context, the site is in an industrial setting and the nearest residential property is affected by HGV movements on Horton Road that are serving other industrial units. The highest calculated noise level is 41 dB at Receptor 1 and this is 26 dB below the existing measured free-field ambient noise level of $L_{Aeq,T}$ 67 dB, therefore noise due to the proposed HGV activities at the nearest residential property will be well below the existing noise levels.

4.11 Taking all of the above factors into consideration, it is our view that the context of the -4 dB to -17 dB excess over background is unlikely to constitute an adverse impact at the nearest residential property. Furthermore, the absolute magnitude of the calculated noise level at nearest residential properties is well below the WHO's 50-55 dB guideline for private amenity spaces which re-enforces the above BS4142 'context' advice.

Noise from Traffic Movements

4.12 The net traffic impact of the development proposals is shown in Table 4.2 and this indicates that the site will generate an additional 70 vehicles/day of which a significant proportion will be cars for the commercial use. Furthermore the TA states that:

"The majority of the HGVs will travel to and from the site via the M4, as such the majority of HGVs will turn right in and left out of the private road access on their way to the site. The rare occurrence that HGVs arrive from the west or need to turn right onto Horton Road will be because the HGVs are coming from/going to nearby industrial units".

4.13 This indicates that the only on '*rare occurrences*' will HGV's from the development site pass the nearest residential properties on Horton Road (Receptor 1).

4.14 Based on site observations during the noise survey, Horton Road is heavily trafficked and it was observed that there were many and frequent HGV movements on this road. The additional 70 daily cars and very occasional HGVs will provide less than a 1 dB noise increase at the nearest residential properties on Horton Road when compared to the existing daily trips. The Design Manual for Roads and Bridges (DMRB) LA111 Noise and Vibration, 2019 considers a noise increase of less than 1 dB to be negligible in both the long and short term.

5. Mitigation

5.1 The BS4142 noise assessment as discussed above considers that the 'context' aspect of the assessment results in a low likelihood of an 'adverse impact' and an indication that the specific sound source has a 'low impact' for the proposed use in terms of the HGV deliveries.

Traffic Noise

5.2 The traffic noise assessment indicates that no further noise mitigation measures are required to reduce the effects of traffic generated by the proposed land use.

6. Conclusion

6.1 Phlorum Limited has been commissioned by Harvest Land Management to undertake a noise assessment for a warehouse development at Beaches Yard, Horton Road, West Drayton. The noise assessment is in support of a Planning Application for the redevelopment of a mixed-use storage and residential site into a warehouse with ancillary office space.

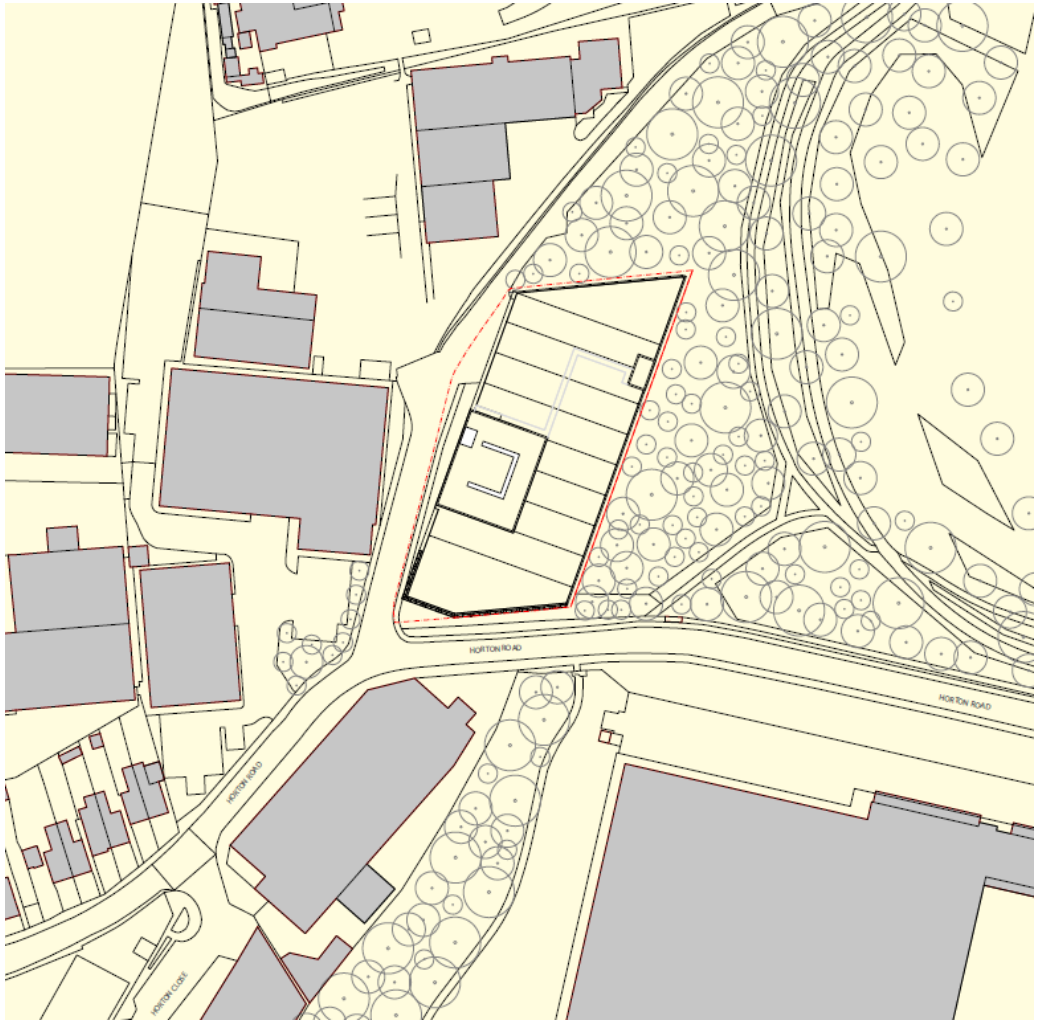
6.2 A Noise Assessment in accordance with BS4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' has been undertaken to gauge the potential noise effects on the nearest residential properties.

6.3 The BS4142 noise assessment indicates that the assessment results in a low likelihood of an 'adverse impact' and an indication that the specific sound source has a 'low impact' for the proposed use in terms of the HGV deliveries.

6.4 The traffic noise assessment indicates that no further noise mitigation measures are required to reduce the effects of traffic generated by the proposed land use.

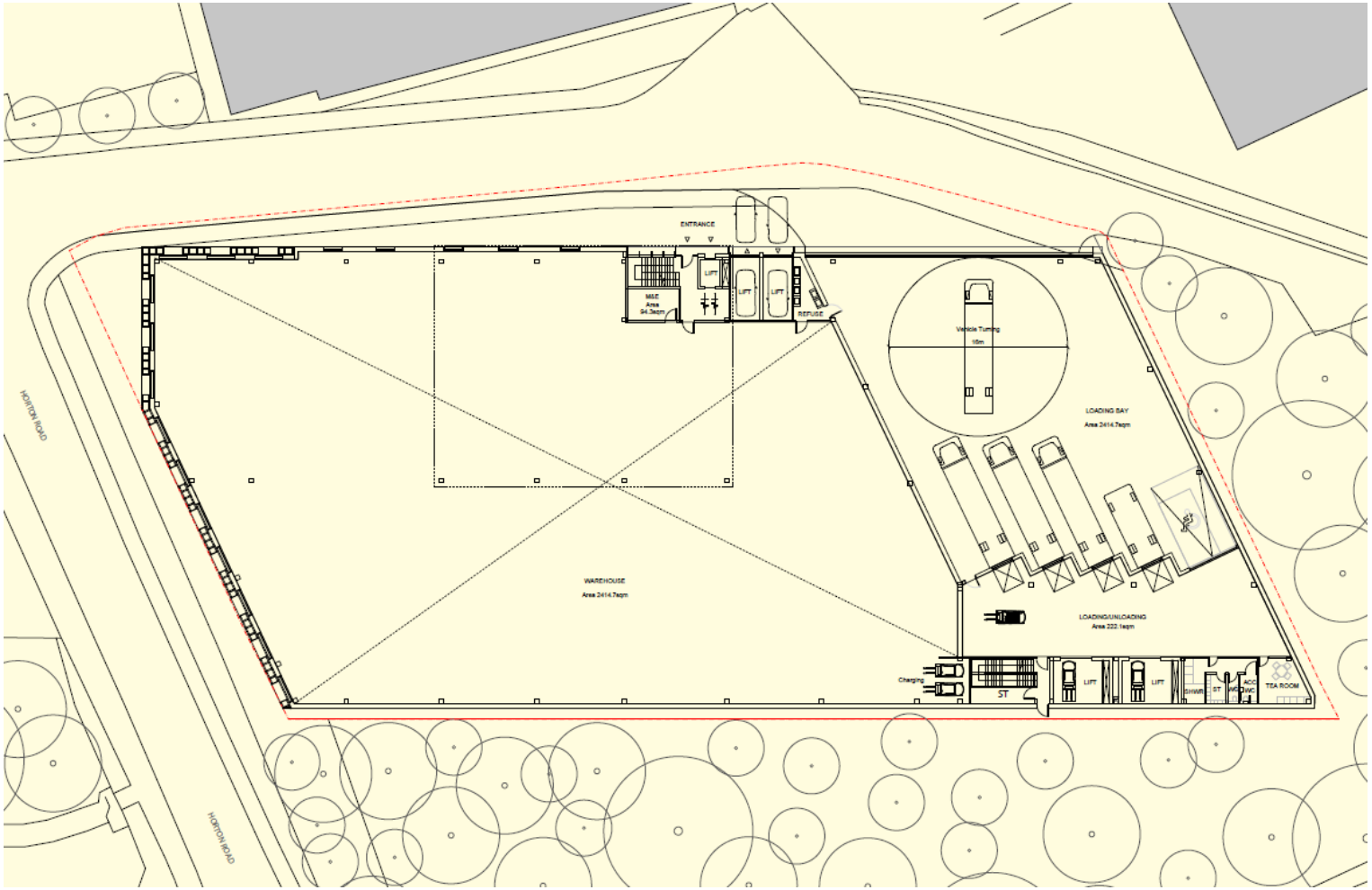
6.5 Based on this assessment, it is considered that noise does not pose a constraint to the proposed development.

Figures and Appendices



	Site Plan	**Job No. 11361(NV)**
		Figure No. 1

	Noise Measurement Locations	**Job No. 11361(NV)**
		Figure No. 2



phlorum	**Ground Floor Plan**	**Job No. 11361(NV)** **Figure No. 3**

Appendix A: Introduction to Noise and Glossary of Terminology

Appendix A: Introduction to Noise and Glossary of Terminology

Noise is defined as unwanted sound. The human ear is able to respond to sound in the frequency range 18Hz (deep bass) to 18,000Hz (high treble) and over the audible range of 0dB (the threshold of perception) to 140dB (the onset of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting (filtering) mechanism is used. This reduces the importance of lower and higher frequencies, approximating the response of the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. Noise can be perceived to be louder or more noticeable if the source of the noise is observed; e.g. roads, trains, factories, building sites etc. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. Various noise indices have been derived to describe the fluctuation of noise levels that vary over time. Usually, these noise indices relate to specific types of noise, and as such different noise indices are used to describe road traffic noise, background noise, construction noise, etc.

The weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement and the levels are denoted as dB(A) or L_{Aeq}, L_{A10}, etc, according to the parameter being measured.

Noise is measured on the decibel scale, which is logarithmic rather than linear. As a result of this, a 3dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3dB(A) is generally regarded as the minimum difference needed to perceive a change. Table A.1 sets out examples of noise levels typically experienced during everyday activities. Table A.2 sets out an explanation of the terminology used in this report.

Table A1: Typical sound levels found in the environment

Sound Level	Location
0 to 10dB(A)	Threshold of hearing
10 to 20dB(A)	Broadcasting studio
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street

Sound Level	Location
70 to 90dB(A)	Inside a factory or noisy pub
100 to 110dB(A)	Burglar Alarm at 1m
110 to 130dB(A)	Pneumatic drill at 1m away
140dB(A)	Threshold of Pain

Table A2: Terminology relating to noise

Term	Description
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by 20 $\log_{10}$ (s_1/s_2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$ or Background Noise Level	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres
Façade	At a distance of 1 metre in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS EN 61672.

Appendix B: Monitoring Equipment

Table B1: Noise monitoring equipment

Position	Equipment	Serial Number
1	LD820 Sound Meter	A1144
	Mic	31825
	Preamp	2054
2	LD824 Sound Analyser	A1419
	Mic	31817
	Preamp	2732
3	LD824 Sound Analyser	A1309
	Mic	28488
	Preamp	5368
1, 2 and 3	LD CAL200 Calibrator	3724

Appendix C: Measured Noise Levels

Table C1: Measured Free-Field Noise Levels, Position 1

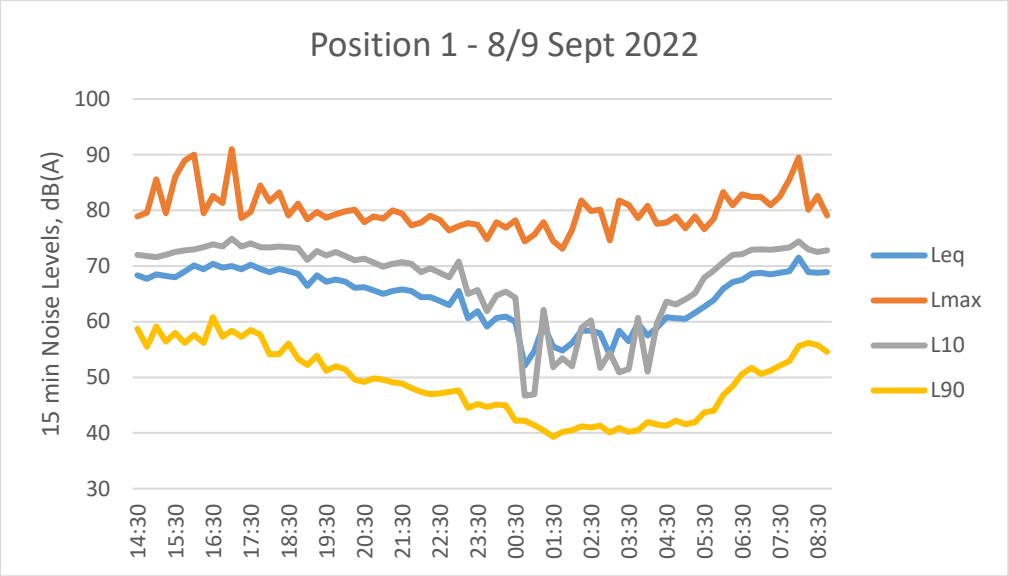


Table C2: Measured Free-Field Noise Levels, Position 2

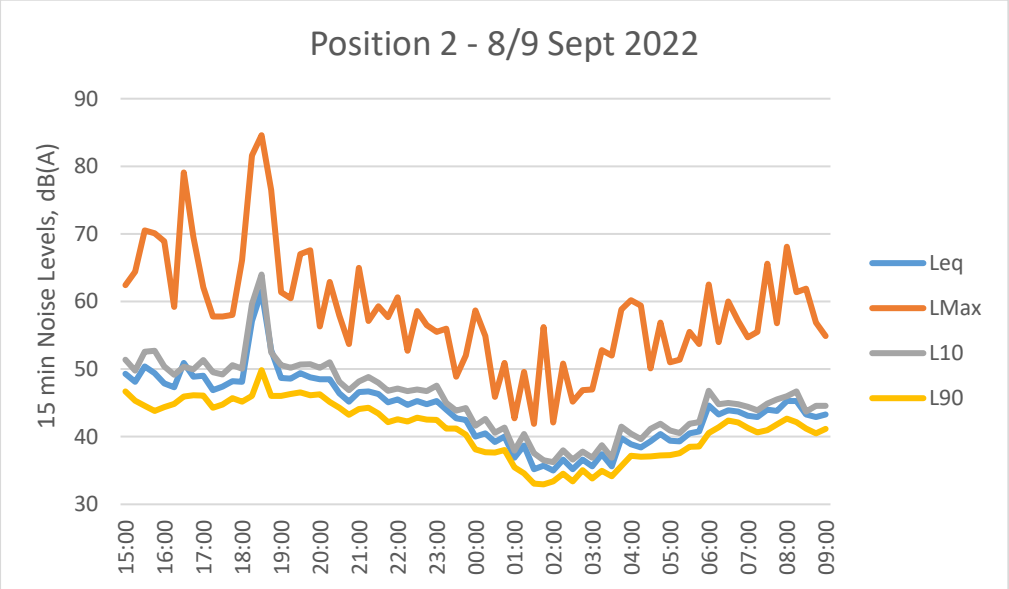
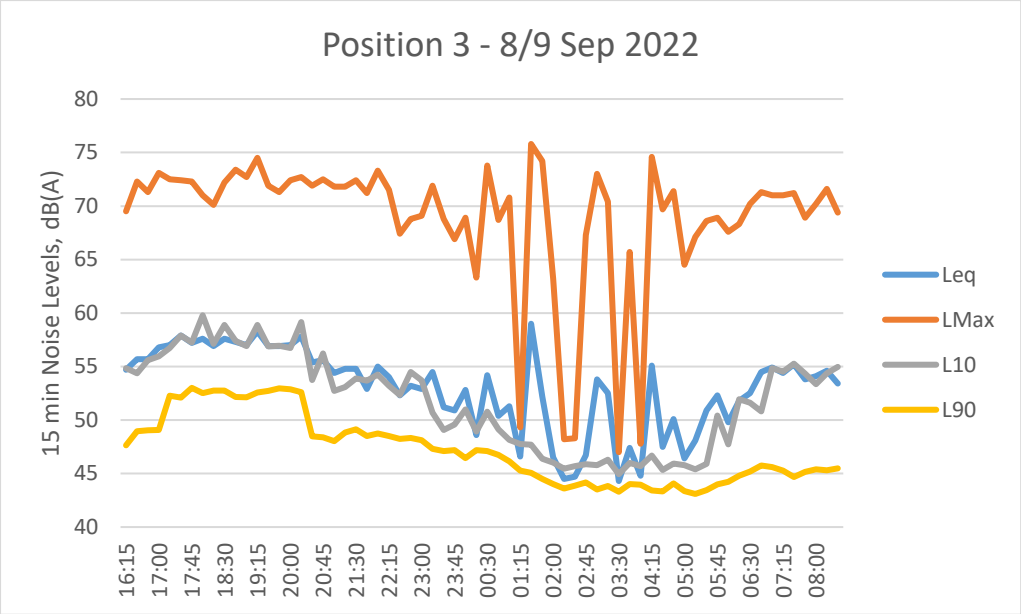


Table C3: Measured Free-Field Noise Levels, Position 3



Appendix D: BS4142 Uncertainty

Appendix D: BS4142 Uncertainty

BS 4142 states that measurement uncertainty depends on a number of factors, including the following, which may be applicable to the Proposed Development and, therefore, need to be considered:

1. the complexity and level of variability of the residual acoustic environment;
2. the location(s) selected for taking the measurements;
3. the measurement time intervals;
4. the range of times when the measurements have been taken;
5. the range of suitable weather conditions during which measurements have been taken;
6. the level of rounding of each measurement recorded; and
7. the instrumentation used.

Each of the measurement uncertainty factors outlined above have been considered and discussed in Table D1.

Table D1: Measurement Uncertainty Factors

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
1	0 dB	Residual acoustic environment is relatively constant, hence no correction for a complex residual acoustic environment.
2	0 dB	Measuring at locations representative of the closest affected receptors to the site has enabled the determination of robust background sound levels.
3	0 dB	Measurement time intervals were set in accordance with BS 4142, hence no further correction needs to be made.
4	0 dB	Measurements were undertaken over a continuous time period.
5	0 dB	No periods of significant wind or precipitation were noted.
6	0 dB	Measured values were rounded to 0.1 dB, therefore rounding would not have had a significant impact on the overall typical background sound levels.
7	0 dB	The acoustic measurement equipment accorded with Type 1 specification of British Standard 61672, and were deployed with appropriate wind shields.

In summary, a correction of 0 dB has been included in the assessment, to account for measurement uncertainty.

Calculation Uncertainty

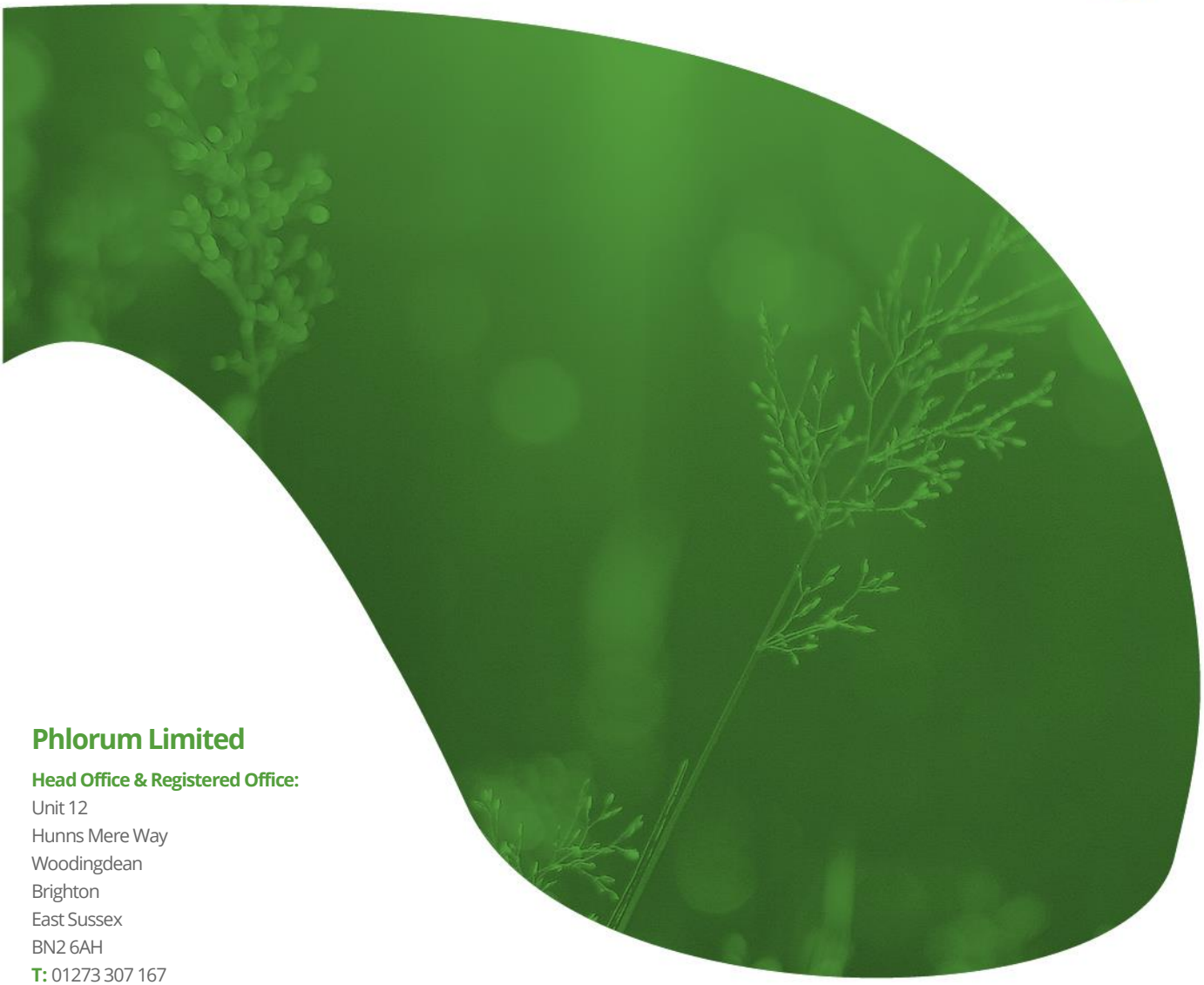
BS 4142 states that calculation uncertainty depends on a number of factors, including the following, which may be applicable to the Proposed Development and, therefore, need to be considered:

1. uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels;
2. uncertainty in the calculation method;
3. simplifying the real situation to "fit" the model (user influence on modelling); and
4. error in the calculation process

Each of the calculation uncertainty factors outlined above have been considered and discussed in Table D2.

Table D2: Calculation Uncertainty Factors

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
1	0 dB	Sound power levels for all plant are based on measured site data, hence no correction.
2	0 dB	Calculations were undertaken in accordance with ISO 9613, which is considered a "validated method" by BS 4142.
3	0 dB	The real situation has not been simplified for the purposes of this assessment.
4	+/-3 dB	ISO 9613 indicates that there is a ±3 dB accuracy to the prediction method, dependent upon input variables and propagation complexities.



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