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Proposed Food Enterprise Zone, Land South of the A17, Holbeach

Noise Assessment Report

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On behalf of
South Holland District Council

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1.0 INTRODUCTION

1.1 Blue Tree Acoustics was commissioned by South Holland District Council to carry out a noise assessment for an outline proposal to develop new industrial units on Land South of the A17, Holbeach.

1.2 The development site will occupy land which is currently in agricultural use.

1.3 The surrounding area is mixed in character with existing nearby residential properties situated in all directions. In addition, we understand that new residential development is proposed on nearby agricultural land, to the east of the site.

1.4 The development proposal is to provide a Food Enterprise Zone (FEZ) and the indicative layout included at Figure 2 shows a potential approach to layout and suggests a range of uses. The focus of development on the FEZ will be on:

- Skills development and Education
- Research, Development and Innovation of crops, food processing, engineering, packaging and logistics
- Business support (professional services, provision of test kitchens and laboratories)
- Premises, including “white wall” units and offices for start-up businesses and re-locations

1.5 The present assessment has included the measurement of existing noise levels in the vicinity of nearby existing and proposed residential properties during representative daytime and nighttime periods.

1.6 As the proposal is at outline stage, the end users of the new units are not known, and therefore detailed information on sound generating activity/plant, hours of use, and vehicle movements is not presently available. Predictions of sound impact based on typical sound levels from similar commercial/industrial units has been undertaken. Based on the background sound survey data, outline limits for control of new building services plant have also been defined.

1.7 Figure 1 presents an aerial view of the site location, the nearest residential properties, and the approximate noise monitoring locations.

2.0 RELEVANT ACOUSTIC STANDARDS & GUIDANCE

BS4142:2014

2.1 The most relevant British Standard for assessing sound impact from commercial and industrial premises upon residential dwellings is *British Standard 4142:2014* '*Methods for rating and assessing industrial and commercial sound*' (BS4142). This requires the level of sound radiating from the proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature (in L_{Aeq}) to be compared with the existing Background Sound Level (L_{A90}) at nearby residential property.

2.2 The scope of BS4142 states:

1.1 This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) sound from industrial and manufacturing processes;

b) sound from fixed installations which comprise mechanical and electrical plant and equipment;

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

d) 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.

The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

1.2 This standard is applicable to the determination of the following levels at outdoor locations:

a) rating levels for sources of sound of an industrial and/or commercial nature;

and

b) ambient, background and residual sound levels, for the purposes of:

1) investigating complaints;

2) *assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and*

3) *assessing sound at proposed new dwellings or premises used for residential purposes.*

1.3 The determination of noise amounting to a nuisance is beyond the scope of this British Standard.

Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems.

The standard is not intended to be applied to the rating and assessment of sound from:

a) recreational activities, including all forms of motorsport;

b) music and other entertainment;

c) shooting grounds;

d) construction and demolition;

e) domestic animals;

f) people;

g) public address systems for speech; and

h) other sources falling within the scopes of other standards or guidance.

The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.

The standard is not applicable to the assessment of low frequency noise.

2.3 The specific sound level of the source to be assessed is determined at the assessment locations and is evaluated over an appropriate reference time interval. The reference time intervals defined in BS4142 are 1 hour during the day (0700-2300 hours) and 15 minutes during the night (2300-0700 hours).

2.4 The standard describes various methods for determining whether a correction or corrections should be applied to take account of the nature of the industrial/commercial sound. In subjective assessment, if the industrial/commercial sound has a tonal element that is just perceptible at the receptor, a 2dB penalty can be applied. If the tone is clearly perceptible, a 4dB penalty can be applied. If the tone is highly perceptible, a 6dB penalty can be applied. The standard also

describes two objective methods for assessing tonal sound which may apply a penalty of up to 6dB.

2.5 Similarly, a penalty of 3dB can be applied for a sound that has impulsivity that is just perceptible. If the impulsivity is clearly perceptible, a 6dB penalty can be applied. If the impulsivity is highly perceptible, a 9dB penalty can be applied. The standard also describes an objective method for assessing impulsivity which may apply a penalty of up to 9dB.

2.6 Where the specific sound features are neither tonal nor impulsive, but are readily distinctive, a 3dB penalty can be applied.

2.7 If the sound is intermittent and this is readily distinctive, a 3dB penalty can be applied.

2.8 Therefore, a total penalty of between 0 and 18dB could potentially be applied in order to make allowance for any characteristic features of the industrial/commercial sound. The level of the industrial/commercial sound measured or calculated in L_{Aeq} terms, plus any penalty as described above, provides the Rating Level.

2.9 BS4142 states that:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (…) from the rating level (…), and consider the following. (…)

a) Typically, the greater this difference, the greater the magnitude of the impact.

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

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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.

NOTE 2. Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. (…)

3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*

   i) *facade insulation treatment;*

   ii) *ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*

   iii) *acoustic screening.*

BS8233:2014

2.10 *British Standard 8233:2014, 'Guidance on sound insulation and noise reduction for buildings'* (BS8233) provides information on the design of internal acoustics in buildings. It deals with control of noise from outside the building, noise from plant and services within it, and room acoustics for non-critical situations.

2.11 BS8233 guidance regarding indoor ambient noise criteria for residential accommodation is presented below.

Table 1: BS8233:2014 Guidance Criteria for Indoor Ambient Noise Levels

Activity	Location	0700-2300 hours	2300-0700 hours
Resting	Living room	35 dB $L_{Aeq\ (16\ hour)}$	-
Dining	Dining room/area	40 dB $L_{Aeq\ (16\ hour)}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq\ (16\ hour)}$	30 dB $L_{Aeq\ (8\ hour)}$

2.12 BS8233 does not stipulate any criteria for maximum noise levels within rooms in terms of dB L_{Amax}, but does state, "*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 $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.*"

2.13 In addition, BS8233 makes reference to noise levels in gardens and balconies, etc., and states that it is desirable that the steady noise level does not exceed 50dB $L_{Aeq,T}$, and that 55dB $L_{Aeq,T}$

should be regarded as the upper limit. Living room and garden criteria apply to daytime use (0700-2300 hours), and bedroom criteria apply to nighttime use (2300-0700 hours).

3.0 BACKGROUND SOUND SURVEYS

3.1 Attended noise surveys were carried out on site and at accessible secure locations in the vicinity of the nearest residential properties, in order to determine the existing sound levels around the development site. The surveys were undertaken on Friday 12th August 2016, Thursday 18th through Friday 19th August 2016, Tuesday 11th October 2016, and Wednesday 12th October 2016, at the locations indicated in Figure 1. Measurements were made over a series of 15-minute periods.

3.2 The instrumentation used for these surveys was 1no Rion NA28 Type 1 Sound Level Meter. The sound level meter was within a valid period of laboratory calibration. The calibration level of the meter was checked before and after the surveys, and no variation in the calibration levels was noted. The sound level meter was mounted on a tripod at an approximate height of 1.5m from local ground level, and was fitted with a proprietary environmental windshield.

3.3 The weather conditions during the noise surveys were dry and calm. Data from a nearby weather station is presented in Appendix III. There was no rainfall on site during the measurement periods.

3.4 The monitoring locations are considered to be representative of the dwellings that may be most exposed to noise from the proposed new development.

3.5 The principal noise source noted during the surveys was road traffic on the A17 and A151. It can be seen that noise levels decrease steadily from around 2100 hours, which is attributable to decreasing traffic flow at this time.

3.6 Measured data is detailed in Appendix II and summarised in Tables 2 and 3 below.

Table 2: Measured Daytime External Sound Levels

Location	dB L_{Aeq}	dB L_{Amax}	dB L_{A10}	dB L_{A90}
1	52 – 60	63 – 85	49 – 59	39 – 51
2	60 – 64	73 – 86	63 – 67	45 – 58
3	60 – 65	69 – 74	63 – 68	50 – 61
4	45 – 57	60 – 75	48 – 58	40 – 51
5	66 – 76	81 – 92	65 – 80	40 – 61
6	68 – 76	88 – 95	67 – 81	43 – 60

Table 3: Measured Nighttime External Sound Levels

Location	dB L_{Aeq}	dB L_{Amax}	dB L_{A10}	dB L_{A90}
1	44 – 47	57 – 59	48 – 52	31 – 34
2	57 – 58	71 – 73	62 – 63	33 – 41
3	56 – 58	72 – 74	61 – 62	36 – 42
4	41 – 42	51 – 54	45	30 – 33
5	71 – 74	90 – 91	71 – 79	50 – 55
6	71 – 75	88 – 90	73 – 79	49 – 54

3.7 From the data presented in Appendix II, representative background sound levels during daytime are determined to be 40dB L_{A90} at Location 1, 45dB L_{A90} at Location 2, 50dB L_{A90} at Location 3, 45dB L_{A90} at Location 4, 49dB L_{A90} at Location 5, and 49dB L_{A90} at Location 6. Background sound levels during nighttime are determined to be 31dB L_{A90} at Location 1, 33dB L_{A90} at Location 2, 36dB L_{A90} at Location 3, and 30dB L_{A90} at Location 4. Nighttime background sound levels at Locations 5 and 6 were taken during morning hours which were dominated by A151 road traffic, and therefore the representative nighttime value has been based on data at Locations 3 and 4, and taken as 35dB L_{A90}.

4.0 NOISE ASSESSMENT & ACOUSTIC DESIGN

4.1 BS4142 is the relevant standard for assessing potential impact of the proposed new industrial units. Based on the measured background sound levels, the following design targets are considered appropriate. These targets are equivalent to the derived representative background sound levels at the nearby residential properties, and therefore can be considered as having low impact.

Table 4: Rating Level Design Targets for Control of Industrial Sound (BS4142 dB $L_{Ar,Tr}$)

Location	Time Period	
	Daytime (0700-2300)	Nighttime (2300-0700)
Residential properties near Location 1	40	31
Residential properties near Location 2	45	33
Residential properties near Location 3	50	36
Residential properties near Location 4	45	30
Residential properties near Location 5	49	35
Residential properties near Location 6	49	35

4.2 The above targets are also appropriate to ensure sound levels are within the limits defined in BS8233 as suitable for residential properties.

4.3 Activities associated with the new development will generate sound. There are a number of types of sound source that should be considered.

Deliveries and Unloading Activities

4.4 The development will receive and send deliveries from vans and HGVs. The design of the development can ensure that all buildings face inwards into the site, and therefore external yards and parking areas are shielded from the site boundaries by the new buildings themselves. HGVs would likely drive into the yard area and reverse into the building or loading bays. Deliveries would then be loaded and unloaded in this area. Delivery and loading activities would potentially take place within loading bays or roller shutter doorways, and therefore will be mostly contained within the building envelope.

4.5 The sound level of a single delivery within a yard area has been calculated based on the above in conjunction with file data for typical HGV delivery vehicle sound levels for driving and manoeuvring within a service yard.

4.6 For existing residential properties near Locations 1-4, the prediction assumes an average distance of 250m between a residential receptor and the nearest loading/delivery area, and that line of sight is broken by the intervening building, as well as use of a white noise reversing alarm. Based on this, the predicted sound level at the nearest dwelling from a single delivery would be 6dB $L_{Aeq,1hr}$ during daytime, and 12dB $L_{Aeq,15min}$ during nighttime. During daytime, it would be feasible to expect multiple deliveries within the hourly assessment period. As an example, the predicted daytime sound level from 4no deliveries (e.g. one every 15 minutes) would become 12dB $L_{Aeq,1hr}$.

4.7 For Locations 5 and 6, representative of the permanent Travellers site and potential nearby future residential development, the prediction assumes an average distance of 80m between a residential receptor and the nearest loading/delivery area, and that the line of sight is broken by the intervening building, as well as use of a white noise reversing alarm. Based on this, the predicted sound level at the nearest dwelling from a single delivery would be 14dB $L_{Aeq,1hr}$ during daytime, and 20dB $L_{Aeq,15min}$ during nighttime. During daytime, it would be feasible to expect multiple deliveries within the hourly assessment period. As an example, the predicted daytime sound level from 4no deliveries (e.g. one every 15 minutes) would become 20dB $L_{Aeq,1hr}$.

4.8 It is feasible that deliveries at multiple buildings could occur simultaneously, but the additional distance and screening from another source location to a given receiver position is such that the additional sound impact would be minimal when added to that of the nearest delivery location.

Break-out Sound from Industrial Activity

4.9 The types of activities within the proposed industrial units are not currently known. Indicative calculations have therefore been carried out to determine recommended maximum internal noise levels to limit the potential for sound break-out from the units adversely affecting the nearest noise-sensitive receptors.

4.10 The calculations for new units along the boundaries assume an external building envelope construction of lightweight metal cladding, building height of 2no storeys, all doors and windows closed, and the shortest distance to the nearest residential receptor. The sound reduction values

in Table 5 published by Kingspan for lightweight cladding panels have been used to provide a suitable minimum performance requirement for the building envelope construction.

Table 5: Building Envelope Minimum Sound Reduction Requirements

Description	R_w	Octave Band Minimum Sound Reduction Indices (dB)						
		63	125	250	500	1k	2k	4k
Kingspan KS1000 RW/40 with 50mm insulation wool & 0.7mm inner steel liner	38	13	14	29	38	40	45	55

4.11 For existing residential properties near Locations 1-4, based on the above, an internal noise level of 85dB L_{Aeq} would result in a sound level of 20dB L_{Aeq} at the nearest residential receptor at 200m. For receptors at greater distance, the received sound level will be less than 20dB L_{Aeq} due to the additional distance attenuation. This is suitable to meet the BS4142 design target values set out above for both daytime and nighttime. If daytime use only is required, a lower sound insulation performance for the building envelope could be considered. Dwellings are potentially exposed to break-out sound from multiple units, but the additional distance attenuation to a given receiver from other units is such that the cumulative sound level based on the above calculation would be around 23dB L_{Aeq}.

4.12 For Locations 5 and 6, representative of the permanent Travellers site and potential nearby future residential development, an internal noise level of 85dB L_{Aeq} would result in a sound level of 32dB L_{Aeq} at the nearest residential receptor at 50m. For receptors at greater distance, the received sound level will be less than 32dB L_{Aeq} due to the additional distance attenuation. Dwellings are potentially exposed to break-out sound from multiple units, but the additional distance attenuation to a given receiver from other units is such that the cumulative sound level based on the above calculation would be around 35dB L_{Aeq}. This is suitable to meet the BS4142 design target values set out above for daytime, but would exceed the nighttime target. Options to reduce potential noise impact at the southern boundary should therefore be considered. These options will be determined in the detailed design of the scheme, but could include:

- Locating only buildings or zones that entail low noise generating uses near the southern boundary, e.g. offices, R&D, etc.

- Provide enhanced sound insulation to buildings located near the southern boundary that potentially generate high levels of internal noise.

- Provision of a buffer zone to increase separation between new noise generating uses and the residential boundary.

- Provision of earth bund and/or barrier fencing to provide an acoustic barrier between new noise sources and the residential boundary.

4.13 The assumed internal noise level is 85dB L_{Aeq}, which is representative of a number of typical light industrial/commercial uses, including sound sources such as intermittent machine operation or manual work with hand-held tools. It is very unlikely that this sound level would occur continuously; nonetheless, the calculation is based on this sound level as being representative of typical sound generation that could feasibly occur, albeit for a short duration. If internal noise levels greater than 85dB L_{Aeq} are envisaged, the sound insulation performance of the building envelope must be increased accordingly.

4.14 It should also be noted that current *Control of Noise at Work* legislation sets noise exposure action values at 80dB(A) as the lower limit and 85dB(A) as the upper limit. The internal noise levels used in this assessment are equal to the Upper Exposure Action Value (8-hour day average), which has been assumed to occur for a period of 1 hour during daytime. At these levels, the wearing of hearing protection and the use of other mitigation measures by the operator to reduce noise levels would be compulsory. It is therefore very unlikely that there would be prolonged generation of the high noise levels indicated above in all the units simultaneously. It can reasonably be expected that typical operating noise levels will be much lower and subsequent noise impact on nearby residential properties will be notably less, being mainly in the region considered to be of low impact.

Fixed Plant & Mechanical Services Sound

4.15 Any new mechanical services, ventilation equipment, or external fixed plant for the proposed new units should be designed to adequately control sound impact upon the existing ambient noise climate. Detailed assessment of future plant will be undertaken once the end users are established and the plant items are known. However, we are able to set suitable limits for the plant sound to not exceed. It is considered that the combined BS4142 Rating Level, including

sound contribution from deliveries, building break-out sound, and fixed external plant, should not exceed the limits defined in Table 4. To achieve this, the table below summarises suitable limits in terms of maximum permissible levels of external plant sound at nearby dwellings. Any plant sound assessment should consider appropriate adjustment for the characteristic features of the sound. In particular, this may require a tonal adjustment K_t to be applied. If such a penalty were due, the below limits would reduce accordingly.

Table 6: Outline Limits for Control of Mechanical Services Sound Emissions (dB L_{Aeq})

Location	Time Period	
	Daytime (0700-2300)	Nighttime (2300-0700)
Residential properties near Location 1	35	25
Residential properties near Location 2	40	26
Residential properties near Location 3	45	30
Residential properties near Location 4	40	23
Residential properties near Location 5	43	29
Residential properties near Location 6	43	29

4.16 A full BS4142 assessment is not possible at this time, as suitably detailed information on the proposed new sound sources is not available. However, based on the above, an indicative BS4142 calculation at the nearest residential locations is given in the following table in order to demonstrate that, with appropriate design and sound control, the proposed development can achieve suitably low sound impact.

Table 7: Indicative BS4142 Assessment to Nearest Noise-Sensitive Properties

	Location 1		Location 2		Location 3		Location 4		Locations 5 & 6	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Building break-out sound level dB L_{Aeq} at receiver (cumulative level from multiple buildings)	19	19	23	23	23	23	21	21	35	20*
Delivery vehicle sound level dB L_{Aeq} at receiver	12	12	12	12	12	12	12	12	20	20
Fixed plant sound level dB L_{Aeq} at receiver	35	25	40	26	45	30	40	23	43	29
Total Specific sound level at receiver	35	26	40	28	45	31	40	25	44	30
Subjective penalty for just perceptible tonality	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2
Subjective penalty for intermittency	+3	+3	+3	+3	+3	+3	+3	+3	+3	+3
Rating level	40	31	45	33	50	36	45	30	49	35
Background sound level	40	31	45	33	50	36	45	30	49	35
Difference	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

*This value assumes mitigation measures as outlined in 4.12 above have been implemented in order to reduce noise impact from new buildings.

4.17 The above table shows that the desirable +0dB BS4142 criteria can be met, based on the sound levels for each type of activity as set out above. Each line shows +0dB because the plant sound limit has been adjusted in each case in order that the +0dB benchmark is not exceeded. Further assessment shall be undertaken as more detailed information on the development design becomes known.

4.18 A detailed assessment of traffic flow data has not been undertaken. However, vehicle access to the proposed new units is via the A151 from the southeast, which runs centrally within the site, and therefore is shielded to nearby housing by the various buildings on site. On this basis, and considering the existing level of general traffic noise in the area from the A17 and A151, additional vehicle movements within the new development are unlikely to have a significant sound impact.

4.19 Existing ambient noise levels typically range between 55 to 73dB L_{Aeq} at residential locations during the day, and so are already greater than the desirable external levels given in BS8233. It

is anticipated that sound levels generated as a result of the scheme will be sufficiently low that the ambient noise levels at residential locations will not significantly change as a result of the scheme or vehicle movements associated with the scheme.

4.20 There may be potential for some sound from new outdoor agricultural machinery. However, this would not represent a significant change from existing conditions given the existing use of the land for agricultural purposes, and therefore is expected to be of minimal sound impact, i.e. no change.

4.21 All recommendations given herein are for acoustic purposes only. Any other requirements such as structural, thermal, fire safety, etc., should be checked by suitably qualified specialists.

5.0 SUMMARY AND CONCLUSIONS

5.1 A noise assessment has been carried out relating to a proposal to develop new industrial units on Land South of the A17, Holbeach.

5.2 Background sound surveys have been undertaken during a weekday and a weeknight in order to determine the existing noise climate at the development site.

5.3 Based on the noise survey results, an assessment of predicted sound impact from use of the new units has been undertaken.

5.4 Where appropriate, sound impact from sources of an industrial nature has been assessed with reference to BS4142. The result of the assessment shows that the proposed development can be designed and constructed such that new sound emissions are no greater than existing background sound levels.

5.5 Given the nature of the existing noise climate around the site, this level of sound impact is considered to be low and unlikely to have negative effect on nearby residential amenity.

5.6 Example mitigation measures to reduce potential noise impact upon nearby noise-sensitive properties have been outlined.

5.7 Outline noise limits have been given for design of any future mechanical services plant proposed for the new development in order to suitably control plant sound emission.

5.8 It is considered that existing ambient noise levels at residential locations will not be significantly increased as a result of the scheme.

5.9 Considering the above, the proposed development is not expected to have a negative effect on the amenity of occupants of nearby residential properties by way of sound. In order to ensure suitable sound levels are achieved, it is recommended that the acoustic design of the units be reviewed once the design develops and more detail of the potential end users is known.

FIGURE 1 – BACKGROUND SOUND SURVEY MEASUREMENT LOCATIONS

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FIGURE 2 – INDICATIVE PROPOSED SITE LAYOUT

FIGURE 3 – SITE AERIAL VIEW WITH OVERLAY OF PROPOSED SITE LAYOUT

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APPENDIX I – NOISE UNITS AND INDICES

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of pressure in air. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. Due to the wide range of pressure variations detectable by the ear, a logarithmic scale is used to convert the values into manageable numbers. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

b) Frequency and Hertz (Hz)

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequencies are often written as kilohertz (kHz), where 1kHz = 1000Hz.

Young people with normal hearing can hear frequencies in the range 20Hz to 20kHz. However, the upper frequency limit gradually reduces as a person gets older.

As the ear hears some frequencies better than others, the A-weighting scale is used to mimic human hearing. A-weighing applies a correction to the sound level at a given frequency depending on how well the ear hears that frequency.

c) Glossary of Terms

In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

L_{Aeq} This is the A-weighted equivalent continuous sound level which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period.

L_{Amax} This is the maximum A-weighted sound level that was recorded during the monitoring period.

L_{A90} This is the A-weighted sound level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

L_{A10} This is the A-weighted sound level exceeded for 10% of the time period and is often used in the assessment of road traffic noise.

SEL The SEL is the single event level (also sometimes called the sound exposure level). This is commutable with L_{Aeq} using the following formula:

$SEL = L_{Aeq} + 10\log(t)$ where t is time in seconds.

APPENDIX II – NOISE SURVEY DATA

Measurement locations described as 'free-field' were suitably distant from acoustically reflecting surfaces and structures, other than the ground, to minimise the influence of reflections.

Location 1 – Nearest Property to the West, along Stockwell Gate – Free-field

Rion NA28 sound level meter, all values dB(A), 15-minute duration
Friday 12/08/2016 and Thursday 18/08/2016 – Friday 19/08/2016

Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	Comments
12/08/2016	10:52	55.8	78.1	54.6	40.4	A17 road traffic
12/08/2016	12:23	56.1	79.9	51.5	38.9	
12/08/2016	13:50	58.5	79.8	56.6	41.0	
18/08/2016	16:36	58.9	79.9	58.7	51.4	
18/08/2016	18:02	60.3	80.9	57.9	49.5	
18/08/2016	19:43	56.8	77.4	57.0	50.2	
18/08/2016	21:04	51.8	63.4	54.4	46.6	
18/08/2016	22:48	54.6	84.6	49.4	39.8	
19/08/2016	00:30	44.0	57.0	48.0	34.2	
19/08/2016	02:04	45.3	57.4	50.1	32.6	
19/08/2016	03:34	47.4	58.7	51.6	30.9	

Location 2 – Nearest Property to the North, off Mill Lane – Free-field

Rion NA28 sound level meter, all values dB(A), 15-minute duration
Friday 12/08/2016 and Thursday 18/08/2016 – Friday 19/08/2016

Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	Comments
12/08/2016	11:13	62.8	73.8	65.6	57.4	A17 road traffic
12/08/2016	12:42	64.1	83.3	66.5	58.2	
12/08/2016	14:14	63.0	73.1	66.3	53.9	
18/08/2016	16:55	60.6	82.2	63.1	52.1	
18/08/2016	18:24	62.1	86.0	63.9	54.2	
18/08/2016	20:03	60.4	74.7	64.3	45.4	
18/08/2016	21:23	61.9	77.1	66.0	45.4	
18/08/2016	23:14	57.9	71.4	62.6	40.5	
19/08/2016	00:52	56.8	70.6	62.4	33.0	
19/08/2016	02:24	57.1	72.5	62.4	38.2	

Location 3 – Nearest Property to the East, off Welbourne Lane North – Free-field

Rion NA28 sound level meter, all values dB(A), 15-minute duration
Friday 12/08/2016 and Thursday 18/08/2016 – Friday 19/08/2016

Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	Comments
12/08/2016	11:34	63.3	71.3	65.4	59.9	A17 road traffic
12/08/2016	13:01	63.7	73.8	66.6	58.9	
12/08/2016	14:37	65.0	72.4	67.6	60.5	
18/08/2016	17:18	62.5	72.6	65.2	57.8	
18/08/2016	18:46	60.9	69.3	63.4	54.9	
18/08/2016	20:22	60.4	68.5	63.9	51.9	
18/08/2016	22:01	61.6	74.4	65.5	50.3	
18/08/2016	23:36	57.4	74.2	62.2	42.4	
19/08/2016	01:15	55.6	71.5	60.5	39.1	
19/08/2016	02:44	57.7	73.0	61.5	35.5	

Location 4 – Nearest Property to the Southeast, off Northons Lane – Free-field

Rion NA28 sound level meter, all values dB(A), 15-minute duration
Friday 12/08/2016 and Thursday 18/08/2016 – Friday 19/08/2016

Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	Comments
12/08/2016	11:57	54.1	75.0	55.5	47.4	A17 road traffic
12/08/2016	13:23	54.4	75.2	56.2	48.8	
12/08/2016	14:59	55.5	71.3	58.1	49.0	
18/08/2016	17:39	56.6	73.6	57.6	51.4	
18/08/2016	19:13	55.1	73.7	56.8	44.9	
18/08/2016	20:44	50.1	71.0	51.2	44.8	
18/08/2016	22:27	44.9	60.4	47.9	39.6	
18/08/2016	00:05	41.5	51.4	44.8	33.3	
19/08/2016	01:43	41.3	53.6	45.2	32.6	
19/08/2016	03:12	41.1	52.9	45.2	29.6	

Location 5 – Southern site boundary near permanent Travellers site – Free-field

Rion NA28 sound level meter, all values dB(A), 15-minute duration
Tuesday 11/10/2016 and Wednesday 12/10/2016

Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	Comments
11/10/2016	04:45	70.8	90.9	71.4	49.9	A151 road traffic
11/10/2016	05:22	72.1	89.8	76.0	49.5	
11/10/2016	06:01	72.6	90.7	77.3	51.7	
11/10/2016	06:40	74.2	89.9	78.8	55.4	
11/10/2016	07:16	75.3	89.6	80.1	57.4	
11/10/2016	08:00	75.4	88.6	80.0	59.5	
11/10/2016	08:35	76.1	88.7	80.3	61.4	
11/10/2016	09:11	74.9	89.0	79.3	55.4	
12/10/2016	14:08	69.0	81.4	73.5	52.3	
12/10/2016	15:52	72.5	87.5	77.2	52.9	
12/10/2016	16:42	74.5	90.2	79.1	54.6	
12/10/2016	19:01	71.2	88.3	75.8	49.4	
12/10/2016	19:47	69.6	90.2	70.0	42.6	
12/10/2016	20:26	68.8	91.6	65.4	40.2	
12/10/2016	21:02	66.4	87.8	67.5	40.2	

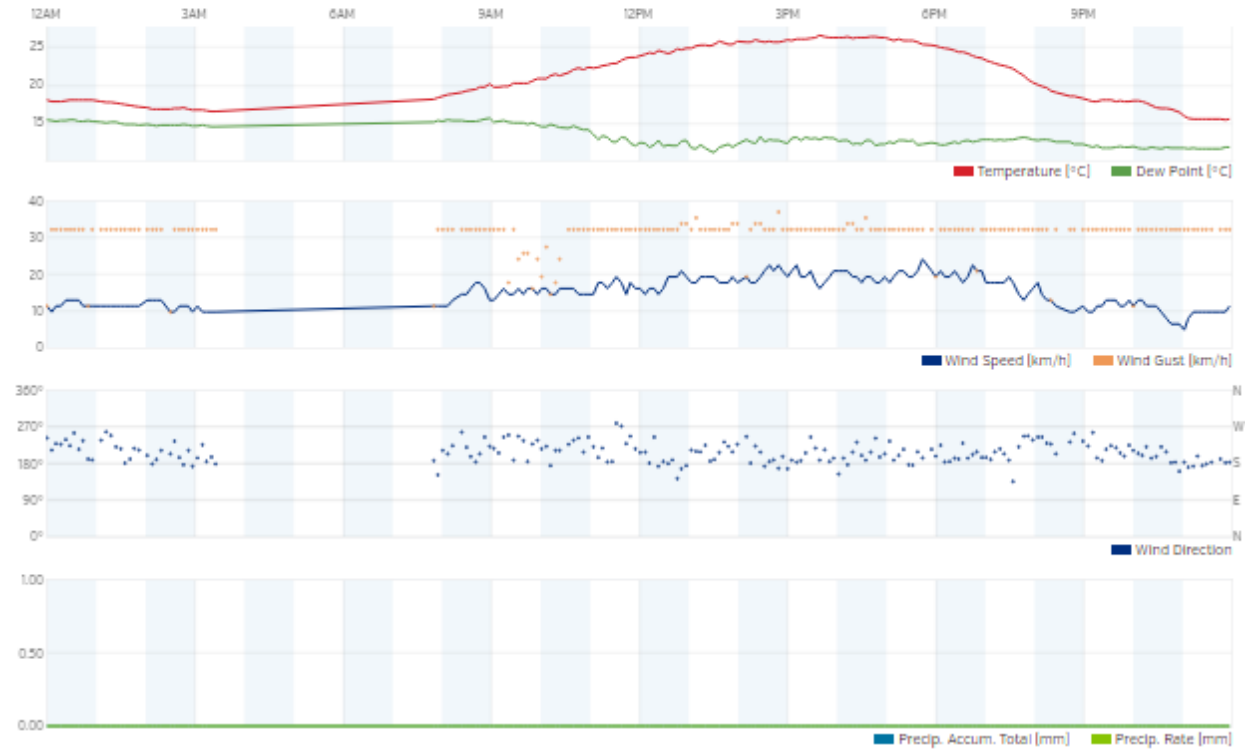
Location 6 – East of A151 near proposed future residential development – Free-field

Rion NA28 sound level meter, all values dB(A), 15-minute duration
Tuesday 11/10/2016 and Wednesday 12/10/2016

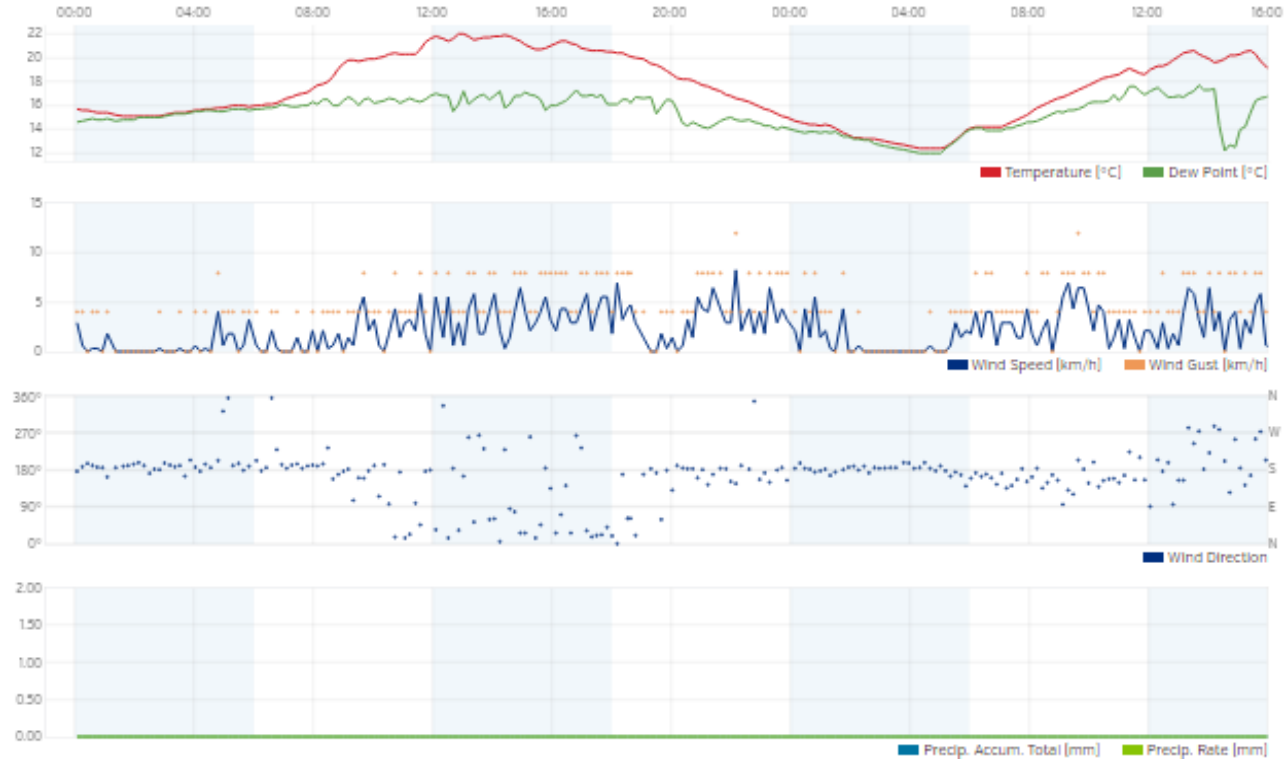
Date	Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	Comments
11/10/2016	05:03	70.8	89.6	73.2	48.8	A151 road traffic
11/10/2016	05:41	73.0	88.4	77.2	51.1	
11/10/2016	06:20	73.6	87.8	78.7	54.0	
11/10/2016	06:57	74.6	88.7	79.2	53.1	
11/10/2016	07:35	76.0	90.3	80.5	56.9	
11/10/2016	08:17	76.0	89.5	80.5	60.3	
11/10/2016	08:52	74.9	92.5	79.2	57.0	
12/10/2016	14:46	71.7	87.1	76.6	53.3	
12/10/2016	15:31	71.9	94.5	76.4	55.8	
12/10/2016	16:20	72.4	89.7	77.0	52.2	
12/10/2016	17:02	71.7	85.2	77.2	52.7	
12/10/2016	19:24	69.4	88.6	72.1	48.6	
12/10/2016	20:07	68.5	88.4	69.4	47.7	
12/10/2016	20:45	68.6	89.0	66.7	46.1	
12/10/2016	21:19	68.2	89.7	67.2	43.3	

APPENDIX III – WEATHER DATA

August 12, 2016



August 18, 2016 - August 19, 2016



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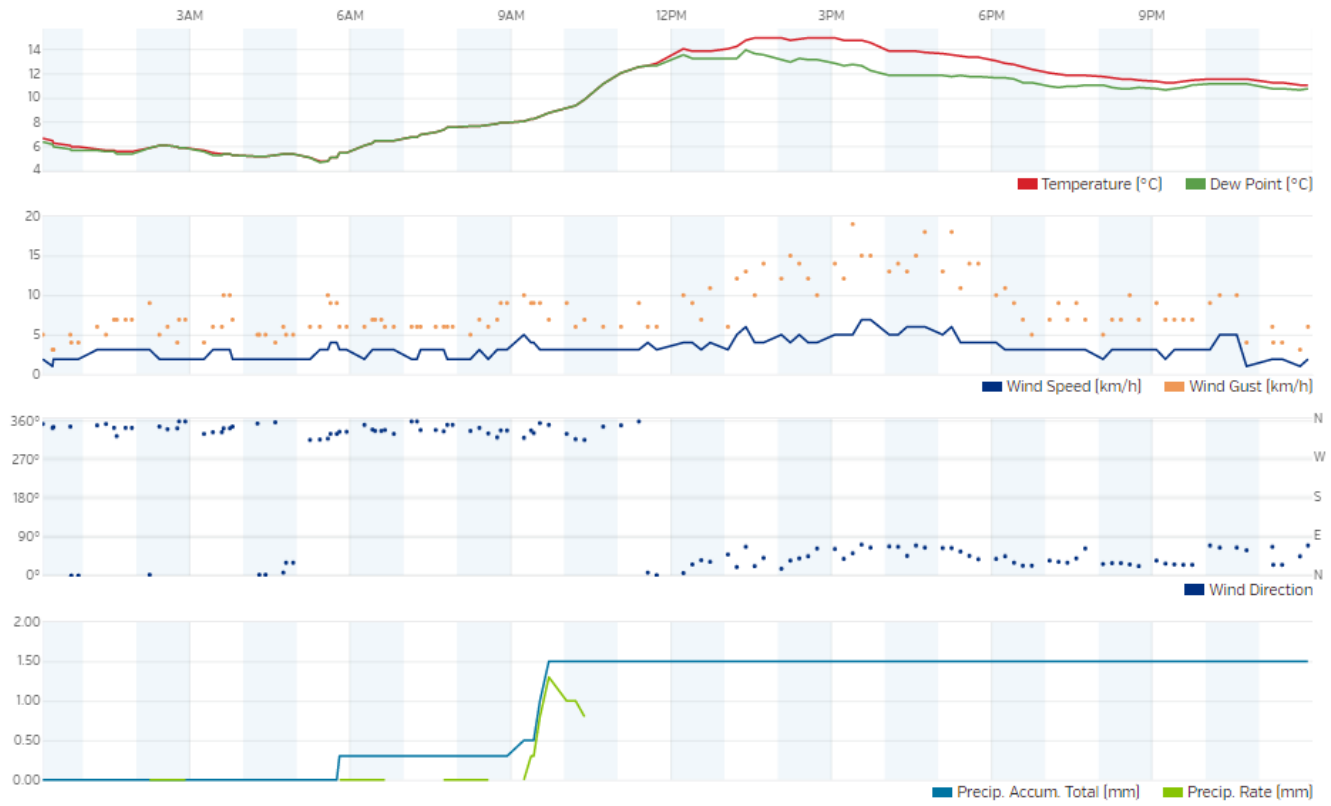
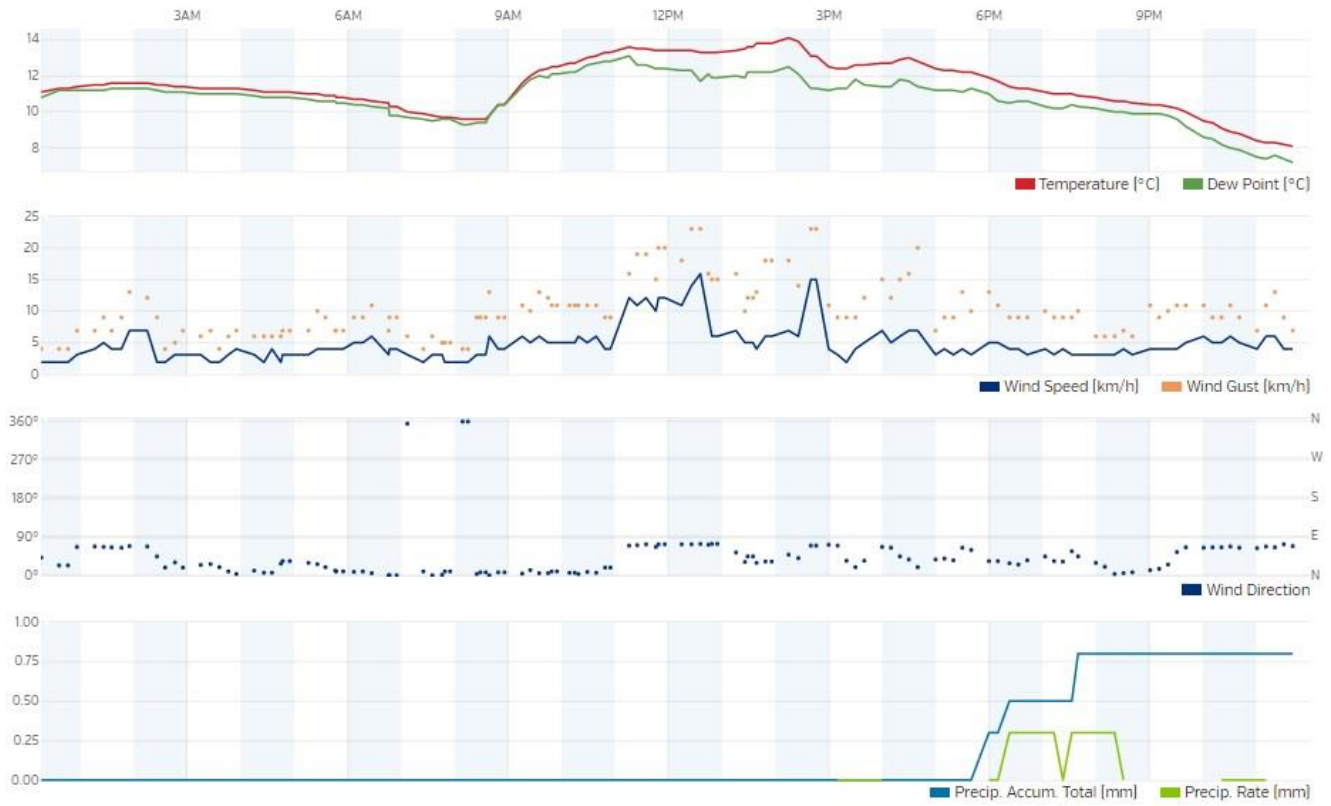
Blue Tree Acoustics

October 11, 2016



October 12, 2016



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