hepworth acoustics

PROPOSED RESIDENTIAL DEVELOPMENT AT LAND AT ILKESTON ROAD/SOWBROOK LANE, ILKESTON

NOISE ASSESSMENT

On behalf of:

Wulff Asset Management Ltd

Report No: P21-283-R01v2
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NOISE ASSESSMENT

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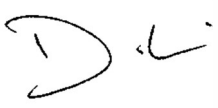
Report checked by: Donald Quinn BSc FIOA – Managing Director	

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1.0 INTRODUCTION

1.1 Hepworth Acoustics was commissioned to carry out a noise assessment relating to a proposed residential development on a site known as Land at Ilkeston Road / Sowbrook Lane, Ilkeston.

1.2 The site is currently open fields / farmland, bounded by Ilkeston Road to the east / southeast and by Sowbrook Lane to the south / southwest. To the north / northeast the site is bounded by Nutbrook Canal and a fishing lake, known as Roughs Open Hole. Otherwise the site is bounded by existing open fields / farmland.

1.3 Ilkeston Road is a relatively busy highway, with Stanton Fishing Club and another fishing lake, known as Privates Pond, to the opposite side. Somewhat further north of the fishing club, beyond the canal and a ~85m wide wooded area, is Quarry Hill Industrial Estate, which includes a Ward waste management site.

1.4 Sowbrook Lane is less busy than Ilkeston Road, though still fairly well trafficked. There is an existing terrace of housing to the opposite side of Sowbrook Lane, close to the junction with Ilkeston Road. Further west, towards the centre of the site boundary to Sowbrook Lane, and to the opposite side, is a moderately large electrical substation site. Further south, to the rear of the existing terraced houses and extending to the rear of the substation, is the works of Sateba, a substantial concrete product manufacturing site, as well as other smaller industrial sites.

1.5 The site location is shown in in Figure 1.

1.6 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 RELEVANT CRITERIA

2.1 The *National Planning Policy Framework* (NPPF) 2021 states at paragraph 174 that "*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 … noise pollution …*".

2.2 Further, paragraph 185 states that "*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 …*".

2.3 Paragraph 187 states that: "*Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*

2.4 However, there is as yet no specific guidance on numerical acoustic assessment/design criteria for proposed new housing developments provided in the NPPF, nor the accompanying Technical Guidance, National Planning Practice Guidance 'Noise'.

ProPG: Planning & Noise

2.5 ProPG: Planning & Noise '*Professional Practice Guidance on Planning & Noise'* 2017 provides "guidance on a recommended approach to the management of noise within the planning system in England", predominantly for proposed new residential developments on land that is exposed to transportation noise.

2.6 The ProPG recommends a staged approach to assessment. Stage 1 is an initial site noise risk assessment, indicating whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

2.7 At low noise levels, the more likely the site is to be acceptable from a noise perspective provided that a good acoustic design process is followed and an ADS (Acoustic Design Statement) confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.

2.8 As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and an ADS confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.

2.9 High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS.

2.10 Stage 2 of the recommended approach in ProPG is a full assessment to consider good acoustic design. The guidelines of ProPG in terms of suitable acoustic design criteria are broadly consistent with the guidance of BS 8233, and the sound insulation recommendations made later in this report have been designed to achieve the BS 8233 guidelines, as described below. The scope of the ProPG is restricted to sites that are exposed predominantly to noise from transportation sources. However, the recommended approach is also stated as being suitable where some industrial or commercial noise contributes to the acoustic environment provided that it is "*not dominant*".

BS 8233

2.11 British Standard 8233: 2014 *Guidance on sound insulation and noise reduction for buildings,* which carries the full weight of an adopted British Standard, recommends guidance on design criteria for acceptable noise levels within proposed new residential accommodation. BS 8233 recommends that it is desirable that noise from external sources does not exceed the guideline values that are shown in Table 1 inside habitable rooms for daytime (0700-2300hrs) and night-time (2300-0700hrs) periods.

Table 1 : BS 8233 Recommended Acoustic Design Criteria

Activity	Location	Internal Noise Levels	
		Daytime 0700-2300hrs	Night-time 2300-0700hrs
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

2.12 BS 8233 states that the values tabled above are based on annual average data and do not have to be achieved in all circumstances.

2.13 BS 8233 also states that, "*where development is considered necessary or desirable … the internal target levels* [i.e. those in Table 1] *may be relaxed by up to 5dB and reasonable internal conditions still achieved*".

2.14 BS 8233 clarifies that the above guidance relates only to noise without specific character (e.g. such as that which has a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content) and that where such characteristics are present, lower noise limits might be appropriate.

2.15 BS 8233 states that if there is a reliance 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*". Further, it is stated that assessments should be based on a room with "*adequate ventilation provided (e.g. trickle ventilators should be open)*".

2.16 BS 8233 also recognises that regular individual noise events at night can cause sleep disturbance. Peaks of noise from individual events are usually described in terms of L_{Amax} values and these can be highly variable and unpredictable. ProPG states that "*in most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events*".

2.17 Regarding outdoor living areas, Clause 7.7.3.2 of BS 8233 states that "*it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$, which would be acceptable in noisier environments. However, it is recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, developments should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."*

BS 4142

2.18 Further relevant guidance is provided in British Standard 4142: 2014 +A1:2019 *Methods for rating and assessing industrial and commercial sound*, provides methods for rating and assessing sound of an industrial and/or commercial nature.

2.19 BS 4142 requires the 'rating' sound level for the operation to be compared with the L_{A90} background sound level in the absence of the operational noise.

2.20 Regarding background noise level, BS 4142 states that "*values are reliable and suitably represent both the particular circumstances and periods of interest … the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods*." It is also stated that "*diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*".

2.21 The rating level is derived based on the 'specific' L_{Aeq} sound level attributable to the operation with an 'acoustic feature' penalty added for any sound sources which give rise to tonal, impulsive, intermittent, or other characteristics readily distinctive against the residual acoustic environment.

2.22 BS 4142 stipulates that impacts should be assessed over a reference time interval of 1-hour during the daytime (0700-2300hrs) and 15-minutes during the night-time (2300-0700hrs).

2.23 An initial estimate of the impact of the operation is determined by subtracting the background level from the rating level. BS 4142 states that:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5dB 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 level, the less likely it is that the operation 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.

2.24 Where the initial estimate of the impact needs to be modified due to the context, BS 4142 states that all pertinent factors should be taken into account in determining whether the initial estimate of the impact needs to be modified, including:

- The absolute level of sound, including "*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 background*
- The character and level of the residual sound
- The sensitivity of the receptor and whether dwellings … will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as: i) façade insulation treatment, ii) ventilation and/or cooling, and iii) acoustic screening.

2.25 The Scope to BS 4142 makes it clear that the Standard applies to "*… 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…"* and also that "*Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads…".*

BS 7445

2.26 In addition to the above, it is noted that British Standard 7445: 1991 *Description and measurement of environmental noise; Part 2: Acquisition of data pertinent to land use* states in paragraph 4.3.1: "*If tonal components are essential characteristics of the sound within a specified time interval, an adjustment may be applied for that time interval, to the measured equivalent continuous noise level [i.e. $L_{Aeq,T}$]…If tonal components are clearly audible and their presence can be detected by one-third octave analysis, the adjustment may be 5 to 6dB*".

3.0 NOISE SURVEY

3.1 A noise survey has been undertaken at the site over a complete 24-hour midweek period commencing at 1400hrs on Tuesday 2 November 2021. The measurement locations that are referenced below are identified in Figure 1.

3.2 Continuous noise monitoring was undertaken at Location 1, which is 10m laterally from the Ilkeston Road carriageway, in sequential 5-minute samples, over the full survey period.

3.3 The actual daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ noise exposure levels at Location 1 have been obtained from the logarithmic average of all measured $L_{Aeq,5min}$ noise measurement samples over each of those periods. To provide a robust interpretation of ProPG guidelines relating to L_{Amax}, the overall night-time L_{Amax} noise level has been determined for assessment purposes as the measured $L_{Amax,5min}$ exceeded no more than 5 times over any full night-time period.

3.4 Additionally, a set of short-term supplementary noise measurements was undertaken over the period 1510-1635hrs on Tuesday 2 November 2021 at each of Locations 2 and 3, which were also 10m laterally from the Ilkeston Road carriageway. The supplementary measurements were undertaken in sequential 5-minute samples, each concurrent with individual 5-minute measurement samples at Location 1.

3.5 In broad accordance with the 'Comparative Measurements' technique set out in the Department of Transport document 'Calculation of Road Traffic Noise' (CRTN), 1988, the overall daytime and night-time noise levels at Locations 2 and 3 have been determined by applying the average difference in measured 5-minute samples noise levels at these locations with the concurrent measurements at Location 1, to the overall daytime and night-time noise levels determined by way of continuous monitoring at Location 1.

3.6 Overall noise levels close to Ilkeston Road, i.e. at Locations 1 - 3, are presented in Table 2.

Table 2 : Overall Noise Levels at Locations 1 - 3

Location	Daytime (0700-2300hrs)	Night-time (2300-0700hrs)	
	dB $L_{Aeq,16hr}$	dB $L_{Aeq,8hr}$	dB L_{Amax}
1	66	61	79
2	65	60	82
3	63	57	79

3.7 At locations along Ilkeston Road, road traffic noise is the dominant noise source. Some occasional noise could be discerned during lulls in passing traffic from Quarry Hill Industrial Estate towards the northeast, including the Ward waste management site, however at all times road traffic noise was the dominant source.

3.8 It is also noted that one of the most notable components of road traffic noise on Ilkeston Road is the proliferation of Ward waste recycling and skip trucks, which were noted to bang and rattle when passing, due to loose metal cargo etc., giving rise to slightly higher peaks in noise. When passing on the highway, this would be considered as a part of the general road traffic noise, rather than as a separate industrial type noise, however the impact of this upon transient noise levels is reflected in the L_{Amax} noise measurements. To ensure a robust approach, the highest assessment level of L_{Amax} from Locations 1-3 is hence adopted for all areas along Ilkeston Road.

3.9 Continuous noise monitoring was also undertaken at Location 4, which is 10m laterally from the Sowbrook Lane carriageway, in sequential 5-minute samples, over the full survey period.

3.10 The actual daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ and L_{Amax} noise exposure levels at Location 4 have been determined as described for Location 1.

3.11 Additionally, a set of short-term supplementary noise measurements was undertaken over the period 1125-1400hrs on Wednesday 3 November 2021 at each of Locations 5 - 8. The supplementary measurements were undertaken in sequential 5-minute samples, each concurrent with individual 5-minute measurement samples at Location 4. Corresponding noise exposure levels at Locations 5 - 8 have been derived in broad accordance with the 'Comparative Measurements' of technique CRTN, as described for Locations 2 - 3.

3.12 Overall noise levels close to Ilkeston Road, i.e. at Locations 4 - 8, are presented in Table 3.

Table 3 : Overall Noise Levels at Locations 4 - 8

Location	Daytime (0700-2300hrs)	Night-time (2300-0700hrs)	
	dB $L_{Aeq,16hr}$	dB $L_{Aeq,8hr}$	dB L_{Amax}
4	56	50	69
5	56	50	67
6	55	49	67
7	55	49	66
8	51	46	64

3.13 At locations along Sowbrook Lane, road traffic noise is the dominant noise source during the daytime. Some occasional noise could be discerned from the Sateba site to the south, however not generally at an intrusive level.

3.14 However, towards the central area of the Sowbrook Lane site boundary, there is a distinct tonal humming noise from the electrical substation to the opposite side of the road. In the closest areas, this is noticeable by day and becomes prominent at night.

3.15 To consider this noise further, some additional short-term noise measurements were undertaken at Locations 5 - 10. This was done mostly during the late evening / early night-time period, at which point it was possible to obtain measurements of the substation noise with minimal interference from other noise. Further measurements were undertaken during daytime hours, only where there was sufficient substation noise to obtain a measurement during lulls in other noise.

3.16 The substation noise is characterised by a discreet tone at 100Hz, and to a lesser extent at harmonics thereof (i.e. 50Hz and 200Hz). As the noise is steady, measurements have been taken in the L_{90} measurement index to assist with excluding extraneous noise. Also, a relatively short 10-second sample period was used to again allow measurements to coincide with otherwise quiet moments.

3.17 The overall A-weighted noise levels and corresponding linear 100Hz third octave band noise level determined at each location are summarised in Table 4. It is generally the case that the 100Hz value is entirely attributable to the substation, whereas the overall A-weighted levels contains some contribution from residual ambient noise, especially at greater distance from the substation where noise from the substation is lower.

Table 4 : Summary of Electrical Substation Noise at Locations 5-10

Location	dB L_{90}	
	A-weighted	100Hz
5	49	66
6	54	71
7	50	67
8	43	59
9	51	67
10	49	65

3.18 It is noted that, as would be expected, the substation noise levels are generally proportionate to the distance between source and measurement location. However it is also noted that a degree of variability exists moving around the relevant part of the site, due to a number of factors, chiefly some acoustic screening provided in certain areas (but not in others) by existing structures on the nearer part of the substation site. Nonetheless, there is a good level of confidence with respect to the highest noise levels representing the worst case, i.e. around Location 6.

Survey Details

3.19 The noise monitoring was undertaken at Location 1 using Norsonic 118 Class 1 Integrating Sound Level Meter (serial no. 31617) and at Location 4 using a Norsonic 140 Class 1 Integrating Sound Level Meter (serial no. 1406529). Noise measurements at all other locations were undertaken using a Bruel & Kjaer 2260 Type 1 Integrating Noise Level Meter (serial no. 2467014).

3.20 Calibration checks were carried out to all equipment using a Bruel & Kjaer Acoustic Calibrator, Type 4231 (serial no. 2389221) before and after the survey, and no variation in calibration level was observed.

3.21 Weather conditions during the survey were dry and warm, with a light breeze of speeds typically up to 4m/s, of south-westerly direction on Tuesday 2 November 2021, changing to north-westerly on Wednesday 3 November 2021.

3.22 At all locations, the measurement microphones were fitted with windshields and mounted in 'free-field' conditions at about 1.4m above local ground.

3.23 All measured noise levels are detailed in Appendix II.

4.0 NOISE ASSESSMENT

4.1 Based on the overall noise levels set out in Table 1, taking these as being representative of road traffic noise levels as is appropriate, the prevailing noise levels at the measurement locations at 10m from Ilkeston Road fall within the '**medium' risk** category as set out in the Stage 1 guidance of ProPG. This is the case for both the daytime and night-time periods, albeit that noise levels are towards the higher end of this category at night.

4.2 As described in Section 3.0, although noise from Quarry Hill Industrial Estate is audible at times, this was found to be not dominant. Consequently, it is appropriate to assess areas of the site adjoining Ilkeston Road based on the approach set out in ProPG: Planning & Noise, as this is applicable where some industrial or commercial noise contributes to the acoustic environment provided that it is "*not dominant*".

4.3 Therefore, noise mitigation measures will be necessary to ensure good acoustic design and a suitable acoustic environment for future occupants of any proposed dwellings close to Ilkeston Road. However, there are no overarching constraints to residential development by reason of noise.

4.4 Based on the overall noise levels set out in Table 2, taking these as being representative of road traffic noise levels as is again appropriate, the prevailing noise levels at the measurement locations at 10m from Sowbrook Lane fall within the '**low' risk** category as set out in the Stage 1 guidance of ProPG. This is case for both the daytime and night-time periods, albeit that noise levels are towards the higher end of this category at night.

4.5 Again, although noise from the Seteba premises to the south is audible at times, this was found to be not dominant – as would be expected, given the presence of the existing terraced housing to those work, which are closer and more exposed than the proposed development site.

4.6 As the noise levels in Table 2 are modest, mitigation required to adequately control Sowbrook Lane road traffic noise, and underlying noise from the Sateba premises, is also fairly modest.

4.7 However, in central areas of the boundary to Sowbrook Lane, although road traffic noise is sufficient to remain the dominant source of noise throughout the day, by late evening and overnight the tonal noise from the opposite electrical substation becomes effectively the dominant source of noise, if not necessarily in terms of the overall 8-hour night-time level, then certainly in terms of being the perceived dominant source in worst-case areas.

4.8 It is therefore necessary to consider the context of the substation noise with regard to BS 4142.

4.9 Based on a worst-case substation noise level of 54dB(A) at Location 6, plus and acoustic feature correction of +6dB to account for the tonal character of the sound, the worst-case substation 'rating' sound level is therefore 60dB $L_{Ar,T}$. From the continuous noise monitoring undertaken at the site, away from the substation, a typical representative background noise level of 40dB L_{A90} may be taken for the early night-time period, which is considered the most important to this assessment. Comparison of the rating and background levels hence yields a difference between the values of 20dB. An initial estimate in line with BS 4142 therefore indicates that based on the current situation, with no noise mitigation measures in place, the substation noise is likely to be of a significant adverse impact at Location 6, depending on the context.

4.10 At other locations, a lesser impact would be expected, however at most locations in the vicinity of the substation, the indication of the initial estimate in line with BS 4142 would be of a significant adverse impact, depending on the context (with no mitigation), albeit with a less pronounced difference between rating and background levels.

4.11 As stated in Section 2.0, where the initial estimate of the impact needs to be modified due to the context, BS 4142 states that all pertinent factors should be taken into account.

4.12 One particular factor in this situation, of note when considering the difference between rating and background noise levels, is that the substation noise is steady and continuous 24-hours a day, 365-days a year. As such, occupants of any new dwellings with exposure to substation noise will not be conscious of the 'background' noise climate and hence will not appreciate that difference.

4.13 Also, BS 4142 identifies pertinent factors that may require consideration in term of the context of an assessment. These include the absolute level of the sound, and also whether dwellings will incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as façade insulation treatment, ventilation and/or cooling, and acoustic screening.

4.14 In this situation, it is therefore of relevance that, notwithstanding the relationship between the rating and background levels in the vicinity of the substation, the absolute level of noise is moderate, and also that there is a good level of scope to incorporate design measures to secure good internal and outdoor acoustic conditions for future residential areas.

4.15 The absolute levels of noise at the site do not present any substantial constraints in terms of achieving the relevant BS 8233 guidelines described in Section 2.0, including the internal design criteria set out in Table 1 (of this report).

4.16 However, as discussed, those guideline values relate only to noise without specific character, and where characteristics are present, lower noise limits might be appropriate.

4.17 Given the tonal characteristics of the substation noise, it is therefore appropriate to adopt lower noise limits. Based on the provisions of BS 7445, it is recommended that sub-station noise should hence be at least 6dB below the standard BS 8233 guidelines for internal and external noise at any new dwellings at the site. It is noted that this adjustment is consistent with the acoustic feature penalty applied in line with BS 4142.

4.18 As such, it is recommended that daytime noise levels attributable to the substation should not exceed 44dB(A) in garden areas. This is based on the 'desirable' level as set out in BS 8233, corrected for tonality as described above

4.19 Further it is recommended that internal daytime noise levels attributable to the substation should not exceed 29dB(A) in habitable rooms, and night-time noise levels attributable to the substation should not exceed 24dB(A) in bedrooms.

4.20 Therefore additional mitigation will be required in order to ensure good acoustic design and a suitable acoustic environment for future occupants of any proposed dwellings close to the substation.

5.0 MITIGATION

5.1 Considering firstly all proposed housing located towards the site boundary with Ilkeston Road, it is recommended that all plots are orientated to front outwards towards the road. The purpose of this is to ensure optimal levels of acoustic protection to rear gardens, to the opposite side. In any areas where significant areas of gardens are left exposed, then acoustic barriers (taking the visual form of typical solid garden walls or fences) will be required to the garden boundaries.

5.2 Any acoustic screening should be of overall surface mass not less than 10kg/m^2 and nominal thickness not less than 20mm. It should be imperforate with no holes or gaps and should be sealed at the base.

5.3 To control internal noise levels, based on a minimum set-back distance from Ilkeston Road of 10m (as per the survey measurement locations) then typically an acoustic glazing system rated not less than ~39dB R_w+C_{tr} will be required (e.g. 8.8mm and 12.8mm laminated panes on a 12mm air gap; 8.8_{lam}-12-12.8_{lam}), with any through-wall ventilators (e.g. trickle vents) to be acoustically rated typically not less than ~45dB $D_{n,e,w}$ (e.g. Greenwood EHA574 - Acoustic Humidity Control Trickle Vent or similar).

5.4 Precise acoustic specification of glazing and ventilation systems is a detailed design matter, but may be readily controlled by way of a suitable planning condition.

5.5 The above is indicative of a likely worst-case scenario, but hence demonstrates the feasibility of incorporating adequate acoustic protection in these areas. Lesser specifications than this indicative example will be appropriate in certain other areas exposed to Ilkeston Road traffic noise, particularly where the set-back distance from the road is appreciably greater than 10m. It is not recommended that the set-back distance should be any less than 10m.

5.6 Considering proposed housing located towards the site boundary with Sowbrook Lane, whilst again it would be optimal for plots to be orientated to front outwards towards the road, in areas away from the electrical substation, this is somewhat less critical (compared to the situation close to Ilkeston Road). Prevailing road traffic noise levels are marginally above the *upper guidelines limit* of BS 8233 for gardens, without any mitigation, at 10m from the road, such that they would be within that limit at about 15m from the road.

5.7 At less than 15m from the road (away from the substation) acoustic barriers would be necessary for garden areas where not protected by way of orientation of the houses.

5.8 To achieve the *desirable* level of BS 8233, the barriers would likely be required in any areas proximate to the road. Any such barriers would need to satisfy the parameters set out above (para 5.2).

5.9 To control internal noise levels, in areas away from the substation, no specific mitigation is necessary. Assuming a set-back distance not significantly lower than 10m from Sowbrook Road, this would be achieved based on standard thermal double glazing, along with standard non-acoustic trickle ventilators, in areas away from the substation.

5.10 Notwithstanding the above, in areas that will be affected by noise from the electrical substation, more careful consideration of noise mitigation will be required. Certainly, in these areas, it is recommended that plots are orientated to front outwards towards Sowbrook Lane, in order to protect garden areas.

5.11 It is also recommended that distance buffers from the road, and hence the substation, are maximised, to achieve best practicable attenuation of noise prior to incidence at residential elevations.

5.12 Indicatively, it is recommended that a buffer of at least about 50m from Sowbrook Lane may be necessary in the worst-case area (i.e. in line with Locations 6, 9 and 10 as per Figure 1), potentially arcing inwards towards the road to each side.

5.13 Even with this order of distance buffer incorporated, it is recommended that habitable rooms facing outwards towards the road (and hence the substation) are avoided, insofar as is possible.

5.14 It is anticipated that this may be generally straightforward in ground floor areas, potentially by locating kitchens and cloakrooms adjacent to hallways on the frontage. However, although bathrooms, ensuites and box rooms (for example) may be biased towards the frontage at upper floors, it may be less practicable in conventional housing to eliminate all bedrooms from frontages. In this case, observing the minimum indicative distance buffer described above, it will be necessary to install high-specification acoustic glazing to habitable rooms that are located on the exposed elevation.

5.15 Indicatively, an acoustic glazing system rated up to ~47dB R_w will be required, importantly with an individual octave band sound reduction index of up to ~29dB in the 125Hz octave band (e.g. 8.8mm and 12.8mm laminated panes on a 12mm air gap; 8.8_{lam}-12-12.8_{lam}).

5.16 Any through-wall ventilators (e.g. trickle vents) to be acoustically rated typically not less than ~55dB $D_{n,e,w}$ (e.g. Titon Sonair F+); alternatively, a whole-house or MVHR type system may be preferable in these areas.

5.17 This demonstrates the feasibility of incorporating adequate acoustic protection in these areas. Lesser specifications than this indicative example will be appropriate in lesser exposed areas.

5.18 Again, precise acoustic specifications is a detailed design matter, readily controlled by way of a suitable planning condition. The above, however, indicates that Sowbrook Lane road traffic noise, and industrial noise from beyond existing housing on that road presents only modest constraints, and that tonal noise from the electrical substation presents more onerous mitigation requirements, achievable with sufficient distance buffers and suitably robust acoustic glazing and ventilation standards.

5.19 An indicative masterplan for the development has been prepared following the guidelines set out above. This is presented in Figure 2.

6.0 SUMMARY AND CONCLUSIONS

6.1 Hepworth Acoustics has undertaken a noise assessment relating to proposed residential development on a site known as Land at Ilkeston Road / Sowbrook Lane, Ilkeston

6.2 Baseline noise surveys have been undertaken at the site and daytime and night-time noise exposure levels have been determined.

6.3 Outline recommendations of appropriate noise mitigation measures have been set out in order to achieve appropriate acoustic criteria in line with relevant British Standard guidelines. This may be readily enshrined for planning purposes by way of a suitable planning condition.

Figure 1: Site Plan

Figure 2: Indicative Development Masterplan

Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. 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. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. 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 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. 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 frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

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

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The indices used in this report are described below.

L_{Aeq} This is the A–weighted 'equivalent continuous noise 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. It is increasingly being used as the preferred parameter for all forms of environmental noise.

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

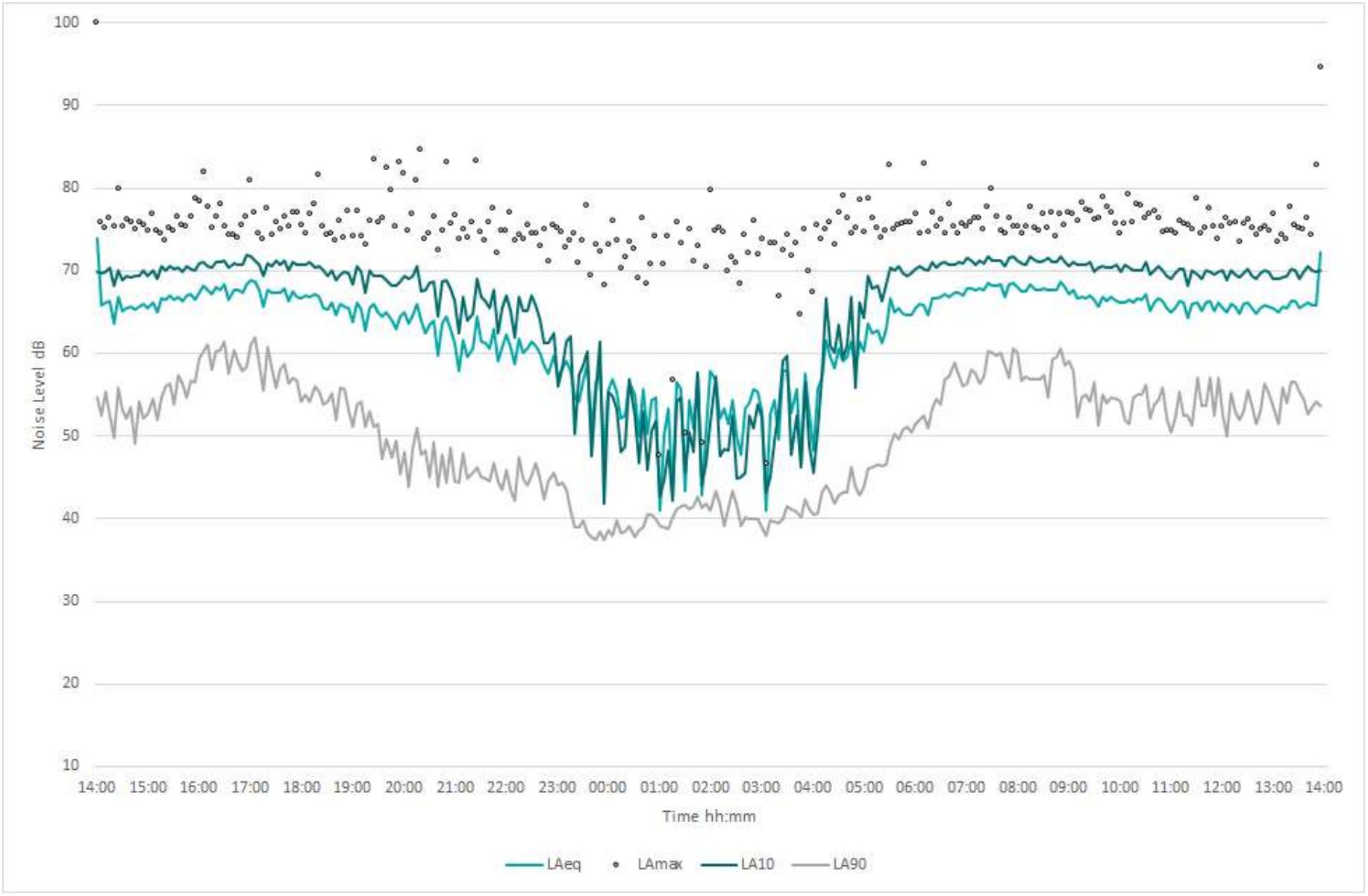
L_{A10} This is the A-weighted noise level exceeded for 10% of the time period. L_{A10} is used as a measure of road traffic noise.

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

Appendix II: Noise Survey Results

Location	Date	Time	Noise Level dB				Main Noise Source
			L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
2	02/11/21	15:55	66	81	69	55	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:00	67	84	70	56	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:05	67	84	70	57	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:10	67	83	70	56	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:15	66	83	69	55	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:20	66	78	69	59	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:25	66	78	70	56	Ilkeston Rd Traffic / General Noise
2	02/11/21	16:30	67	77	70	58	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:10	61	73	65	50	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:15	64	79	66	55	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:20	63	75	65	52	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:25	64	72	66	57	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:30	63	74	65	56	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:35	64	75	66	55	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:40	64	76	67	58	Ilkeston Rd Traffic / General Noise
3	02/11/21	15:45	64	81	66	56	Ilkeston Rd Traffic / General Noise
5	03/11/21	12:35	55	65	58	51	Sowbrook Ln Traffic / General Noise
5	03/11/21	12:40	55	62	58	50	Sowbrook Ln Traffic / General Noise
5	03/11/21	12:45	56	66	58	51	Sowbrook Ln Traffic / General Noise
5	02/11/21	23:15	50	51	50	50	Substation Noise
5	02/11/21	23:15	50	52	51	49	Substation Noise
5	02/11/21	23:15	50	50	50	49	Substation Noise
6	03/11/21	11:45	55	62	57	53	Sowbrook Ln Traffic / General Noise
6	03/11/21	11:55	55	63	57	53	Sowbrook Ln Traffic / General Noise
6	03/11/21	13:15	53	62	57	47	Sowbrook Ln Traffic / General Noise
6	03/11/21	13:20	52	61	55	47	Sowbrook Ln Traffic / General Noise
6	03/11/21	13:35	53	60	56	47	Sowbrook Ln Traffic / General Noise
6	02/11/21	23:06	55	56	55	54	Substation Noise
6	02/11/21	23:07	55	55	55	54	Substation Noise
6	02/11/21	23:07	55	55	55	54	Substation Noise
7	03/11/21	11:25	53	62	57	47	Sowbrook Ln Traffic / General Noise
7	03/11/21	11:30	53	64	58	47	Sowbrook Ln Traffic / General Noise
7	03/11/21	13:45	59	73	62	52	Sowbrook Ln Traffic / General Noise
7	03/11/21	13:50	54	68	57	50	Sowbrook Ln Traffic / General Noise
7	03/11/21	13:55	55	63	58	50	Sowbrook Ln Traffic / General Noise
7	02/11/21	23:04	50	51	50	50	Substation Noise
7	02/11/21	23:05	50	51	51	50	Substation Noise
7	02/11/21	23:05	51	52	51	50	Substation Noise
8	03/11/21	12:05	50	58	52	45	Sowbrook Ln Traffic / General Noise
8	03/11/21	12:10	51	60	54	45	Sowbrook Ln Traffic / General Noise
8	03/11/21	12:15	51	61	54	44	Sowbrook Ln Traffic / General Noise
8	03/11/21	22:45	45	46	46	43	Substation Noise
8	03/11/21	22:45	45	47	46	43	Substation Noise
8	03/11/21	22:46	43	44	44	43	Substation Noise
9	03/11/21	13:03	52	53	52	52	Substation Noise
9	03/11/21	13:04	52	53	52	51	Substation Noise
9	03/11/21	13:07	52	53	53	52	Substation Noise
10	03/11/21	13:12	51	53	52	51	Substation Noise
10	03/11/21	13:13	52	54	53	51	Substation Noise
10	03/11/21	13:14	50	51	50	49	Substation Noise

Location 1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Noise Level dB
14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00
Time hh:mm
LAeq
LAmax
LA10
LA90

Location 4


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Noise Level dB
14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00
Time hh:mm
LAeq
LAmax
LA10
LA90