



NOISE IMPACT ASSESSMENT IN SUPPORT OF
PLANNING CONDITION 16 DISCHARGE

COPTHORNE CARE HOME

HORIZON CONSTRUCTION LONDON

JULY 2026

NOISE IMPACT ASSESSMENT IN SUPPORT OF PLANNING CONDITION 16 DISCHARGE COPTHORNE CARE HOME

Our Ref: 9131_001R_1-0_MJ



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Date: 7 July 2026

Project No: 9131
Status: For Issue

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7 July 2026

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REVISION HISTORY

Version	Comments	Changes made by	Approved by
1-0	For issue	MJ	CB

1 INTRODUCTION

Anderson Acoustics Ltd was commissioned by Horizon Construction London to undertake a noise impact assessment for the proposed care home development at Off Turners Hill Road, Crawley.

The project has been granted planning permission subject to a number of planning conditions (planning reference DM/23/2961). An acoustic assessment is required to support the discharge of Planning Condition 16 (PC 16) imposed by West Sussex County Council, which relates to noise emissions from plant and machinery.

The proposed plant associated with the development comprises multiple ventilation plant and cooling and heating plant.

A noise survey was undertaken by Auracle Acoustics in August 2023 (document reference: '*Land to the north of Rowan & east of Turners Hill Rd - Noise Assessment - Condition 20 Report - 2024-04-10a*'), which forms the basis of this assessment.

This report is technical in nature and contains acoustic terminology. A glossary of terms used within this report can be found at www.andersonacoustics.co.uk/resources/acoustics-glossary.

2 DESIGN CRITERIA

Assessment guidance for the proposed external plant is summarised below. It should be considered in conjunction with the government's overarching planning principles with respect to noise including: Noise Policy Statement for England; National Planning Practice Framework and Planning Practice Guidance – Noise. These documents are summarised in Appendix A along with a description of relevant acoustic terminology.

2.1 Planning Condition 16

Planning permission (ref. DM/23/2961) was granted by Mid Sussex District Council subject to a number of planning conditions. Planning Condition 16 relates to noise emissions from fixed plant and machinery associated with the development and is the subject of this assessment. The condition states the following:

“The development hereby permitted shall not come into operation until a scheme has been submitted to and approved in writing by the Local Planning Authority demonstrating that the noise rating level ($L_{Ar,Tr}$) of plant and machinery within the development shall be at least 5dB below the background noise level ($L_{A90,T}$) at the nearest residential facade. All measurements shall be defined and derived in accordance with BS4142:2014+A1:2019. The assessment shall be carried out with the plant/machinery operating at its maximum setting. The approved measures shall be implemented before the development is brought into first use and thereafter be maintained in accordance with the approved details.

Reason: To protect the amenity of local residents and to accord with Policy DP29 of the Mid Sussex District Plan 2014-2031.”

The condition therefore requires an assessment of the proposed plant and machinery in accordance with BS 4142:2014+A1:2019 to demonstrate that noise emissions from the development will achieve the specified criterion at the nearest residential façade.

2.2 BS 4142:2014+A1:2019

BS 4142 provides methods for rating and assessing sound/noise of an industrial or commercial nature in relation to residential premises, hence its relevance here. The assessment methodology evaluates the “specific sound level” of each industrial or commercial sound source, corrects for distinguishable features to derive the “rating level”, and compares this with the “background sound level”.

The advice is that the background sound level ($L_{A90,T}$) should be derived from continuous measurement of normally not less than 15-minute intervals over the period of interest, and that it should not be the lowest level, but representative of typical conditions at the noise-sensitive receiver(s) relevant to the periods of operation.

The specific sound level ($L_{Aeq,T}$) is obtained (by measurement or calculation) over a reference period of 1 hour in terms of the daytime (07:00 to 23:00) and 15 minutes during the night-time (23:00 to 07:00).

The rating level ($L_{Ar,Tr}$) is the specific sound level corrected to account for any acoustic features present in the sound in question, as experienced at the receptor, such as distinguishable, discrete, continuous note (a whine, hiss, screech or hum etc.) or distinct impulses (bangs, clatters or thumps etc.). Where no correction is warranted, the rating level is equal to the specific level.

The “subjective method” to calculate the rating level incorporates the following corrections (particularly appropriate for new sources that cannot be measured in-situ):

- Up to +6 dB due to tonality, subjectively this might be +2 for a tone that is just perceptible, +4 where it is clearly perceptible and +6 where it is highly perceptible.
- Up to +9 dB for impulsivity, subjectively this might be +3 for impulsivity that is just perceptible, +6 where it is clearly perceptible and +9 where it is highly perceptible; and
- Up to +3 dB for other acoustic features that are neither tonal nor impulsive, though readily distinctive at the receptor.

An “initial estimate” of the impact of the specific sound is calculated by subtracting the measured background sound level from the rating level. The following advice applies:

- 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.

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.

Where the initial estimate of the impact needs to be modified due to the context, the assessment should take into account all pertinent factors, including:

- the absolute level of sound
- the character and level of the residual sound compared to the character and level of the specific sound, and
- the sensitivity of the receptor and whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions

Helpfully, BS 4142 includes some example assessments. In one example, it is concluded that:

“In addition to the rating/background sound level comparison...” where “the primary concern is the potential for disturbance of residents who could be sleeping with open bedroom windows... Other guidance, such as BS 8233, might also be applicable in this instance.”

An assessment, therefore, is effectively in two parts. The first part results in an initial indication of the impact, which is subsequently considered in terms the context unique to the situation at hand; and where this second part may require consideration of alternative guidance and metrics.

3 SITE DESCRIPTION

3.1 Existing Site

The application site is located on land off Turners Hill Road, Crawley Down, West Sussex. The site is surrounded by a mixture of residential and highway infrastructure. The nearest noise-sensitive receptors comprise existing residential properties in the surrounding area.

The Auracle Acoustics noise assessment undertaken in August 2023 (document reference: “*Land to the north of Rowan & east of Turners Hill Rd - Noise Assessment - Condition 20 Report - 2024-04-10a*”) notes that the prevailing acoustic environment at the site is influenced primarily by road traffic on the B2028 Turners Hill Road, which runs to the west of the site. Additional road traffic noise arises from the A264 Snow Hill to the south, while a bus depot located to the south-east may also make a minor contribution to the local sound environment. The report also notes that Chapel Lane, located to the north of the site, carries very little traffic and is not considered to be a significant noise source.

A baseline noise survey undertaken by Auracle Acoustics in August 2023 forms the basis of the existing acoustic environment considered within this assessment.

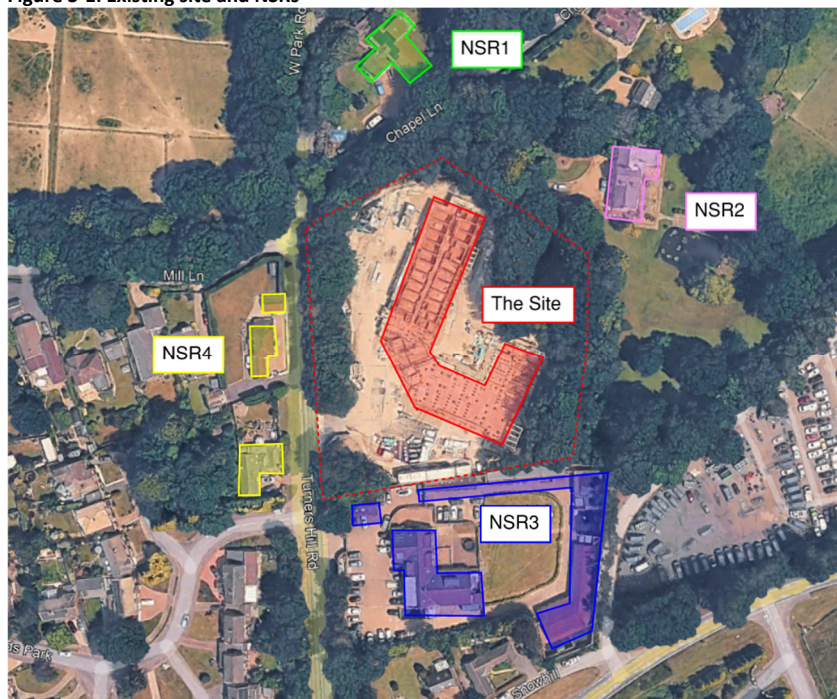
The following worst-case NSRs (Noise Sensitive Receptors) have been identified:

- NSR1: Residential houses located to the north of the development, near Chapel Ln.
- NSR2: Residential houses situated to the east of the development, Chapel Ln.
- NSR3: Assisted living residence dwellings located to the south of the development, near Turners Hill Road.
- NSR4: Residential houses located to the west of the development, near Turners Hill Road.

Figure 3-1 illustrates the existing site layout and the identified NSRs.

The existing noise environment at the proposed development site and at the nearest noise sensitive premises has been considered and discussed in Section 4.

Figure 3-1: Existing site and NSRs



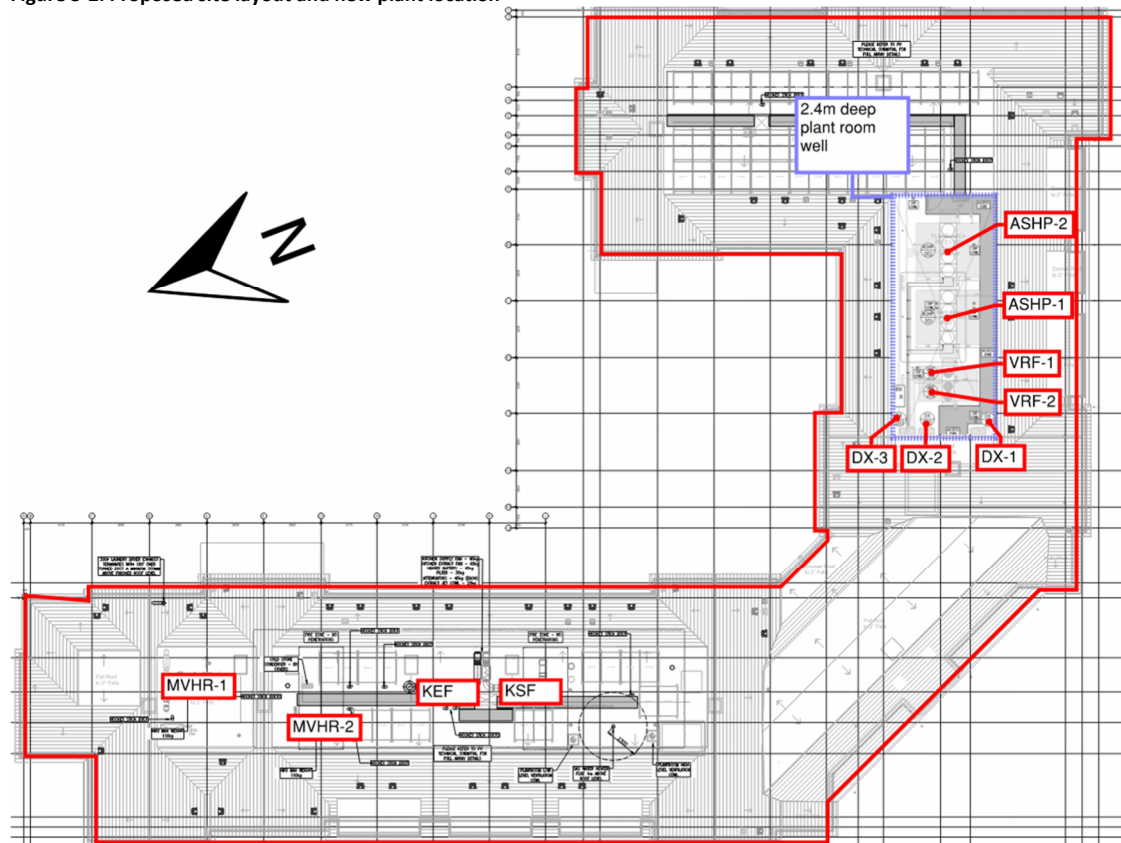
3.2 Proposed Development and Installations

A number of new externally located plant items have also been proposed to service the development, including multiple MVHR atmosphere outlets located on the building's façade, two externally located MVHR units, one kitchen supply fan (KSF), one kitchen extract fan (KEF), two ASHPs, two VRF systems, and three DX units.

The proposed ASHPs, VRF units and DX units are all located within a recessed rooftop plant well, with all cooling plant having an overall height lower than the depth of the enclosure. The plant well is formed by permanent building structures and extends approximately 2.4 m below the surrounding roof level, providing substantial screening between the cooling plant and the nearest noise-sensitive receptors. As a result, direct line of sight between the cooling plant and surrounding receptors is significantly restricted, reducing the propagation of noise from these sources. The inherent acoustic screening afforded by the plant well has been included within the 3D noise model (see Section 5.6).

Figure 3-2 illustrates the proposed development layout, showing the location of the new external plant items. Details of the proposed plant items and their operational times are provided in Section 5.

Figure 3-2: Proposed site layout and new plant location



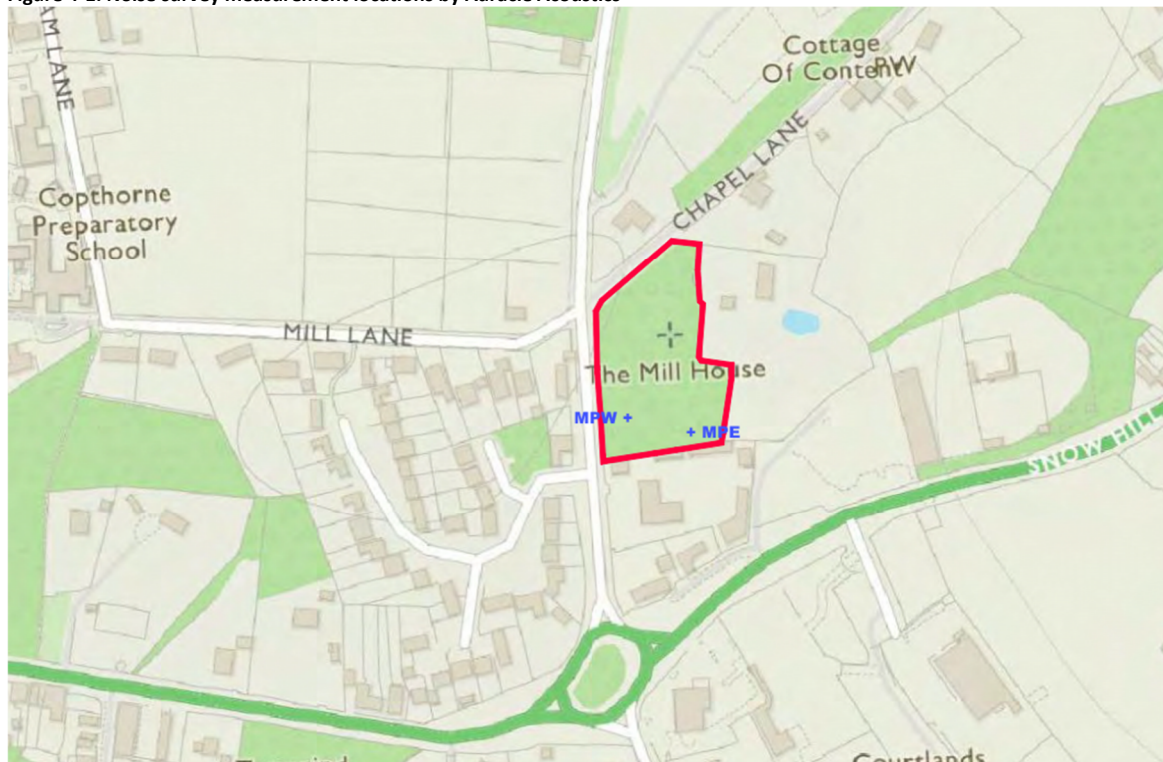
4 NOISE SURVEY

The Auracle Acoustics noise assessment (document reference: “*Land to the north of Rowan & east of Turners Hill Rd - Noise Assessment - Condition 20 Report - 2024-04-10a*”), included in Appendix B for reference, outlines the environmental noise survey undertaken to establish the existing acoustic environment at the site. The survey was undertaken over a 24-hour period between 15:00 on 9 August 2023 and 15:00 on 10 August 2023 using unattended monitoring at two locations, MPW and MPE. The survey identified road traffic as the dominant noise source, primarily associated with Turners Hill Road to the west of the site, with lesser contributions from the wider road network. The monitoring results demonstrate that MPE was noticeably quieter than MPW, particularly during the night-time period, reflecting its greater separation from Turners Hill Road and the corresponding reduction in road traffic influence.

A detailed review of the survey data was undertaken as part of this assessment. It was noted that representative background sound levels were not specifically derived within the Auracle Acoustics report for BS 4142 assessment purposes. Instead, overall daytime and night-time L_{A90} values were reported for each monitoring position, which is not indicative of a typical lowest background noise environment required by BS 4142, together with a breakdown of hourly measurement data. As no shorter-term background sound level data were available, the hourly L_{A90} results were reviewed to establish representative background sound levels for assessment purposes.

Figure 4-1 shows the measurement locations. Please refer to the Auracle Acoustics report attached in Appendix B for full survey details.

Figure 4-1: Noise survey measurement locations by Auracle Acoustics



5 PLANT NOISE ASSESSMENT

5.1 Assessment Criteria

Planning Condition 16 requires the rating level of fixed plant and machinery noise to be at least 5 dB below the representative background sound level at the nearest residential façade, with the assessment undertaken in accordance with BS 4142:2014+A1:2019.

A detailed review of the Auracle Acoustics survey data was undertaken. Whilst the survey reports overall daytime and night-time L_{A90} values for monitoring positions MPW and MPE, it does not derive representative or typical background sound levels in the manner commonly adopted for BS 4142 assessments. The report also does not include the 15-minute measurement interval L_{A90} data that would typically be reviewed when establishing representative background sound levels. Instead, the survey data is presented as a series of hourly measurement intervals.

The Auracle Acoustics survey data demonstrates that monitoring position MPE is consistently quieter than MPW, particularly during the night-time period. This is consistent with the observations reported by Auracle Acoustics, which identify road traffic as the dominant noise source affecting the site, with MPE located further from Turners Hill Road than MPW. Given the absence of 15-minute measurement data, MPE has been adopted as the worst-case assessment location for all NSRs to ensure a robust and conservative approach in deriving representative background sound levels.

L_{A90} measurements were assessed and the modal daytime and night-time background sound levels were used to derive representative values for the assessment. On this basis, representative typical background sound levels of 49 dB $L_{A90,T}$ during the daytime period and 35 dB $L_{A90,T}$ during the night-time period were adopted. These values are considered representative of the typical prevailing acoustic environment at the nearest noise-sensitive receptors and provide a robust basis for demonstrating compliance with Planning Condition 16.

Accordingly, the target rating levels for fixed plant and machinery noise are as follows:

- **Daytime:** 44 dB $L_{Ar,Tr}$ (49 dB $L_{A90,T}$ minus 5 dB)
- **Night-time:** 30 dB $L_{Ar,Tr}$ (35 dB $L_{A90,T}$ minus 5 dB)

5.1.1 Low Background Sound Levels

In environments where background sound levels routinely fall below, or are close to, 30 dBA, it may be more appropriate to adopt an absolute rating limit to avoid overly stringent criteria driven by unusually low background sound levels. Within such contexts, a specific or rating level of approximately 30 dBA $L_{Ar,Tr}$ is often considered an appropriate and proportionate threshold, balancing the protection of residential amenity with the practical feasibility of achieving lower plant noise levels. As such, the 30 dB $L_{Ar,Tr}$ criterion derived from the modal hourly night-time background sound level is considered appropriate for the purposes of this assessment.

5.2 Plant Operational Times

As a worst-case conservative assumption, it has been assumed that all plant will operate continuously during the night-time period, including the KSF and KEF, which are unlikely to operate during the night-time period.

5.3 Plant Noise Data

Table 5-1 details proposed externally located plant items.

Table 5-1: Details of proposed equipment

Reference	Type of Plant	Manufacturer/ model	Proposed Operating Hours
ASHP-1 and 2	Air Source Heat Pump	Mitsubishi / EAHV-M1500YCL(-N)	Operating at all times
VRF-1	VRF Heat Pump	Mitsubishi / PURY-P300YNW-A2	Operating at all times
VRF-2	VRF Heat Pump	Mitsubishi / PURY-P400YNW-A2	Operating at all times
DX-1	Direct Expansion Unit	Mitsubishi / PUZ-ZM50VKA2	Operating at all times
DX-2 and 3	Direct Expansion Unit	Mitsubishi / PUZ-ZM200YKA2	Operating at all times
KEF	Kitchen supply fan	Systemair / MUB/T-S 042 400EC	Daytime only ¹
KSF	Kitchen extract fan	Systemair / MUB 042 450DV	Daytime only ¹
MVHR-1	Heat Recovery Unit	Mitsubishi / LGH-160RVX3-E	Operating at all times
MVHR-2	Heat Recovery Unit	Mitsubishi / LGH-35RVX3-E	Operating at all times

1 – As a conservative assumption to support robust assessment, plant assumed to operate during night-time and daytime periods

Manufacturer's acoustic data was provided by the project M&E engineers for all proposed plant items. The available data comprised a combination of sound power levels (SWL) and sound pressure levels (SPL) measured at 1 metre from the equipment. Where octave band sound power spectra were not provided by the manufacturer, octave band data for similar plant of the same make and type, obtained from previous project experience, was used to establish an appropriate spectral profile. The adopted octave band spectra were subsequently calibrated to ensure consistency with the overall dBA sound pressure levels reported by the manufacturer.

For the purposes of noise modelling, plant items for which only sound pressure level data was available were converted to equivalent sound power levels prior to being entered into the CadnaA 3D noise model. This approach ensured that all plant sources were assessed using a consistent methodology while maintaining agreement with the manufacturer's published acoustic performance data. Assessment methodology further detailed in Section 5.4.

The following noise data has been used in the assessment:

Table 5-2: Manufacturer's externally located plant noise data

Plant	Data type	Sound Power/Pressure Levels, dB, at Octave Band Centre Frequency, Hz							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
ASHP-1	SPL at 1 m	78	78	75	74	73	69	64	60
ASHP-2	SPL at 1 m	78	78	75	74	73	69	64	60
VRF-1	SPL at 1 m	76	76	73	72	71	67	62	58
VRF-2	SPL at 1 m	78	78	75	74	73	69	64	60
DX-1	SWL	74	71	68	64	62	58	56	49
DX-2	SPL at 1 m	77	74	71	67	65	61	59	52
DX-3	SPL at 1 m	77	74	71	67	65	61	59	52
KEF	Casing radiated noise, SWL	64	73	64	52	49	44	36	27
KSF	Casing radiated noise, SWL	58	60	54	44	41	40	33	23
MVHR-1	Casing radiated noise, SWL	70	66	59	50	44	38	33	28
MVHR-2	Casing radiated noise, SWL	58	52	46	36	32	28	25	23

5.3.1 MVHR, KEF and KSF atmosphere side terminations

Specific attenuator selections have not yet been finalised at this stage. To minimise noise emissions from the MVHR, KEF and KSF atmosphere terminations, it is recommended that suitably selected in-duct attenuators are incorporated within the ventilation systems and designed to achieve a maximum noise level of 40 dBA at 1 m from each termination. This approach has been coordinated with the project M&E engineers.

On this basis, noise from the atmosphere terminations of ventilation plant is not expected to make a significant contribution to the overall plant noise levels at the nearest noise-sensitive receptors and has therefore not been considered a determining source within this assessment.

5.4 Prediction Methodology

Predictions are based on the information supplied by Harniss Ltd within the technical document submittal, manufacturers published sound power levels corresponding to the proposed plant shown in the specification document and mechanical and electrical services layout drawings.

DataKustik's "CadnaA" modelling software has been used to determine the specific sound levels at 1 m from the nearest noise sensitive receptors.

Predictions have been carried out in accordance with the ISO 9613-2:1996 '*Acoustics. Attenuation of sound during propagation outdoors - General method of calculation*' prediction methodologies, which allow consideration of the effects of the acoustic screening provided by the existing buildings surrounding the application site, the topographical conditions throughout the area, ground absorption, atmospheric absorption, acoustic reflections and acoustic screening, as well as applying a light downwind propagation correction to represent a worst-case.

3D modelling details are as follows:

- › The topography across the development site and surrounding area has been rendered within the model using 1 m LIDAR data provided by DEFRA.
- › Receivers have been set at a height of 1.5 m above local ground level. For multistorey buildings, receivers are set at a height of 1.5 m above ground level, then 3.0 m for each additional storey.
- › Ground modelled as a mix between soft and hard and reflective due to proximity of roads/carparks and fields towards the nearest receptors (i.e. $G = 0.5$).
- › Buildings set to acoustically reflective, plant items modelled as point sources, order of reflections set to 3.

The reported sound pressure levels were converted to equivalent sound power levels using the following formula:

$$L_W = L_p + 10 \cdot \log \left(\frac{Q}{4\pi \cdot r^2} \right)$$

5.5 Acoustic Characteristics

As ASHP, VRF and DX units typically start and stop gradually, in a similar manner to fan-based plant equipment such as AHUs, KEFs and KSFs, no impulsive acoustic characteristics are expected.

Furthermore, whilst 1/3-octave band data was not available for all plant items, octave band data obtained from similar plant type, informed by previous project experience, was reviewed to establish representative spectral profiles. This review did not identify any characteristics indicative of tonal noise. Accordingly, no acoustic character corrections have been applied to these plant sources.

It should also be noted that background sound levels at the assessment locations are relatively low and the proposed plant has been designed to achieve noise levels below the representative background sound level.

Therefore, any residual acoustic characteristics associated with the plant are unlikely to be perceptible at the nearest noise-sensitive receptors.

5.6 Predicted Specific Noise Level

Figures below present the predicted worst-case specific sound levels at noise sensitive receptor façades (free-field) near to the development site. It is also noted that predictions have been made assuming 100% operating duty in line with noise data provided within manufacturer technical data.

Figure 5-1: Predicted specific plant noise levels at the nearby NSRs (1 m from façade, free-field)

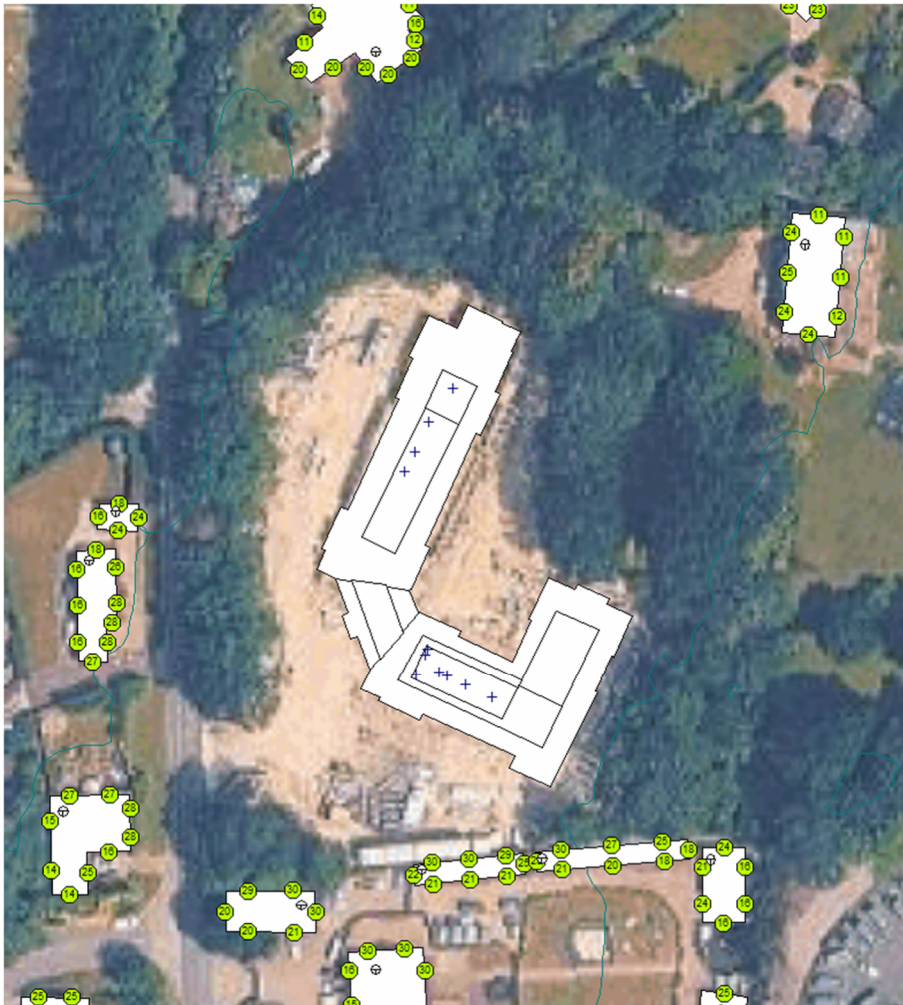
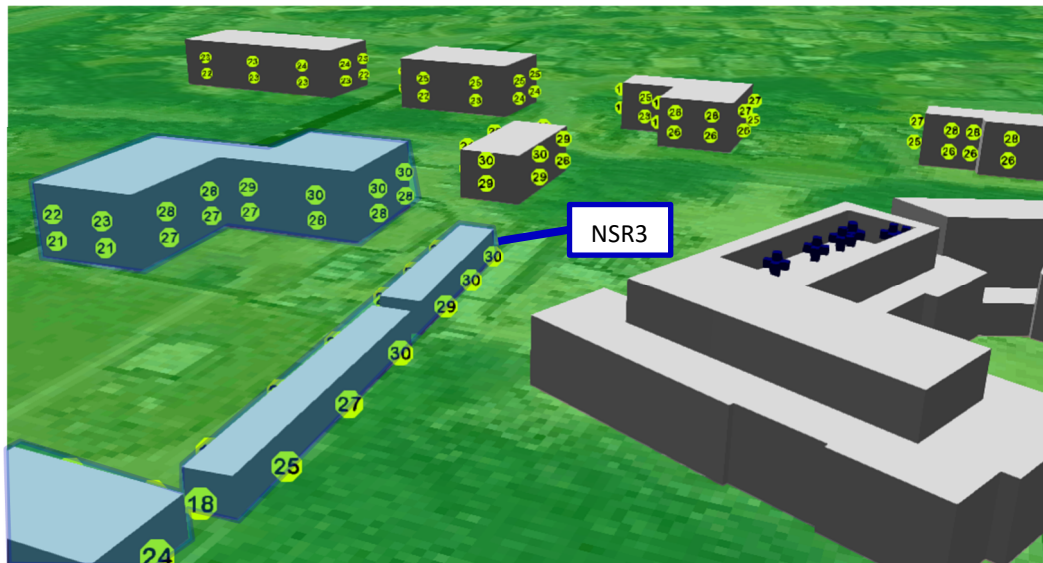


Figure 5-2: 3D view of the worst-case NSR3 and the development in CadnaA noise model



5.7 Noise Impact Assessment

NSR3 located immediately south from the development is the most affected by plant noise. Details of the assessment at the worst-case NSR3 provided in the Table 5-3 below. Predictions indicate that plant noise levels from all plant is within the worst-case night-time limit of 30 dB $L_{A,r,Tr}$.

Table 5-3: Noise Impact Assessment

Description	NSR3 (worst case)
Maximum Predicted Specific Sound Level, $L_{Aeq,T}$, worst-case at NSR3	30 dB
Acoustic Penalties (None)	+ 0 dB
Rating Level, $L_{A,r,Tr}$	30 dB
Night-time Rating Level Limit, $L_{A,r,Tr}$ (worst-case)	30 dB
Excess of calculated Rating Level over Target Rating Level	0 dB

The assessment indicates that the proposed plant is predicted to operate within the established plant noise limits at all assessed receptors during both the daytime and night-time periods. Given the conservative assumptions adopted throughout the assessment, including the use of worst-case operating conditions and background sound level criteria, the predicted noise levels are considered robust. Accordingly, no additional acoustic mitigation measures are required to achieve compliance with the established plant noise criteria. As such, Planning Condition 16 is expected to be satisfied.

5.8 Uncertainty in Calculations

- Distance propagation from specific sound source to receiver based on scale drawings; any slight differences in distance are expected have negligible effect on the assessment
- Calculations rounded up to nearest dB
- During normal operation and with the proposed mitigation measures in place, the proposed plant is not expected to exhibit any impulsive or tonal characteristics that would warrant a correction penalty
- Unable to validate predicted specific sound level with measurements as the plant is yet to be installed
- Assumes all plant running simultaneously at 100% capacity throughout the assessment period to provide a worst-case

5.8.1 Uncertainty Summary

The effect of uncertainty on the outcome of the assessment is not considered to be significant.

6 SUMMARY

Anderson Acoustics was commissioned by Horizon Construction London to undertake a noise impact assessment in support of the discharge of Planning Condition 16 associated with the proposed care home development off Turners Hill Road, Crawley (planning reference DM/23/2961). The assessment considered noise emissions from the proposed building services plant, comprising ASHPs, VRF units, DX units, kitchen ventilation systems and MVHR units.

Representative background sound levels were derived from a review of the available hourly L_{A90} measurements, as 15-minute measurement interval data was not available within the Auracle Acoustics survey. To ensure a robust assessment, conservative assumptions were adopted throughout, including the use of worst-case plant operating conditions, simultaneous operation of all plant items at maximum duty, and the adoption of the most acoustically sensitive monitoring location as the basis for the assessment.

A 3D CadnaA noise model was developed to predict noise emissions from the proposed plant at the nearest noise-sensitive residential receptors. The assessment was undertaken in accordance with BS 4142:2014+A1:2019 and the requirements of Planning Condition 16, which requires plant noise to remain at least 5 dB below the representative background sound level.

The assessment indicates that the proposed plant is predicted to operate within the established noise criteria at all assessed receptors during both the daytime and night-time periods.

In conclusion, the proposed plant is expected to comply with the requirements of Planning Condition 16 without the need for additional acoustic mitigation measures. As such, Planning Condition 16 is expected to be satisfied.



APPENDIX A

NOISE POLICY

Noise Policy Statement for England (NPSE, 2010)

The NPSE is the Government's overarching statement on noise policy for England, and applies to all forms of noise other than occupational noise, setting out the long-term vision of Government noise policy, which is to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

Which is supported by the following noise policy aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- a) *Avoid significant adverse impacts on health and quality of life;*
- b) *Mitigate and minimise adverse impacts on health and quality of life; and*
- c) *Where possible, contribute to the improvement of health and quality of life.*

When discussing the meaning of significant adverse and adverse within an Explanatory Note, the NPSE states:

There are two established concepts from toxicology that are currently being applied to noise impacts for example, by the World Health Organisation. They are

NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

To which the NPSE added the following related concept:

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

The Explanatory Note continues:

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three aims listed above. Logically, it starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL, when *“all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development.”* The final aim envisages proactive management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

National Planning Policy Framework (NPPF)

First published in 2012, and most recently updated in December 2024, the NPPF sets out the Government's planning policies for England, and how these are expected to be applied. Noise is referenced within the NPPF as follows. These are effectively the NPPF's policies on noise.

187. Planning policies and decisions should contribute to and enhance the natural and local environments 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...*

198. 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 life⁷²...*

Reference number 72 of the above quotation points to the Explanatory Note to the NPSE (see above).

The following policy is also relevant to noise.

200. *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.*

As mentioned above, the Government has published accompanying web-based planning guidance for a number of categories, including noise (see below).

Planning Practice Guidance, Noise (PPG-N, 2019)

Following initial release in 2014, the planning practice guidance now forms part of the NPPF, referred to as relevant planning practice guidance, which includes guidance on the category of Noise. The guidance is often referred to as PPG-Noise, PPG-N or PPG(N).

In keeping with the NPSE and NPPF, no values (in dB) are presented; however, plenty of guidance is provided as to the issues to consider in assessing noise and determining suitable thresholds.

A noise exposure hierarchy table is provided, which summarises the noise exposure hierarchy based on the likely average response of those affected, and is reproduced below. It includes examples of outcomes relevant to the NOEL, LOAEL and SOAEL effect thresholds described in the NPSE. These outcomes are in descriptive form; there is no numerical definition of the NOEL, LOAEL and SOAEL.

Table A-1: Noise exposure hierarchy table (as per PPG-N)

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			

Response	Examples of outcomes	Increasing effect level	Action
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

It is left to other guidance documents (e.g. BS 8233) and professional opinion to determine thresholds where required.



APPENDIX B

NOISE SURVEY REPORT

Proposed residential care home development at

Land to the north of Rowan
and east of Turners Hill Road
Crawley Down, West Sussex

Noise Assessment addressing Planning Condition 20

Report prepared on behalf of:

Barchester Healthcare

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Owen Clingan BSc (Hons) MIOA FRSA – 10 April 2024

Limit of liability

This report has been prepared in connection the site identified on the title page on behalf of and for the benefit of Barchester Healthcare only.

No responsibility to any other party is intended or implied.

Liability is limited to a period of 6 years from the date of the report.

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Chapter 1 - Introduction

Planning consent has been granted for a residential care home development on land to the north of Rowan and east of Turners Hill Road, Crawley Down, West Sussex. The location of the site is shown in Figure 1, while the proposed development is shown in Figures 2A to 2I.

The site is potentially affected by noise arising from the B2028, Turners Hill Road, which lies to the west of the site, and to a lesser extent by noise arising from the A264, Snow Hill to the south and a bus depot to the south-east. Chapel Lane to the north of the site carries very little traffic and has no potential to affect the development site.

Planning Condition 20 of the consent states:

“ACOUSTIC PROTECTION

No development shall take place until a scheme for protecting the proposed residential units from noise generated by traffic or other external sources, has been submitted to, and approved in writing by, the Local Planning Authority. All works that form part of the scheme shall be completed in accordance with the approved details before any part of the noise sensitive development is occupied.

Unless otherwise agreed in writing, the submitted scheme shall demonstrate that the maximum internal noise levels in bedrooms post construction will be 30 dB LAeq T (where T is 23:00 - 07:00) and in bedrooms and living rooms will be 35 dB LAeq T (where T is 07:00 - 23:00). Noise from individual external events typical to the area shall not exceed 45 dB L_{Amax} when measured in bedrooms internally between 23:00 and 07:00, post construction.

In the event that the required internal noise levels can only be achieved with windows closed, then the applicant shall submit details of an alternative means of ventilation with sufficient capacity to ensure thermal comfort of the occupants with the windows closed.

Unless agreed in writing, noise levels in gardens and outdoor living areas shall not exceed 55 dB LAeq 1 hr when measured at any period.

Details of post installation acoustic installation testing shall be submitted to and approved in writing by the Local Planning Authority upon request.

If it cannot be demonstrated that the aforementioned sound levels have been achieved, a scheme incorporating measures to achieve those sound levels shall be submitted for the written approval of the Local Planning Authority. All works comprised within those measures shall be completed and written evidence to demonstrate that the aforementioned sound levels have been achieved shall be submitted to and approved in writing by the Local Planning Authority before the development is first brought into use.”

A noise assessment has therefore been undertaken on the basis of:

- a noise monitoring exercise employing two monitoring positions on the site;
- a noise prediction exercise using a noise model; and
- an assessment taking account of appropriate national guidance documents and the requirements of Condition 20 set out above.

It is assumed that the daytime noise limit specified in Planning Condition 20 above is intended to apply to the residential bedrooms and that communal lounge areas only, with a more relaxed noise limit being appropriate for other, less sensitive rooms, for example dining rooms and offices.

Additionally, it is noted that established guidance documentation that is relevant in this case permits:

- a maximum noise level of 45 dB L_{AFmax} to be exceeded in bedrooms up to 10 to 15 times per night in bedrooms; and
- noise levels not exceeding 55 dB $L_{Aeq,16h}$ in gardens and outdoor living areas, averaged over the entire daytime period 07.00 to 23.00 hours.

Chapter 2 – Noise assessment criteria

A glossary of acoustical terms is reproduced in Appendix A.

The assessment has been undertaken using the guidance provided by:

- National Planning Policy Framework (NPPF) (Ref 1);
- Noise Policy Statement for England (NPSE) (Ref 2);
- BS8233: 2014 ‘Guidance on sound insulation and noise reduction for buildings’ (Ref 3);
- Professional Practice Guidance on Planning & Noise (ProPG) (Ref 4);
- Acoustics, Ventilation and Overheating Residential Design Guide (AVO Guide) (Ref 5);
- Building Regulations Approved Document F ‘Ventilation’ (Ref 6);
- Building Regulations Approved Document O ‘Overheating’ (Ref 7);
- Planning Practice Guidance on Noise provided on the UK Government website (Ref 8); and
- the local planning authority in the form of Planning Condition 20.

These reference documents and standards are discussed below.

2.1 National Planning Policy Framework

The current edition of the National Planning Policy Framework was published on 24 July 2018 and came into force with immediate effect. It supersedes the original edition of the NPPF issued in March 2012, which was formerly the central national planning guidance document relating to noise in the UK.

Paragraph 1 of the document states:

“The National Planning Policy Framework sets out the Government’s planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.”

Paragraph 7 of the document states:

“The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

Three overarching objectives of the planning system are identified, an economic objective, a social objective and an environmental objective.

Paragraph 10 of the document states:

“So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development (paragraph 11).”

As is to be expected, much of the document deals with strategic planning issues such as delivering a sufficient supply of homes, building a strong, competitive economy and ensuring the vitality of town centres.

Specific references to noise are limited, but occur in:

- paragraph 170, which 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”;
- paragraph 180, which states:
“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”;
- paragraph 204, which states:
“Planning policies should:
g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction”; and
- paragraph 205, which states:
“When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy⁶⁵. In considering proposals for mineral extraction, minerals planning authorities should:
c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties”.

Additionally, the document refers to the Explanatory Note to the Noise Policy Statement for England.

2.2 Noise Policy Statement for England

The Noise Policy Statement for England was published by the Department for Environment, Food and Rural Affairs (Defra) in March 2010. The complete document includes the Policy Statement itself and an Explanatory Note.

Key concepts used in the NPSE are:

- NOEL or “no observed effect”, meaning the level (of noise) below which no effect on health or quality of life can be detected;
- LOAEL or “lowest observed adverse effect”, meaning the level (of noise) above which adverse effects on health and quality of life can be detected; and
- SOAEL or “significant observed adverse effect”, meaning the level (of noise) above which significant adverse effects on health and quality of life can occur.

The first aim of the NPSE is to: “Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of the policy on sustainable development”.

The second aim of the NPSE is to: “Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of the policy on sustainable development”.

The third aim of the NPSE is to: “Where possible, contribute to the improvement of health and quality of life through the effective management of environmental, neighbour and neighbourhood noise within the context of the policy on sustainable development”.

The second aim refers to the situation lies somewhere between LOAEL and SOAEL.

However, paragraph 2.3 of the Explanatory Note makes it clear that the approach to the minimisation of noise from environmental and related sources should be reasonable and balanced in stating:

- “2.3 Furthermore, the broad aim of noise management has been to separate noise sources from sensitive noise receivers and to “minimise” noise. Of course, taken in isolation and to a literal extreme, noise minimisation would mean no noise at all. In reality, although it has not always been stated, the aim has tended to be to minimise noise ”as far as reasonably practical”. This concept can be found in the Environmental Protection Act 1990, where, in some circumstances, there is a defence of “best practicable means” in summary statutory nuisance proceedings.

2.3 BS8233: 2014 ‘Guidance on sound insulation and noise reduction for buildings’

BS8233: 2014: ‘Guidance on sound insulation and noise reduction for buildings’ provides guidance on indoor ambient noise levels for dwellings which are applicable in this case and which are set out in Table 4 of the document. These are set out below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB LAeq,16h	-
Dining	Dining room / area	40 dB LAeq,16h	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq,16h	30 dB LAeq,16h

A note to this table states:

“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.”

Allowing for this relaxation the figures in Table 4 are as set out below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	40 dB LAeq,16h	-
Dining	Dining room / area	45 dB LAeq,16h	-
Sleeping (daytime resting)	Bedroom	40 dB LAeq,16h	35 dB LAeq,16h

The 1999 edition of the document also included an internal maximum noise level standard for bedrooms at night, although this does not appear in the current version. In accordance with World Health Organisation (WHO) guidance (which is still current), the 1999 edition recommended that an internal noise level of 45 dB LA_{max} should be exceeded no more than approximately 10 to 15 times per night in bedrooms.

In respect of noise levels in garden areas BS8233: 2014 states:

“For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized 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, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.”

Paragraph 6.2.2 of the document also states that for moderate and heavy traffic flows a 16-hour LAeq noise level can be derived from an 18-hour LA₁₀ level by subtracting 2 dB. This conversion factor was previously provided in Planning Policy Guidance note 24 ‘Planning and Noise’ (PPG24).

2.4 Professional Practice Guidance on Planning & Noise

This guidance document was published jointly by Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH) in May 2017. The foreword of the document states:

“This Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

“The National Planning Policy Framework (NPPF) encourages improved standards of design. The CIEH, IOA and the ANC have worked together to produce this guidance which

encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

“Good acoustic design is about more than the numbers. It is a holistic design process that creates places that are both comfortable and attractive to live in, where acoustics is considered integral to the living environment.

“Good acoustic design can involve, for example, careful site layouts and better orientation of rooms within dwellings. Good acoustic design does not mean “gold plating” or significantly increasing costs. This guidance seeks to encourage and promote design outcomes that are proportionate and reasonable in the particular circumstances of each development site.”

To these ends, Chapter 2 the document sets out a recommended approach for new residential development, which includes two sequential stages in the overall approach, which are:

- Stage 1 - an initial noise risk assessment of the proposed development site; and
- Stage 2 - the systematic consideration of four key elements in the site layout and design process.

The noise risk assessment of Stage 1 is to “provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective. The document provides guidance on this assessment in graphical form in Figure 1.

The four elements of Stage 2 (which should be undertaken in parallel) are:

- Element 1 – demonstrating a “Good Acoustic Design Process”;
- Element 2 – observing internal “Noise Level Guidelines”;
- Element 3 – undertaking an “External Amenity Area Noise Assessment”; and
- Element 4 – consideration of “Other Relevant Issues”.

In this context the document states:

“2.5 The approach is underpinned by the preparation and delivery of an “Acoustic Design Statement” (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk.

“2.6 Having followed this approach to its end, it is envisaged that noise practitioners will then have a choice of one of four possible recommendations to present to the decision maker. In simple terms the choice of recommendation is as follows: grant without conditions, grant with conditions, “avoid” or “prevent” (see Section 3).”

(Section 3 provides additional information on the four possible recommendations that are to be made by the noise practitioner to the decision maker.)

Paragraph 2.12 of the document states:

“2.12 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design.”

Paragraph 2.33 of the document states:

“2.33 It should be noted that the acoustic performance of the building envelope will be reduced in the event windows are opened for ventilation or cooling purposes, typically reducing the insulation to no more than 10 to 15 dB(A). Most residents value the ability to open windows at will, for a variety of reasons, and LPAs should therefore normally request that designers principally aim, through the use of good acoustic design, to achieve the internal noise level guidelines in noise-sensitive rooms with windows open. Where internal noise levels are assessed with windows closed the justification for this should be included in the ADS.”

Section 3 sets out four possible recommendations that noise practitioners should make to decision makers, which are:

- “A. Planning consent may be granted without any need for noise conditions;
- B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
- C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects (“avoid”); or
- D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects (“prevent”).”

A summary of the overall ProPG approach is illustrated in Figure 4 of the document.

Section 4 of the document deals with the provision of specialist assistance.

Appendix A of the ProPG is entitled “Dealing with Noise Events” provides additional information on the consideration of individual noise events such as those arising from transportation sources at night, where sleep disturbance may be an issue.

2.5 Acoustics, Ventilation and Overheating Residential Design Guide

The Acoustics Ventilation and Overheating – Residential Design Guide was published by the Association of Noise Consultants (ANC) in January 2020. This followed the publishing of the Draft for Consultation published in March 2018.

The Guide promotes an approach to environmental noise assessments for new residential developments that takes account of the interdependence of any acoustic measures that may be required, the ventilation

provision and the need to avoid overheating, demonstrating how the competing aspects of thermal and acoustic comfort can be managed.

Specific recommendations made by the document are concerned with transportation noise only, and does not consider noise arising from industrial, commercial or entertainment noise sources. However, it does consider the noise that may arise from any mechanical ventilation systems that may be required.

The aims of the Guide are set out in paragraph 1.14, which states:

“1.14 The AVO Guide seeks to:

- encourage an assessment of noise that recognises the interdependence between the acoustics, ventilation and overheating designs;
- provide a means of assessment to satisfy the need to consider acoustics, ventilation and overheating at the planning stage;
- assist in educating clients, environmental health / planning officers and other stakeholders of the interdependence of design for acoustics, ventilation and overheating.”

In respect of the concept of Good Acoustic Design as promoted by the ProPG, paragraph 1.19 of the AVO Guide states:

“1.19 The ProPG emphasises the importance and principles of good acoustic design; the AVO Guide is intended to contribute to the practice of good acoustic design. It is noted that the overarching aspiration of good acoustic design is that residents may open windows without any adverse acoustic impact (ProPG para. 2.33); where a site layout achieves these conditions, the portion of the AVO Guide relating to environmental noise is not applicable.”

The Guide then goes on to state:

“1.20 In particular, the paragraphs 2.34 – 2.36 of the ProPG indicate that an integrated design approach must be taken to acoustic, ventilation and thermal comfort conditions:

- Para 2.34: ‘design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort’
- Para 2.36: ‘[where a] scheme is reliant on open windows to mitigate overheating, it is also necessary to consider the potential noise impact during the overheating condition. In this case a more detailed assessment of the potential impact on occupants should be provided in the ADS’.”

and:

“1.20 In addition, Para 2.38 says: ‘Where mechanical services are used as part of the ventilation or thermal comfort strategy for the scheme, the impact of noise generated by these systems on occupants should also be assessed’.”

Chapter 2 of the Guide is concerned with relevant legislation and guidance relating to ventilation, overheating and acoustics. Paragraph 2.4 of this chapter acknowledges that Approved Document F of the Building Regulations (ADF) states that:

“Ventilation may also provide a means to control thermal comfort but this is not controlled under the Building Regulations”.

Paragraph 2.4 then goes on to state:

“However, it is important to differentiate between the need to provide ‘purge ventilation’ as required occasionally under ADF (ie to remove smoke from burnt food etc); against the need to provide ventilation for the ‘overheating condition’ which is not covered by the Building Regulations.”

The four template ventilation systems that comply with the ventilation requirements for new dwellings that are described in ADF are summarised in Table 2-2 of the AVO Guide.

Chapter 2 of the guide also states that overheating is taken to mean:

“the phenomenon of excessive or prolonged high temperatures in homes, resulting from internal or external heat gains, which may have adverse effects on the comfort, health or productivity of the occupants.”

Paragraph 2.15 makes reference to the Overheating Risk – Early Stage Tool included in the document ‘Overheating in New Homes’ published by the Good Homes Alliance (GHA), confirming that this may be used to evaluate overheating risk at the stage that the acoustic assessment is carried out.

In considering cooling strategies that may be applied to dwelling Chapter 2 of the Guide states:

“2.19 In accordance with sustainable design and construction principles, development proposals should, amongst other things, maximise opportunities to orientate buildings and streets to minimise summer and maximise winter solar gains; use trees and other shading; increase green areas in the envelope of a building, including its roof and environs; and maximise natural ventilation. These sustainable design principles mirror good acoustic design as described in the ProPG. More information is available in paragraph A.19.

“2.20 To minimise the risk of overheating in most residential buildings it is normally necessary to use some form of cooling system. The three main methods of providing additional cooling are:

- Passive ventilative cooling – Introducing external air to a space to provide a cooling effect without the use of fans. The most common method is to use open windows but other façade openings can also be used.
Note that trickle vents do not enable sufficient airflow to have a significant cooling effect.
- Mechanical ventilative cooling – Using fans to introduce external air to a space to provide a cooling effect. Due to the airflow required, this type of system often involves significant plant and duct size requirements.
- Comfort cooling – Using a mechanical system to cool the air within a space to achieve a user-defined setpoint. This type of system will require some form of mechanical device to cool the air, such as a fan coil unit (FCU).

“2.21 A more recently developed alternative to the systems above is a tempered fresh air system. These systems add a small amount of cooling to the whole dwelling ventilation supply system (e.g. to the MVHR). This provides a reduced temperature fresh air supply which can provide some cooling to a space. Unlike comfort cooling, these systems are not designed to achieve a specific temperature in a space.”

The final part of Chapter 2 discusses current planning policy, regulations and guidance documents relating to acoustics, including the NPSE, BS8233 and the Pro PG referred to above.

Chapter 3 of the Guide is concerned with Internal Ambient Noise Level Guidelines, pointing out that the contribution from transportation noise sources should be considered separately from and independently of the contribution from ventilation noise.

In this context the Guide states:

“3.4 For both sources of noise, the guidance makes a clear distinction between provisions for fresh air to achieve whole dwelling ventilation rates (‘ADF ventilation condition’), and provisions for ventilative cooling to mitigate overheating (‘overheating condition’)

“3.4 In terms of noise effect, the important distinction between these two situations is that the ADF ventilation condition applies for the entire time whereas the overheating condition applies only for part of the time.”

In considering appropriate internal ambient noise levels due to transportation noise the Guide states:

“3.9 It is suggested here that the desirable internal noise standards within Table 4 of BS 8233:2014 should be achieved when providing adequate ventilation as defined by ADF whole dwelling ventilation. However, it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

“3.10 The basis for this is that the overheating condition occurs for only part of the time. During this period, occupants may accept a trade-off between acoustic and thermal conditions, given that they have some control over their environment. In other words, occupants may, at their own discretion, be more willing to accept higher short-term noise levels in order to achieve better thermal comfort. The importance of control is relevant to daytime exposure, but not to night time exposure where the consideration is sleep disturbance.”

“3.13 The values in Table 3-2 are based on the assumption of a 13 dB difference between external free-field noise levels and internal ambient noise levels. Refer to paragraph 3.24 for further discussion.

“3.14 Table 3-2 suggests that a Level 2 assessment is not required in situations where it is expected that reasonable internal conditions, described in ProPG as BS 8233 levels relaxed by up to 5 dB, will be achieved.”

“3.18 In the case of the overheating condition, the effect of increased internal ambient noise from external noise sources will depend both on the absolute noise level and the amount of time for which the overheating condition occurs. A good design process should therefore, as a priority, seek to minimise heat gains thereby reducing the amount and duration of ventilation required to control overheating and the consequential effect from increased ingress of noise.

“3.19 No quantitative guidance regarding the combined effect of level and duration for the overheating condition is included in the current version of this document. However, the situation is summarised qualitatively in Figure 3-2 and also addressed in the worked examples included in Appendix B.”

Table 3-1 of the Guide confirms that for the ventilation conditions set out in Approved Document F of the Building Regulations (the ADF ventilation condition) the internal noise standards set out on BS8233: 2014 are appropriate, noting that no specific acoustic criteria need to be met under purge ventilation conditions.

Figure 3-1 of the Guide sets out in a flow chart the proposed two-level noise assessment procedure that is to apply to transportation noise in the potential overheating condition. In turn this assessment procedure makes reference to:

- a Level 1 assessment where the risk of an adverse effect is assessed in accordance with the guidance provided in Table 3-2; and
- a Level 2 assessment where the risk of an adverse effect is assessed in accordance with the guidance provided in Table 3-3 and Figure 3.2.

The Guide provides guidance on appropriate internal ambient noise levels due to mechanical ventilation systems in:

- Table 3-4, which sets out the indoor ambient noise levels from mechanical services that are likely to be acceptable for the ADF ventilation condition; and
- Table 3-5, which sets out the indoor ambient noise levels from mechanical services that are likely to be acceptable for ventilation condition required to avoid overheating.

Appendix A of the guide provides additional information, including more detailed guidance on ventilation and overheating criteria and the achievement of satisfactory levels of thermal comfort.

In respect of overheating criteria and guidance reference is made to CIBSE Technical Memorandum 59 'Design methodology for the assessment of overheating risk in homes'. This document sets out a standardised methodology for predicting temperatures inside dwellings (including care homes and student accommodation) and also provides overheating 'compliance criteria'.

Paragraph A.22 of the AVO Guide states:

"A.22 CIBSE TM59 notes that:

This methodology is proposed for all residences and should especially be considered for:

- large developments
- developments in urban areas, particularly in southern England
- blocks of flats
- dwellings with high levels of insulation and air-tightness
- single aspect flats.

Individual houses and developments with a low risk of overheating may not require the use of dynamic thermal modelling..."

The Guide then goes on to discuss the compliance criteria specified in CIBSE TM59 for homes that are predominantly naturally ventilated and for homes that are predominantly mechanically ventilated.

Reference is also made to:

- the Standard Assessment Procedure for Energy Rating of Dwellings' (SAP), 2012; and
- the Housing Health and Safety Rating System; and
- the IEA Energy in Buildings and Communities Programme – Annex 62 – Ventilative Cooling.

Dynamic thermal modelling is also discussed as is the early stage overheating assessment tool contained in the document 'Overheating in New Homes' published by the Good Homes Alliance.

The latter includes the consideration of situations where noise levels may be a reason for occupants preferring to keep windows closed for all or part of the day or night- time periods. It is suggested that this assessment tool may be of assistance in enabling non-specialists to obtain a quantitative estimate of the potential overheating risk for proposed developments.

Appendix B is concerned with the practical application of the Guide, with Table B-1 identifying three steps to link the noise assessment to the ventilation and overheating strategies. Figure B-1 shows the typical activity of the acoustic designer in developing the design.

In considering the acoustics effects of the ventilation strategy guideline external noise constraints are proposed for ADF ventilation Systems 1 & 2, System 3 and System 4. A summary of potential level differences associated with the different ventilation Systems from ADF is provided in Table B-2, the level differences equating to the external free-field noise level and the internal reverberant level.

The need to assess individual noise events (in contrast to average noise levels expressed in terms of dB LAeq) is also discussed.

Table B-3 provides a summary of the potential noise issues associated with ventilation strategies described in ADF.

Table B-4 provides a summary of the potential noise issues associated with various cooling strategy that may be required in order to control overheating.

Table B-5 includes a number of examples of passive ventilation solutions that can provide enhanced levels of sound insulation.

The Guide then goes on to recommend:

- the items of information that may be considered appropriate for submission to local planning authorities in connection with planning applications; and
- a schedule of acoustic performance requirements that may be appropriate to include in any testing schedule that may be required.

The final section of Appendix B consists of a worked example.

Appendix C of the Guide is concerned with the sound insulation provided by partially open windows, and discusses:

- the results of a field study covering 102 dwellings in Switzerland that were affected by road traffic noise; and
- laboratory measurements made in the UK for 14 window types and arrangements with various degrees of opening.

2.6 Buildings Regulations Approved Document F Volume 1; Dwellings

This Approved Document is concerned with the provision of ventilation in new residential accommodation in England where construction commences on or after 15 June 2022. The document applies solely to self-contained dwellings.

Blocks of flats with shared communal rooms, rooms for residential purposes and buildings containing rooms for residential purposes are covered by Approved Document F Volume 2: Buildings other than dwellings.

The document does not relate to hospitals.

Requirement F1(1): Means of ventilation

Requirement F1(1): Means of ventilation states:

“F1. (1) There shall be adequate means of ventilation provided for people in the building.

“Requirement F1 does not apply to a building or space within a building:

- a. into which people do not normally go;
- b. which is used solely for storage; or
- c. which is a garage used solely in connection with a single dwelling.”

The document goes on to state:

“In the Secretary of State’s view, requirement F1(1) is met if the dwelling has a means of ventilation that achieves all of the following.

- a. Extracts water vapour and indoor air pollutants from areas where they are produced in insignificant quantities (e.g. kitchens, utility rooms and bathrooms) before they spread through the building, following the guidance on extract ventilation in paragraphs 1.17 to 1.22.
- b. Supplies a minimum level of outdoor air for occupants’ health, following the guidance for whole dwelling ventilation in paragraphs 1.23 to 1.25.
- c. Rapidly dilutes indoor air pollutants, and disperses water vapour when necessary in habitable rooms, following the guidance for purge ventilation in paragraphs 1.26 to 1.31.
- d. Minimises the entry of external air pollutants, following the guidance in Section 2.
- e. Achieves all of the following, as far as is reasonably practicable.
 - i. Produces low levels of noise, following the guidance in paragraphs 1.5 to 1.7.
 - ii. Offers easy access for maintenance, following the guidance in paragraph 1.8.
 - iii. Provides protection from cold draughts.

In the Secretary of State’s view, requirement F1(1) is met for work on an existing dwelling by following the guidance in Section 3.

Section 1: Ventilation provision

General

This section deals with the need to provide adequate ventilation

Noise

This section states that both continuous and intermittent mechanical ventilation systems should be designed and installed to minimise noise, and identifies the means by which this aim can be achieved.

Paragraph 1.7 states:

“Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation.”

However, the document does not specify the external noise levels above which purge ventilation should not be provided by means of opening windows.

In respect of noise from mechanical ventilation systems this paragraph also states:

“NOTE: Although there is no requirement to undertake noise testing, achieving the levels in the following guidance would ensure good acoustic conditions. The average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following.

- a. 30dB LAeq,T* for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical ventilation system is running on its minimum low rate.
- b. 45dB LAeq,T* in less noise-sensitive rooms (e.g. kitchens and bathrooms) when a continuous operation system is running at the minimum high rate or an intermittent operation system is running.

“* The noise index LAeq,T is used in BS 8233, where T is the duration of the measurement. If the noise from the sound source is steady (i.e. fluctuating by up to 3dB), a measuring time of 1 minute will be adequate and the LAeq, 1 min level will be similar to the dB(A) level used elsewhere. If the noise from the sound source fluctuates more than this, a longer measuring time (T) may be required, but the higher portion of the fluctuating level should be considered, and the sound may attract more attention due to the changes in level.”

Extract ventilation

Rooms where extract ventilation is always required, extract ventilation rates and the locations of extract ventilation terminals and fans are specified in paragraphs 1.7 to 1.22.

Whole dwelling ventilation

Whole dwelling ventilation is considered in paragraphs 1.23 to 1.25.

Purge ventilation

Purge ventilation is discussed in paragraphs 1.26 to 1.31.

Performance testing

Performance testing is discussed in paragraph 1.32 which refers to BS EN 13141 for the measurement of the performance of individual ventilation components.

Control of ventilation

The means of controlling ventilation systems and positioning of background ventilators is covered in paragraphs 1.33 to 1.37.

System-specific guidance

Guidance is provided on three types of ventilation system, these being identified in Table 1.6 as:

- Natural ventilation – applicable to less airtight dwellings only;
- Continuous mechanical extract ventilation – applicable to all dwellings; and
- Mechanical ventilation with heat recovery – applicable to all dwellings.

These three ventilations systems are discussed in paragraphs 1.47 to 1.59, paragraphs 1.60 to 1.66 and paragraphs 1.67 to 1.73 respectively.

Installation of ventilation systems

Advice on the installation of ventilation systems is provided in paragraphs 1.74 to 1.83.

Section 2: Minimising the ingress of external pollutants

This section is concerned with the ingress of external airborne pollutants and specifies limits for carbon monoxide, sulphur dioxide, nitrogen dioxide, benzene, PM₂₅ particles and PM₁₀ particles.

Section 3: Work on existing dwellings

This section deals with work on existing dwellings only, so does not apply to new-build developments.

Requirement F1(2) and regulations 39, 42 and 44

Requirement F1(2) states:

“F1. (2) Fixed systems for mechanical ventilation and any associated controls must be commissioned by testing and adjusting as necessary to secure that the objective referred to in sub-paragraph (1) is met.

“Requirement F2 does not apply to a building or space within a building:

- a. into which people do not normally go;
- b. which is used solely for storage; or
- c. which is a garage used solely in connection with a single dwelling.”

Information about ventilation

Regulation 39 states:

“(1) This regulation applies where paragraph F1(1) of Schedule 1 imposes a requirement in relation to building work.

(2) The person carrying out the work shall not later than five days after the work has been completed give sufficient information to the owner about the building’s ventilation system and its maintenance requirements so that the ventilation system can be operated in such a manner as to provide adequate means of ventilation.”

Mechanical ventilation air flow rate testing

Regulation 42 states:

“(1) This regulation applies where paragraph F1(1) of Schedule 1 imposes a requirement in relation to the creation of a new dwelling by building work.

(2) The person carrying out the work shall, for the purpose of ensuring compliance with paragraph F1(1) of Schedule 1—

- (a) ensure that testing of the mechanical ventilation air flow rate is carried out in accordance with a procedure approved by the Secretary of State; and
- (b) give notice of the results of the testing to the local authority.

(3) The notice referred to in paragraph (2)(b) shall—

- (a) record the results and the data upon which they are based in a manner approved by the Secretary of State; and
- (b) be given to the local authority not later than five days after the final test is carried out.”

Commissioning

Regulation 44 states:

- “(1) This regulation applies to building work in relation to which paragraph F1(2) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed system for mechanical ventilation or any associated controls where testing and adjustment is not possible.
- (2) This regulation also applies to building work in relation to which paragraph L1(b) of Schedule 1 imposes a requirement, but does not apply to the provision or extension of any fixed building service where testing and adjustment is not possible or would not affect the energy efficiency of that fixed building service.
- (3) Where this regulation applies the person carrying out the work shall, for the purpose of ensuring compliance with paragraph F1(2) or L1(b) of Schedule 1, give to the local authority a notice confirming that the fixed building services have been commissioned in accordance with a procedure approved by the Secretary of State.
- (4) The notice shall be given to the local authority—
- (a) not later than the date on which the notice required by regulation 16(4) is required to be given; or
- (b) where that regulation does not apply, not more than 30 days after completion of the work.”

Section 4: Commissioning and providing information

This section provides detailed guidance on the commissioning of ventilation systems and the provision of operating and maintenance instructions to the owners of dwellings.

Appendices

Appendix A provides definitions of key terms used in the document.

Appendix B is concerned with the achievement of satisfactory levels of moisture and other pollutants in dwellings and to this end specifies performance criteria.

Appendix C deals with installation completion checklists and commissioning sheets.

Appendix D provides a checklist in that may be used when installing energy efficiency measures in an existing dwelling, following paragraphs 3.6 to 3.13.

Appendix E refers a number of other relevant guidance documents.

2.7 Building Regulations Approved Document O: Overheating

This Approved Document is concerned with the control of overheating in new residential accommodation in England where construction commences on or after 15 June 2022.

The document applies to:

- residential dwelling houses and flats;
- institutional residential accommodation including residential homes, residential schools and colleges, halls of residence and other student accommodation; and
- residential accommodation for older and disabled people, due to illness or other physical or mental condition and residential accommodation for children.

No specific reference is made to hospitals.

Requirement O1

Requirement O1 Overheating Mitigation states:

“(1) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel (“residences”) to—

(a) limit unwanted solar gains in summer;

(b) provide an adequate means to remove heat from the indoor environment.

“(2) In meeting the obligations in paragraph (1)—

(a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and

(b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.”

Compliance with Part O can be demonstrated by the use of one of one of the following methods:

- a. The simplified method for limiting solar gains and providing a means of removing excess heat, as set out in Section 1 of the document.
- b. The dynamic thermal modelling method, as set out in Section 2 of the document.

Simplified overheating assessment method

For the purposes of the simplified overheating assessment method residential accommodation is categorised as ‘moderate risk’ or ‘high risk’ on the basis of its geographical location and whether or not it is cross-ventilated.

Urban parts and some suburban parts of London and some parts of central Manchester, all as detailed in Appendix C, are considered to be ‘high risk’. The remainder of England is considered to be ‘moderate risk’.

In respect of cross ventilation paragraph 1.4 states:

“For the purposes of following the simplified method, it should be identified whether the dwellinghouse or each residential unit, shared communal room and common space is able to have cross-ventilation, i.e. it has openings on opposite façades.

“NOTE: Having openings on façades that are not opposite does not meet the approved document definition of cross-ventilation, e.g. in a corner flat.

“NOTE: A multi-occupancy residential building should not be categorised as having or not having cross-ventilation. Each residential unit, shared communal room and common space should be categorised separately.”

Paragraph 1.5 then states:

“The building’s overheating risk category based on location and whether it is cross-ventilated should be used to select the relevant guidance for both of the following purposes.

a. To limit unwanted solar gains in summer – follow paragraphs 1.6 to 1.9.

b. To provide an appropriate means of removing excess heat from the indoor environment – follow paragraphs 1.10 to 1.13.”

The guidance provided by paragraphs 1.6 to 1.9 includes tables that specify the maximum permissible areas of glazing (expressed as a percentage of the floor areas) for buildings and parts of buildings for ‘high risk’ and ‘moderate risk’ locations with and without cross-ventilation.

Reference is also made to the employment of shutters (with ventilation), low solar gain glazing and overhangs for buildings in ‘high risk’ areas.

Limiting solar gains

Guidance on limiting solar gains is provided by paragraphs 1.6 to 1.9. These paragraphs include Tables 1.1 & 1.2 that specify the maximum glazing areas for limiting solar gains in buildings and parts of buildings with and without cross ventilation (expressed as a percentage of the floor area and room floor area).

Paragraph 1.9 states:

“Residential buildings in the high risk location should, in addition to following the maximum glazing areas in Table 1.1 and Table 1.2, provide shading for glazed areas between compass points north-east and north-west via the south.”

and provides optional means for providing such shading.

Removing excess heat

Guidance on removing excess heat is provided by paragraphs 1.10 to 1.13. These paragraphs include Tables 1.3 & 1.4 that specify the minimum free ventilation areas for removing excess heat in buildings and parts of buildings with and without cross ventilation (expressed as a percentage of the floor area and glazing area).

Paragraph 1.12 states:

“Openings should be designed to achieve the free areas in paragraphs 1.10 and 1.11. The equivalent area of the opening should meet or exceed the free area of the opening. The equivalent area of the opening should be assessed by either of the following means.

a. Measurement of the product to BS EN 13141-1.

b. Calculation using Appendix D.

“NOTE: A system for purge ventilation should be provided in each habitable room to demonstrate compliance with Part F of the Building Regulations. The guidance in Section 1 of Approved Document F, Volume 1: **Dwellings** gives minimum standards for purge ventilation. When following this simplified method, applying the guidance in paragraphs 1.10 to 1.12 will usually result in free areas that exceed the free areas in Approved Document F, Volume 1: **Dwellings**.”

Paragraph 1.13 states:

“The simplified method is not suitable for buildings with more than one residential unit which use a communal heating or hot water system with significant amounts of horizontal heating or hot water distribution pipework. Main distribution routes should be through vertical risers to minimise heat gains into common spaces.”

Dynamic thermal modelling method

Where dynamic thermal modelling is required Approved Document O refers to the CIBSE TM59 methodology for predicting overheating risk, published by the Chartered Institute of Building Services Engineers.

Paragraph 2.3 states:

“To demonstrate compliance using the dynamic thermal modelling method, all of the following guidance should be followed.

- a. CIBSE’s TM59 methodology for predicting overheating risk.
- b. The limits on the use of CIBSE’s TM59 methodology set out in paragraphs 2.5 and 2.6.
- c. The acceptable strategies for reducing overheating risk in paragraphs 2.7 to 2.11.”

Paragraph 2.4 states:

“The building control body should be provided with a report that demonstrates that the residential building passes CIBSE’s TM59 assessment of overheating. This report should contain the details in CIBSE’s TM59, section 2.3.

“NOTE: Appendix B of this approved document includes a compliance checklist. The designer may use this checklist to demonstrate compliance to the building control body.”

The limits on CIBSE’s TM59 modelling procedures are discussed.

This section of the document concludes by setting out acceptable strategies for reducing overheating risk, including options for reducing solar gains and options for the removal of excess heat.

Section 3: Ensuring the overheating mitigation strategy is usable

Section 3 of the Approved Document is concerned with practicalities of ensuring that the overheating mitigation strategy will work as intended, bearing in mind factors such as noise, pollution, security, protection from falling and protection from entrapment.

Noise

Paragraphs 3.1, 3.2, 3.3 & 3.4 relate to noise.

Paragraph 3.1 states:

“The standards in this section may mean that the standards of the simplified method cannot be met. For example, if external noise is an issue, it is unlikely that windows would be opened by

an occupant and therefore the minimum free areas of the simplified method cannot be met. In such cases, dynamic thermal modelling should be used.”

Paragraph 3.2 states:

“In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).”

Paragraph 3.3 states:

“Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40 dB LAeq,T, averaged over 8 hours (between 11pm and 7am).

b. 55 dB LAFmax, more than 10 times a night (between 11pm and 7am).”

These internal noise levels are 10 dB higher than the corresponding internal noise levels specified in Table 4 of BS8233: 2014 and in World Health Organisation (WHO) guidance.

Paragraph 3.4 states:

“Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants’ Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

“NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants’ Acoustics, Ventilation and Overheating: Residential Design Guide (2020).”

Section 4: Providing information

Paragraph 4.1 states:

“Sufficient information about the overheating mitigation strategy and its maintenance requirements must be given to owners so that it can be used effectively. The information should be provided in a clear manner, for a non-technical audience.”

Paragraph 4.2 specifies the information that should be provided.

Home user guide

Paragraph 4.3 states:

“A Home User Guide should be provided for new dwellings as described in Section 9 of Approved Document L, Volume 1: Dwellings. The Home User Guide should contain a section on ‘Staying cool in hot weather’, which provides non-technical advice on how to keep the dwelling cool in hot weather. The information in paragraph 4.2 should be provided in this section of the Home User Guide.

“NOTE: Information about ventilation and the conservation of fuel and power is required under different regulations and guidance is given in Approved Document F (Ventilation) and

Approved Document L (Conservation of fuel and power). Where the system provides more than one function, the owner should be informed of each separate function.”

Appendices

Appendix A provides definitions of key terms used in the document.

Appendix B provides compliance checklists.

Appendix C identifies the areas of England where buildings are deemed to have a high risk of overheating.

Appendix D deals with the calculation of equivalent areas.

Appendix E refers to BS EN 13141-1 Ventilation for buildings. Performance testing of components/products for residential ventilation – Externally and internally mounted air transfer devices [2019] as well as a number of other relevant guidance documents.

2.8 Planning Practice Guidance on Noise provided on the UK Government website

This guidance includes the following assessment table for environmental noise:

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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. Potential for some reported sleep disturbance. Affects the acoustic character of the	Observed Adverse Effect	mitigate and reduce to a minimum

	area such that there is a small actual or perceived change in the quality of life.		
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and /or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation /awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Paragraph: 005 Reference ID: 30-005-20190722

Revision date: 22 07 2019

2.7 Requirements of the local planning authority

As discussed above, this report addresses the requirements of Planning Condition 20.

Chapter 3 – Noise monitoring exercise and derivation of reference noise levels

Noise monitoring was undertaken at two positions identified in Figure 1 as

- MPW – a free-field position near the western boundary of the site which was the same distance from Turners Hill Road as the worst-case locations on the western elevation of the proposed care home, the microphone being positioned at a height of approximately 4.0 metres above local ground level; and
- MPE – a free-field position near the southern boundary of the site, corresponding to the southern / south-eastern corner of the proposed care home, the microphone being positioned at a height of approximately 4.0 metres above local ground level.

Monitoring at these positions was undertaken between 15.00 hours on Wednesday 9 and 15.00 hours on Thursday 10 August 2023.

Road traffic noise was found to be the only significant noise source in the vicinity of the development site during the noise monitoring exercise with the exception of some light construction noise arising from activities on the Rowans site. Noise from the construction activities at the Rowans site and other occasional extraneous noise events has been excluded from the results discussed below.

Type 1 precision, integrating equipment that carries current calibration certification was used at all positions, data being logged in terms of broadband dB LAeq, dB LA10, dB LA90 and dB LAmax and 1/3 octave dB LAeq.

Full details of the noise monitoring exercise and the results obtained are provided in:

- Appendix B, which includes the monitoring results obtained at MPW; and
- Appendix C, which includes the monitoring results obtained at MPE.

Weather conditions were good throughout the noise monitoring period, and all calibration checks were satisfactory. The results may therefore be taken to be fully representative.

3.1 Noise monitoring at results obtained at MPW

With extraneous noise events excluded, the road traffic noise levels prevailing at MPW were found to be:

- 60.2 dB LAeq,16h during the daytime period 07.00 to 23.00 hours; and
- 55.1 dB LAeq,8h during the night-time period 23.00 and 07.00 hours.

The absolute worst-case maximum noise level recorded at night was found to be 79.1 dB LAmax, with a level of 73.3 dB LAmax being exceeded 10 times during the night-time period and a level of 72.1 dB LAmax being exceeded 15 times during the night-time period.

When rounded to the nearest whole dB, these maximum noise levels are respectively:

- 79.1 minus 55.1 = 24 dB higher than the overall night-time LAeq noise level;

- 73.3 minus 55.1 = 18 dB higher than the overall night-time LAeq noise level; and
- 72.1 minus 55.1 = 17 dB higher than the overall night-time LAeq noise level.

3.2 Noise monitoring at results obtained at MPE

With extraneous noise events excluded, the road traffic noise levels prevailing at MPE were found to be:

- 54.3 dB LAeq,16h during the daytime period 07.00 to 23.00 hours; and
- 48.8 dB LAeq,8h during the night-time period 23.00 and 07.00 hours.

The absolute worst-case maximum noise level recorded at night was found to be 73.0 dB LAmax, with a level of 65.7 dB LAmax being exceeded 10 times during the night-time period and a level of 65.4 dB LAmax being exceeded 15 times during the night-time period.

When rounded to the nearest whole dB, these maximum noise levels are respectively:

- 73.0 minus 48.8 = 24 dB higher than the overall night-time LAeq noise level;
- 65.7 minus 48.8 = 17 dB higher than the overall night-time LAeq noise level; and
- 65.4 minus 48.8 = 17 dB higher than the overall night-time LAeq noise level.

3.3 Noise from drain covers on Turners Hill Road

Heavy good vehicles (HGVs) passing over poorly installed drain covers near the southern portion of the site were found to give rise to relatively high noise levels on occasions during the noise monitoring exercise.

Therefore, the developer will check all drain covers on the stretch of Turners Hill Road adjacent to the site and will re-install any that give rise to this kind of noise.

3.4 Attenuation of LAmax noise levels with distance

For line sources such as roads, the attenuation with distance for maximum (LAmax) noise levels is greater than that for average (LAeq) noise levels. This is illustrated by the consideration of the first three maximum noise events (the highest) set out in the table of maxima provided in Appendix B and Appendix C, which all arose from vehicle movement in Turners Hill Road. These maxima are summarised and compared in the table provided in Appendix D.

The propagation distance from Turners Hill Road to MPW is approximately 23 metres, while that to MPE is approximately 66 metres. From these distances and the three highest maxima recorded at the two monitoring positions, the calculations in Appendix D confirm that in this case LAmax noise levels due to vehicle movements on Turners Hill Road attenuate at a rate of approximately 4.5 dB per doubling of distance. This compares to 3.0 dB per doubling of distance for a line source and 6.0 dB per doubling of distance for a point source.

Chapter 4 – Predicted noise levels at the development site and surroundings

4.1 Noise modelling exercise

Free-field noise levels at the development site and its surroundings have been predicted by means of a noise model. The topography of the noise model has been taken from DEFRA digital terrain mapping, OS digital mapping and the topographical survey data for the site.

The noise model has been used to generate noise contours due to road traffic based on the reference daytime and night-time road traffic noise monitoring results obtained at MPW and MPE. As discussed above, the only noise source with the potential to affected the proposed development is road traffic noise.

The road traffic noise source in the noise model has been calibrated to accord with the reference daytime and night-time LAeq road traffic noise levels derived from the monitoring results obtained at MPW and MPF, the calibration being demonstrated by:

- Figure 3A, which shows the reference daytime road traffic noise contour plotted at the height of the measurement microphones;
- Figure 3B, which shows the reference night-time road traffic noise contour plotted at the height of the measurement microphones.

The noise model has then been used to predict road traffic noise levels for the proposed development.

Daytime road traffic noise levels for the proposed development are shown in:

- Figure 4A, which shows predicted daytime road traffic noise contours plotted at the height of a person seated in the external areas (including ground floor terraces) of the proposed development;
- Figure 4B, which shows predicted daytime road traffic noise contours plotted at the height of the ground floor window heads of the proposed development;
- Figure 4C, which shows predicted daytime road traffic noise contours plotted at the height of a person seated in the first floor terraces of the proposed development;
- Figure 4D, which shows predicted daytime road traffic noise contours plotted at the height of the first floor window heads of the proposed development; and
- Figure 4E, which shows predicted daytime road traffic noise contours plotted at the height of the second floor window heads of the proposed development.

Night-time road traffic noise levels for the proposed development are shown in::

- Figure 5A, which shows predicted night-time road traffic noise contours plotted at the height of the ground floor window heads of the proposed development;
- Figure 5B, which shows predicted night-time road traffic noise contours plotted at the height of the first floor window heads of the proposed development;

- Figure 5C, which shows predicted night-time road traffic noise contours plotted at the height of the second floor window heads of the proposed development.

4.2 Predicted road traffic noise levels – Day – 07.00 to 23.00 hours

From Figures 4A to 4E it can be seen that when rounded to the nearest whole dB daytime road traffic noise levels are predicted not to exceed:

- 50 dB LAeq,16h in the external area at the rear of the proposed care home, which includes all of the proposed external seating, the Activity Lawn and the ground floor and first floor Terraces;
- 59 dB LAeq,16h at the location of a window of bedroom (Bedroom 49); and
- 60 dB LAeq,16h at the location of the window of the Cinema.

4.3 Predicted road traffic noise levels – Night – 23.00 to 07.00 hours

From Figures 5A to 5C it can be seen that when rounded to the nearest whole dB night-time road traffic noise levels are predicted not to exceed:

- 54 dB LAeq,8h at the location of a window of bedroom (Bedroom 49).

As discussed above, an external noise level of 54 dB LAeq,8h at the location of the eastern elevation of the proposed care home corresponds to an external noise level of $54 \text{ dB LAeq,8h} + 18 = 72 \text{ dB LAmax}$ not being exceeded more than 10 times during the night-time period.

As the internal LAeq noise standard for bedrooms at night required by Condition 20 (30 dB LAeq,8h) is 15 dB lower than the LAmax noise standard for bedrooms at night (45 dB LAmax), the night-time LAmax standard is the critical standard. If this is achieved, the night-time internal LAeq standard will also be achieved, as will the daytime internal LAeq standard.

Chapter 5 – Assessment

5.1 Assessment – Condition 20, BS8233: 2014 and WHO guidance

It has been demonstrated that worst-case road traffic noise levels at the proposed development will not exceed:

- 50 dB LAeq,16h during the day in the external area at the rear of the proposed care home, which includes all of the proposed external seating, the Activity Lawn and the ground floor and first floor Terraces;
- 59 dB LAeq,16h during the day at the location of a window of bedroom (Bedroom 49);
- 60 dB LAeq,16h during the day at the location of the window of Cinema; and
- 54 dB LAeq,8h at night at the location of a window of bedroom (Bedroom 49), which corresponds to an external noise level of 72 dB LAmax not being exceeded more than 10 times during the night-time period.

The above external noise level for the proposed amenity complies with the requirements of Planning Condition 20 and recommendations of BS8233: 2014, so will be satisfactory.

Although Condition 20 states: “Noise from individual external events typical to the area shall not exceed 45 dB LAmax when measured in bedrooms internally between 23:00 and 07:00”, as discussed above, the maximum noise standard normally applied in the UK is the WHO guidance that states that an internal noise level of 45 dB LAmax should be exceeded no more than approximately 10 to 15 times per night in bedrooms.

In this case, the absolute worst-case maximum noise level recorded at MPW (which was the same distance from Turners Hill Road as the most westerly part of the western elevation of the proposed care home) during the night was 79 dB LAmax when rounded to the nearest whole dB. This is 7 dB higher than the level of 72 dB LAmax that will not be exceeded more than 10 times during the night-time period.

In the opinion of the author, therefore, the internal maximum noise level standard set out in Condition 20 is unnecessarily cautious, and an internal noise level of 45 dB LAmax not being exceeded more than 10 times per night would be more reasonable and would provide a satisfactory level of acoustic protection for future residents.

With an external noise level of 79 dB LAmax, the minimum façade required in order to achieve 45 dB LAmax internally would be $79 - 45 = 34$ dB. This compares to a minimum façade performance of $72 - 45 = 27$ dB for an external level of 73 dB LAmax.

Internal noise levels with partially open windows

The attenuation from a façade with a partially open window is normally taken to be 13 dB, and applying this correction to the above worst-case external noise levels yields corresponding internal noise levels for the worst-case bedroom with a partially open window of:

- $59 - 13 = 46$ dB LAeq,16h;
- $54 - 13 = 41$ dB LAeq,8h; and

- 72 minus 13 = 59 dB LA_{max}.

These worst-case internal noise levels exceed the levels required, so it will be necessary to provide a means of ventilation for the proposed bedrooms that does not require the opening of windows where external road traffic noise levels exceed:

- 35 plus 13 or 48 dB LA_{eq,16h} during the day at the location of a sensitive window of the proposed development;
- 30 plus 13 or 43 dB LA_{eq,8h} at night at the location of a sensitive window of the proposed development; and
- 45 plus 13 or 58 dB LA_{max} at night at the location of a bedroom window of the proposed development.

The means of ventilation for such proposed residential rooms is discussed further in the following chapter.

Worst-case glazing specification

At the worst-case bedroom location, and taking account of a road traffic noise spectrum, the attenuation required from the proposed glazing will need to be the highest of approximately:

- 59 minus 35 or 24 dB R_{w+Ctr};
- 54 minus 30 or 24 dB R_{w+Ctr}; or
- 72 minus 45 or 27 dB R_{w+Ctr}.

From the information on glazing specifications provided in Appendix E it can be seen that this level of acoustic performance will be achieved with 6/12/6.4(PVB) glazing.

More relaxed glazing specifications will be appropriate at other locations where noise levels are lower.

5.3 Assessment using Planning Practice Guidance on Noise – Proposed development

When assessed using this guidance, noise from road traffic is expected to be “Present and not intrusive”, both in the proposed amenity spaces and within sensitive rooms within the proposed care home.

Chapter 6 – Conclusions and recommendations

6.1 Proposed development

External areas

It has been demonstrated noise levels will be satisfactory in the amenity areas to the rear of the building, meaning that no mitigation will be required for these areas.

Bedrooms

It has been demonstrated that the worst-case bedrooms within the proposed development will require a means of ventilation that does not require the opening of windows. This provision will be required where external road traffic noise levels exceed the greater of:

- 35 plus 13 or 48 dB LAeq,16h during the day;
- 30 plus 13 or 43 dB LAeq,16h at night; or
- 45 plus 13 or 58 dB LAmax more than 10 times per night.

This night-time maximum noise level equates to a night-time average noise level of approximately 40 dB LAeq,8h on the most westerly portion of the western elevation of the proposed development where propagation distances are similar to that prevailing at monitoring position MPW.

As discuss in Chapter 3, in this case, LAmax noise levels due to vehicle movements on Turners Hill Road attenuate at a rate of approximately 4.5 dB per doubling of distance, which is greater than the attenuation rate of 3.0 dB per doubling of distance that applies to LAeq noise levels due to a line source.

Therefore, the remaining parts of the proposed development that are further from Turners Hill Road (the source that gives rise to highest maximum noise levels at the site) than the most westerly part of the development will be exposed to maximum noise levels that differ from the predicted LAeq noise levels by a smaller margin.

The calculations set out in Appendix D confirm that, when rounded to the nearest whole metre, the propagation distances at which attenuation of maxima with distance is greater than the attenuation at MPW are:

- 23 metres for additional attenuation of 0.0 dB and
- 27 metres for additional attenuation of 1.0 dB;
- 31 metres for additional attenuation of 2.0 dB; and
- 37 metres for additional attenuation of 3.0 dB.

At these propagation distances from Turners Hall Road, therefore, an alternative means of ventilation will be required only where LAeq noise levels respectively exceed:

- 43 plus 3 = 46 dB LAeq,8h at night at a propagation distance of 23 metres;
- 43 plus 2 = 45 dB LAeq,8h at night at a propagation distance of 27 metres;

- 43 plus 1 = 44 dB LAeq,8h at night at a propagation distance of 31 metres; and
- 43 plus 0 = 43 dB LAeq,8h at night at a propagation distance of 37 metres.

At propagation distances greater than 37 metres from Turners Hill Road, the need for a form of ventilation other than opening windows will be also determined on the basis of the external LAeq noise level at night.

The means of ventilation will be specified on the basis of an overheating assessment that will comply with the requirements of Approved Document F 'Ventilation' (Ref 6), Approved Document O 'Overheating' (Ref 7) and other relevant guidance.

It is anticipated that the ventilation proposals proposed for bedrooms will be determined during the detailed design phase of the proposed development.

Other sensitive rooms

It is understood that in other sensitive rooms within the proposed development (day rooms, dining rooms etc) where satisfactory internal noise levels will not be achieved with windows partially open, an appropriate overheating will be strategy will be employed so that windows can be fully closed when the rooms are in use.

It is anticipated that these provisions will be specified during the detailed design phase of the proposed development, an where necessary will comply with the requirements of Approved Document F 'Ventilation' (Ref 6), Approved Document O 'Overheating' (Ref 7) and other relevant guidance.

Noise from drain covers

As discussed above, HGVs passing over poorly installed drain covers near the southern portion of the site were found to give rise to relatively high noise levels on occasions during the noise monitoring exercise.

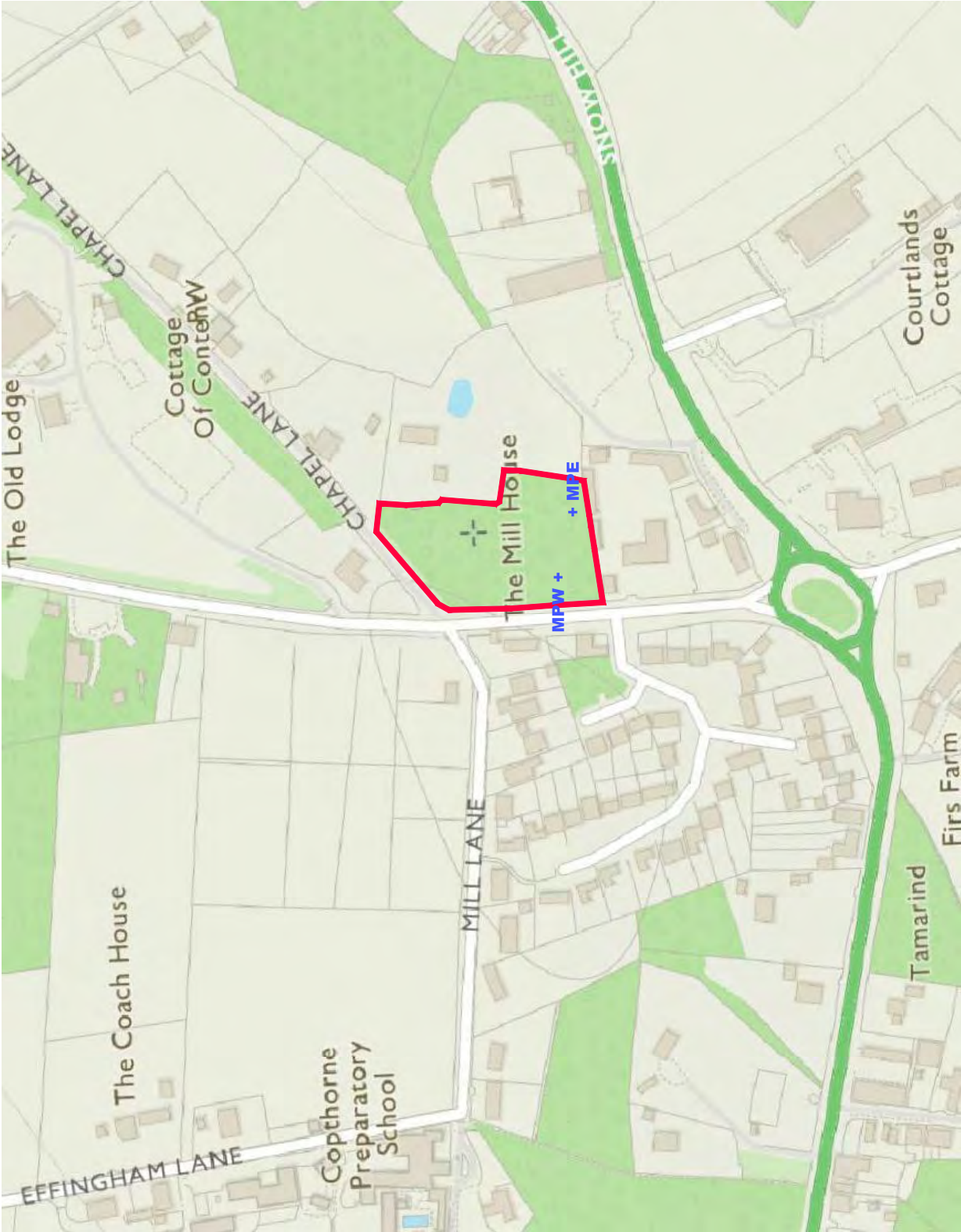
Therefore, the developer will check all drain covers on the stretch of Turners Hill Road adjacent to the site and will re-install any that give rise to this kind of noise.

References

- 1 National Planning Policy Framework; Department for Communities and Local Government; 2012
- 2 Noise Policy Statement for England; Department for Environment, Food and Rural Affairs; 2010
- 3 BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'; BSI
- 4 Professional Practice Guidance on Planning & Noise; Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH); 2017
- 5 Acoustics, Ventilation and Overheating Residential Design Guide; Association of Noise Consultants; 2020
- 6 Building Regulations Approved Document F 'Ventilation'; Department for Levelling Up, Housing and Communities; 2021
- 7 Building Regulations Approved Document O 'Overheating'; Department for Levelling Up, Housing and Communities; 2021
- 8 Planning Practice Guidance provided on the UK Government website:
<https://www.gov.uk/guidance/noise--2>

Figure 1

Site location



No.		Rev.	Revised By	Revised Date	Checked
1		1	RM	10/06/2020	RM

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Web: www.rma-architects.com

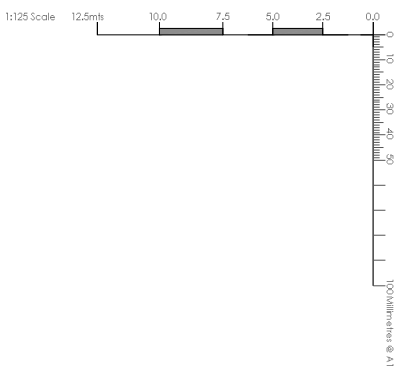
Client	Rainier Developments Limited
Project	Crawley Down

Drawing	Site Location Plan
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Scale	1:1250@A1
Project No.	176
Drawing No.	100
Revision	A
Status	P
Date	Jun 2020
Drawn by	HD, GR
Checked by	RM

Figures 2A to 2I

Drawings of the proposed development



REV	DONE	REVISION	AMOUNT	COST
P1	06/17/23	Revised BUD	KM	GL
P2	06/17/23	Input of global considerations into it to added "Business-globals" into it Planning BUD - second year	KM	GL

Do not code, use typed dimensions only.

At dimension 1, we identified the first part of the comment as any word in the collection of any shape above. At dimension 2, we identified the next word.

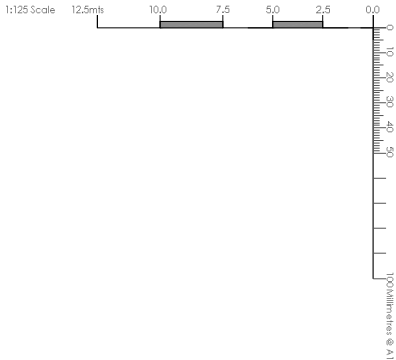
This drawing is to be used in conjunction with identified words and dimensional drawings and any other relevant information.

This drawing is copyright © of DCD Architects Ltd.

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DRAWING STATUS

FOR DISCUSSION (RIBA STAGE 0-2)
FOR PLANNING (RIBA STAGE 3)
FOR TENDER (RIBA STAGE 4)
FOR CONSTRUCTION (RIBA STAGE 5)
AS-BUILT (RIBA STAGE 6)
AS-RECORDED (RIBA STAGE 6)



First floor as proposed
22 Bedrooms

SECOND FLOOR ONE 123m²
SECOND FLOOR TWO 123m²
GROUND FLOOR 144m²

TOTAL AREA 370m² (97,900 sq ft)
TOTAL AREA 370m² (97,900 sq ft)



REV	DATE	DESCRIPTION	BY	CHECKED
1	10/10/20	ISSUED FOR TENDER	RM	RM
2	10/10/20	ISSUED FOR TENDER	RM	RM
3	10/10/20	ISSUED FOR TENDER	RM	RM
4	10/10/20	ISSUED FOR TENDER	RM	RM
5	10/10/20	ISSUED FOR TENDER	RM	RM
6	10/10/20	ISSUED FOR TENDER	RM	RM
7	10/10/20	ISSUED FOR TENDER	RM	RM
8	10/10/20	ISSUED FOR TENDER	RM	RM
9	10/10/20	ISSUED FOR TENDER	RM	RM
10	10/10/20	ISSUED FOR TENDER	RM	RM

Notes

1. All dimensions to be finished on site prior to the commencement of construction.

2. All dimensions to be finished on site prior to the commencement of construction.

3. All dimensions to be finished on site prior to the commencement of construction.

4. All dimensions to be finished on site prior to the commencement of construction.

5. All dimensions to be finished on site prior to the commencement of construction.

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9. All dimensions to be finished on site prior to the commencement of construction.

10. All dimensions to be finished on site prior to the commencement of construction.

TDC ARCH DESIGN

The Design Collective Architects

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2015-2016

2017-2018

2019-2020

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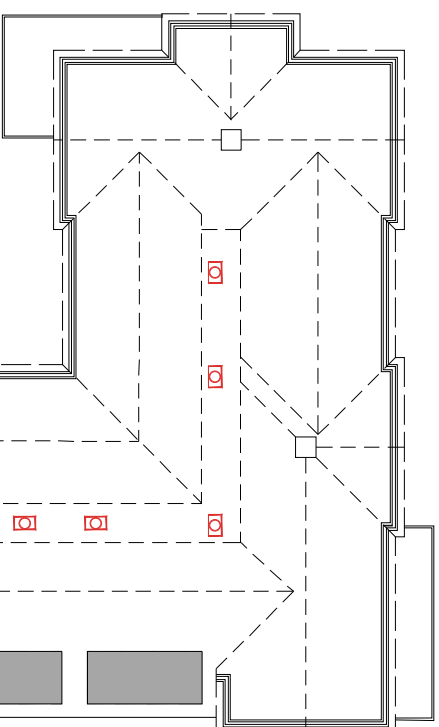
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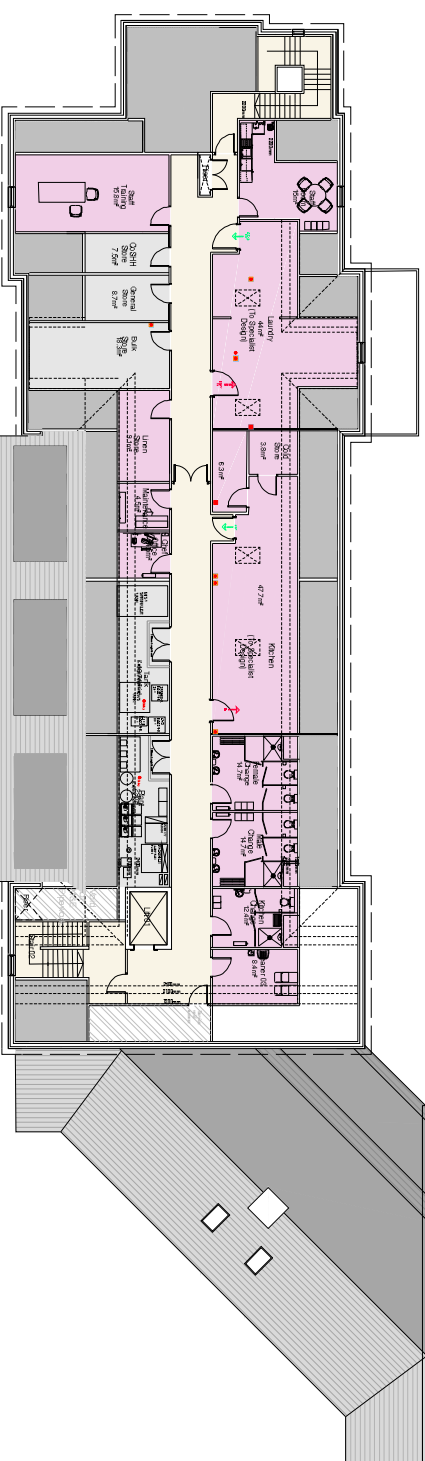
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3599-3600



Ancillary floor



REV	DATE	REVISION	REVISION	DATE
P1	10/1/03	Planned BMD	KM	1/04
P2	10/1/03	Grounding of cable and a different pulsed test point are added. The type are specified as "wireless" and "wired". Planned BMD	KM	04/04

Labels

Do not code, use figured dimensions only.

All dimensions to be used must be indicated prior to the commencement of any work or the production of any shop drawing. All dimensions shall be reported to the Architect.

The quantity is derived in conjunction with methods described in Architect's General Notes and any relevant information.

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Revision numbering: 1 = Initial stage; 2 = RIBA Stage 2; 3 = RIBA Stage 3; 4 = RIBA Stage 4; 5 = RIBA Stage 5.

DEVELOPING
STUDIOS

FOR DISCUSSION: REB, STAGE 0-2;
FOR PLANNING: REB, STAGE 3;
FOR CONCEPT DESIGN: REB, STAGE 4;
FOR DESIGN DEVELOPMENT: REB, STAGE 5;
FOR CONSTRUCTION: REB, STAGE 6;
FOR ASSEMBLY: REB, STAGE 7;
FOR COMPLETION: REB, STAGE 8;
FOR MAINTENANCE: REB, STAGE 9;
FOR DISMANTLING: REB, STAGE 10.

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Client

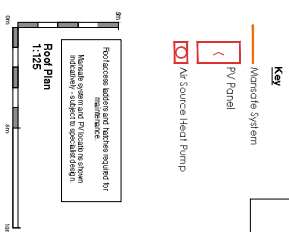
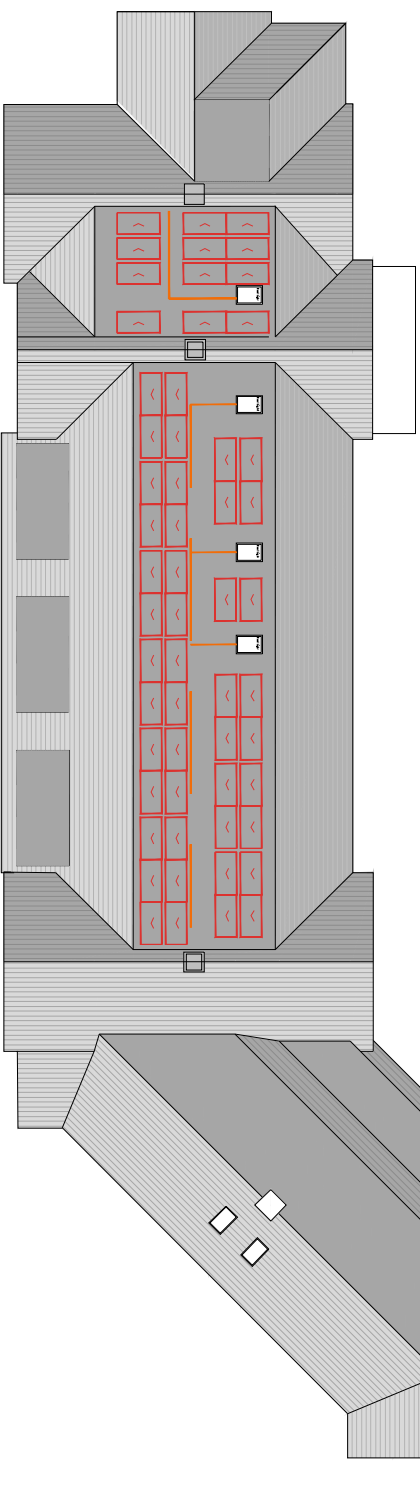


BARCHESTER
Celebrating life

Project
Proposed Care Home at
Crawley Down, Copthorne

Second Floor GA

Scale	1:25 @ A1	Date	Feb 2023
Drawn by	GMI	Checked by	SEL
Job No.	B222093	Drawing No.	AL(1)102
		Rev.	P-2

[illegible]

Do not code, use figured dimensions only.

All dimensions to be marked on the plan prior to the commencement of work. Dimensions shall be marked on the plan and also on the structure to be erected to the architect.

The drawing is to be used in conjunction with the detailed architect's drawings and specifications and any other relevant information.

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Revision numbering: 1 = RFA Stage 1, 2 = RFA Stage 2, 3 = RFA Stage 3, 4 = RFA Stage 4, 5 = RFA Stage 5, 6 = RFA Stage 6, 7 = RFA Stage 7, 8 = RFA Stage 8, 9 = RFA Stage 9, 10 = RFA Stage 10, 11 = RFA Stage 11, 12 = RFA Stage 12, 13 = RFA Stage 13, 14 = RFA Stage 14, 15 = RFA Stage 15, 16 = RFA Stage 16, 17 = RFA Stage 17, 18 = RFA Stage 18, 19 = RFA Stage 19, 20 = RFA Stage 20, 21 = RFA Stage 21, 22 = RFA Stage 22, 23 = RFA Stage 23, 24 = RFA Stage 24, 25 = RFA Stage 25, 26 = RFA Stage 26, 27 = RFA Stage 27, 28 = RFA Stage 28, 29 = RFA Stage 29, 30 = RFA Stage 30, 31 = RFA Stage 31, 32 = RFA Stage 32, 33 = RFA Stage 33, 34 = RFA Stage 34, 35 = RFA Stage 35, 36 = RFA Stage 36, 37 = RFA Stage 37, 38 = RFA Stage 38, 39 = RFA Stage 39, 40 = RFA Stage 40, 41 = RFA Stage 41, 42 = RFA Stage 42, 43 = RFA Stage 43, 44 = RFA Stage 44, 45 = RFA Stage 45, 46 = RFA Stage 46, 47 = RFA Stage 47, 48 = RFA Stage 48, 49 = RFA Stage 49, 50 = RFA Stage 50, 51 = RFA Stage 51, 52 = RFA Stage 52, 53 = RFA 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DRAMA STATE

FOR JOCKUSON (REDA STATE-2)

FOR PLANNING (REDA STATE-3)

FOR CONSTRUCTION (REDA STATE-5)

AS LULU (REDA STATE-6)

AS RED (REDA STATE-9)

☐ ☒ ☐ ☐ ☐

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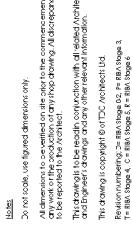
Client

Project
Proposed Care Home at
Crawley Down, Copthorne

Drawing Title
Roof GA

Scale	Date
1:125 @ A1	Feb 2023
Drawn by	Checked by
GM	SEL

Job No.	Drawing No.	Rev.
B222093	AL(1)103	P-2



REV	DATE	REVISION	APPROV	CHECK
P1	8/10/21	Column, brace and chimney design and reinforcement details are to be submitted for review and approval to the relevant authority and to be approved for construction. The reinforcement is to be made to BS 5951 and BS 8007.	BA	LM
P2	8/10/21	Reinforcement details are to be submitted for review and approval to the relevant authority and to be approved for construction. The reinforcement is to be made to BS 5951 and BS 8007.	BA	LM

DRAWING STATUS

☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
FOR DISCUSSION (RIBA STAGE 0-2)									
FOR PLANNING (RIBA STAGE 3)									
FOR TENDER (RIBA STAGE 4)									
FOR CONSTRUCTION (RIBA STAGE 5)									
AS-BUILT (RIBA STAGE 6)									
AS-RECORDED (RIBA STAGE 6)									

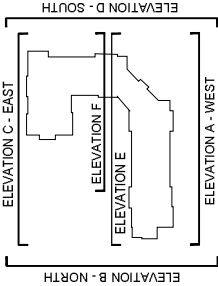


Client

Project
Proposed Care Home at
Crawley Down, CopthorneDrawing Title
Elevations 1

Scale	Date
1:100 @ A1	Feb 2023
Drawn by	Checked by
GmM	SEL

Job No. B222093 Drawing No. AL(1)140 Rev. P-2



ELEVATION KEY
1:1000



MATERIAL KEY

- | | |
|---|--|
|  | Main brick
Nutcombe Multiflock |
|  | Hanging Tiles
Sundorff Tucson Hanging Tiles |
|  | Roof Tile
Fenestrate Gemini Concrete Tiles Mixed Russet |
|  | External Windows & Doors
Sage Green (RAL6021) uPVC |
|  | Curtain Walling & Main Entrance Doors
PPC Aluminium - Sage Green (RAL6021) |
|  | Rainwater Goods
Black uPVC |
|  | Fascia & Soffits
Black uPVC |



All dimensions to be verified on site prior to the commencement of any work or the production of any shop drawing. All discrepancies to be reported to the Architect.

This drawing is to be read in conjunction with all related Architects and Engineer's drawings and any other relevant information.

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PROJ	DATE	REVISION	REVISION DESCRIPTION	INITIALS	CHECK
P1	14/10/23			KW	LAR
P2	14/10/23		Column, brace and chimney design surface availability was added to the design. The design was then checked by the design engineer.	KW	LAR

	☒	☐	☐	☐	☐
DRAWING STATUS	FOR DISCUSSION (RIBA STAGE 0-2) OR PLANNING (RIBA STAGE 3) OR TENDER (RIBA STAGE 4) OR CONSTRUCTION (RIBA STAGE 5) S-BUILT (RIBA STAGE 6) S-RECORDED (RIBA STAGE 6)				



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Client



reject

Proposed Care Home at
Crawley Down, Copthorne

Drawing Title

levations 2

cable

1V @ 0.01:1

drawn by
GMM

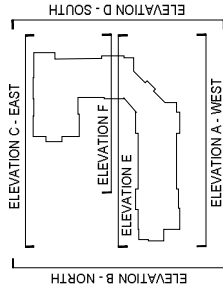
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5222093



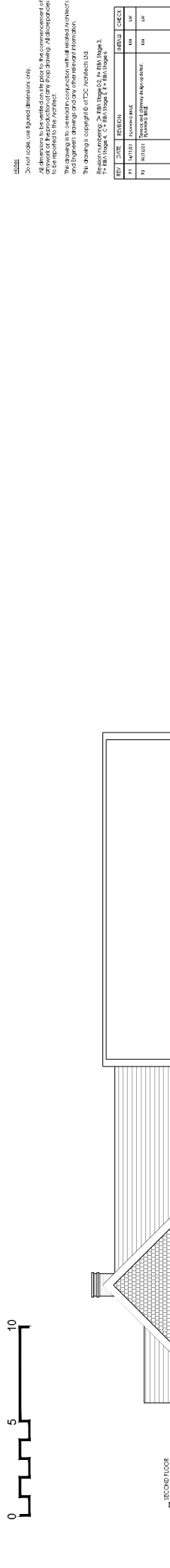
MATERIAL KEY

-  **Main Brick**
Nantes/Brick Multitack
 -  **Hanging Tiles**
Sandhill/Tuscan Hanging Tiles
 -  **Roof Tile**
Forced/Green/Concrete Tile (Mixed/Rosette)
 -  **External Windows & Doors**
Sage Green (RAL6021) 6 PVC
 -  **Curtain Walling & Main Entrance Doors**
PVC Aluminium: Sage Green (RAL6021]
 -  **Rainwater Goods**
Black 6 PVC
 -  **Fascia & Soffits**
Black 6 PVC



EVALUATION KEY

1:1000



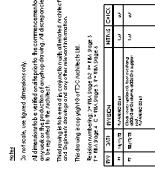
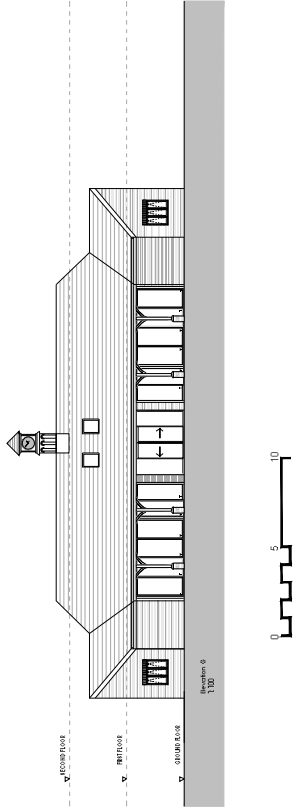
☐	☒	☐	☐	☐
DRAWING STATUS				
FOR DISCUSSION (RIBA STAGE 0-2)				
FOR PLANNING (RIBA STAGE 3)				
FOR TENDER (RIBA STAGE 4)				
FOR CONSTRUCTION (RIBA STAGE 5)				
AS-BUILT (RIBA STAGE 6)				
AS-RECORDED (RIBA STAGE 6)				



BARCHESTER
Celebrating life

Project	Proposed Care Home at Crawley Down, Copthorne
Drawing Title	Elevations 3

Scale	Date	Rev.
1:100 @ A1	Feb 2023	P-2
Drawn by	Checked by	
GRI	SEL	
Job No.	Drawing No.	
B222093	AL(1)142	



ARCHESTER
Publishing

Scale 1:100 @ A0
Drawn by KIN
Date July 2023
Checked by CME

Figures 3A & 3B

Reference road traffic noise contours for monitoring positions – Day & Night

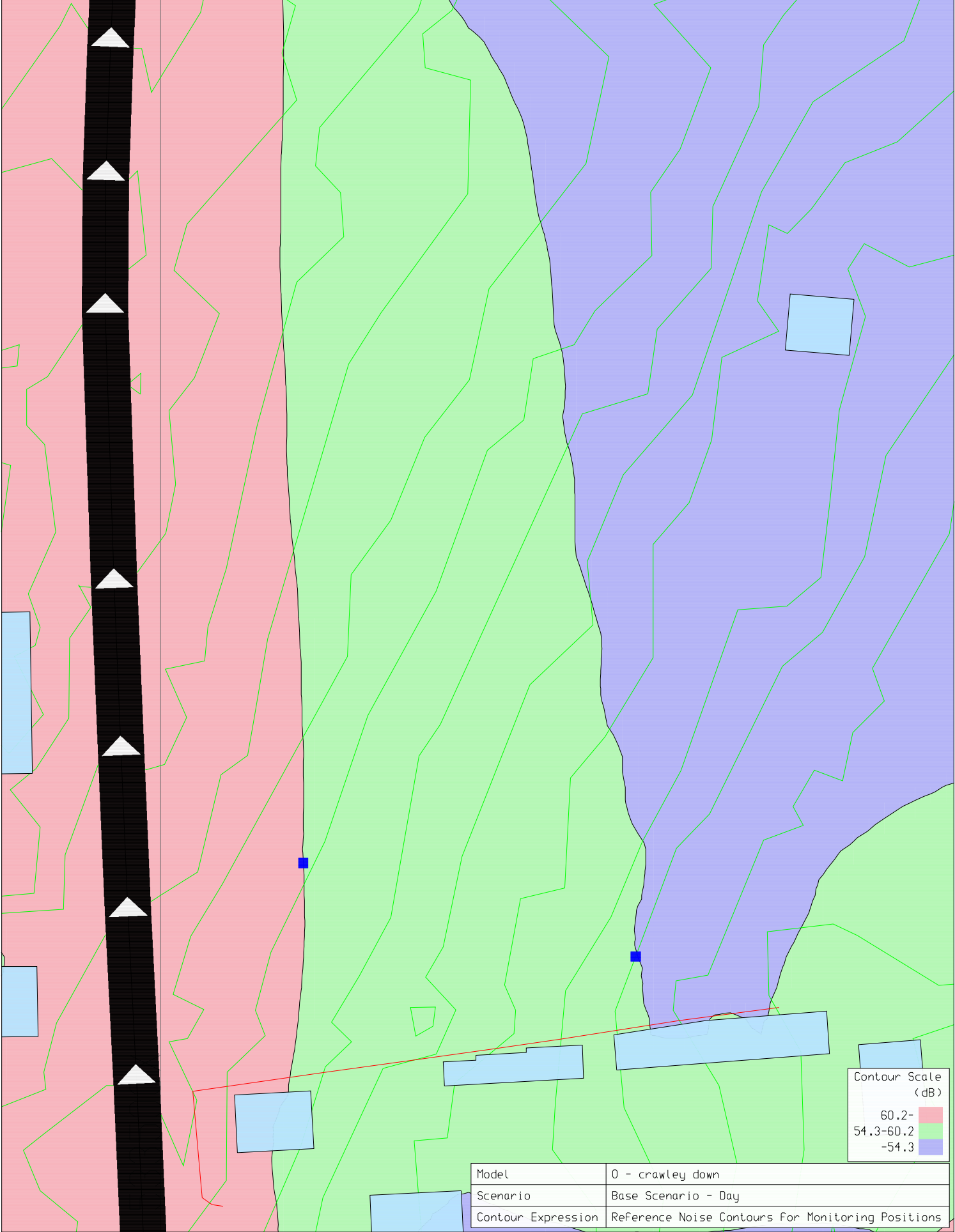
Crawley Down
Base Scenario - Day

Scale 1 : 625.0 17:58:55 06/01/2024

N

↑

NoiseMap



Model	0 - crawley down
Scenario	Base Scenario - Day
Contour Expression	Reference Noise Contours For Monitoring Positions

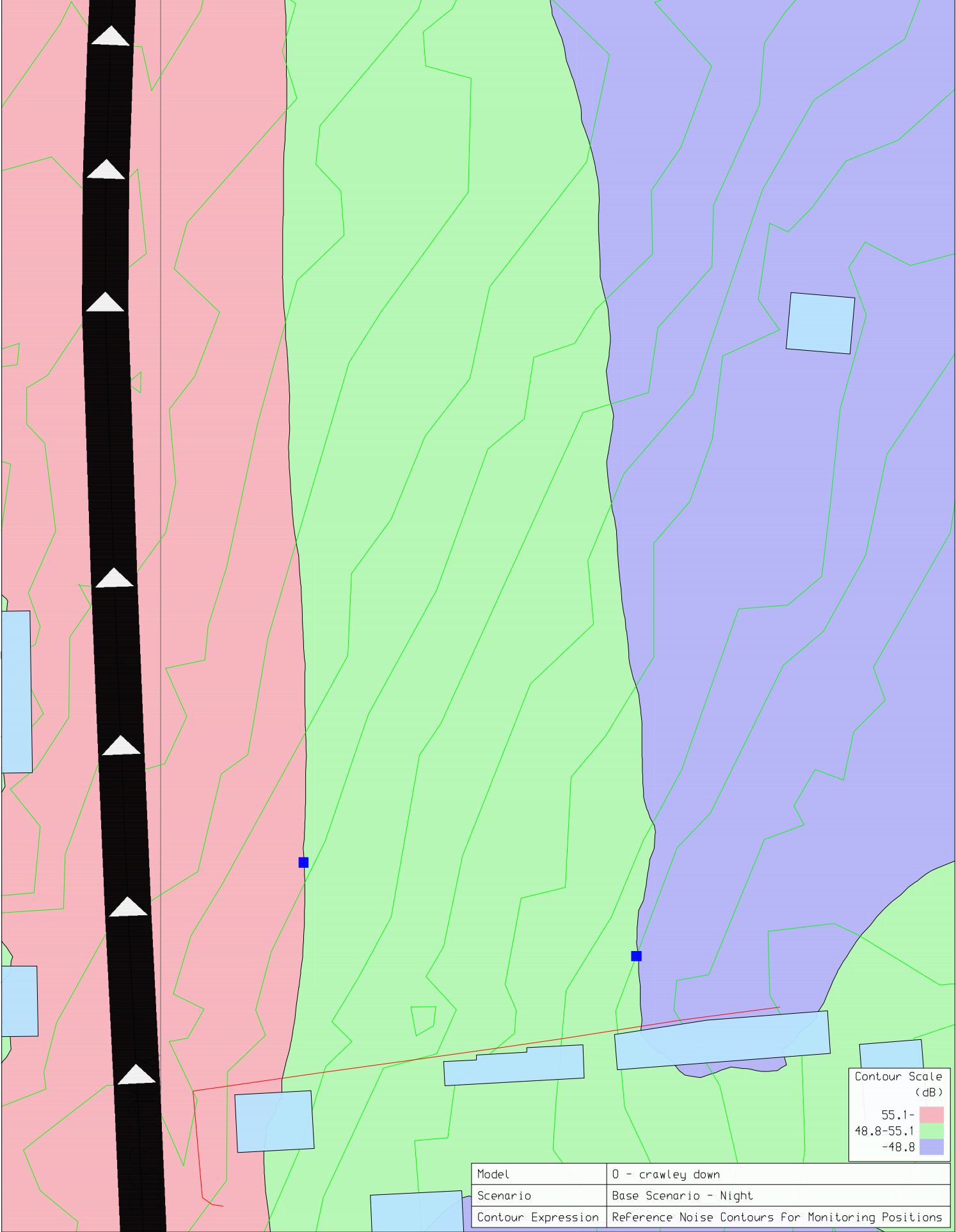
Crawley Down
Base Scenario - Night

Scale 1 : 625.0 18:01:01 06/01/2024

N

↑

NoiseMap



Contour Scale (dB)	
55.1-	Pink
48.8-55.1	Green
-48.8	Purple

Model	0 - crawley down
Scenario	Base Scenario - Night
Contour Expression	Reference Noise Contours For Monitoring Positions

Figures 4A to 4E

Road traffic noise contours – Proposed development - Day

Crawley Down
With Development - Ground Floor - Day

Scale 1 : 500.0 08:53:05 15/01/2024

N

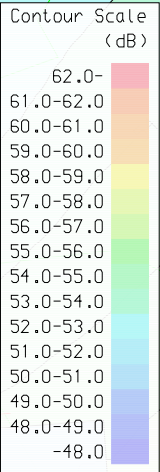
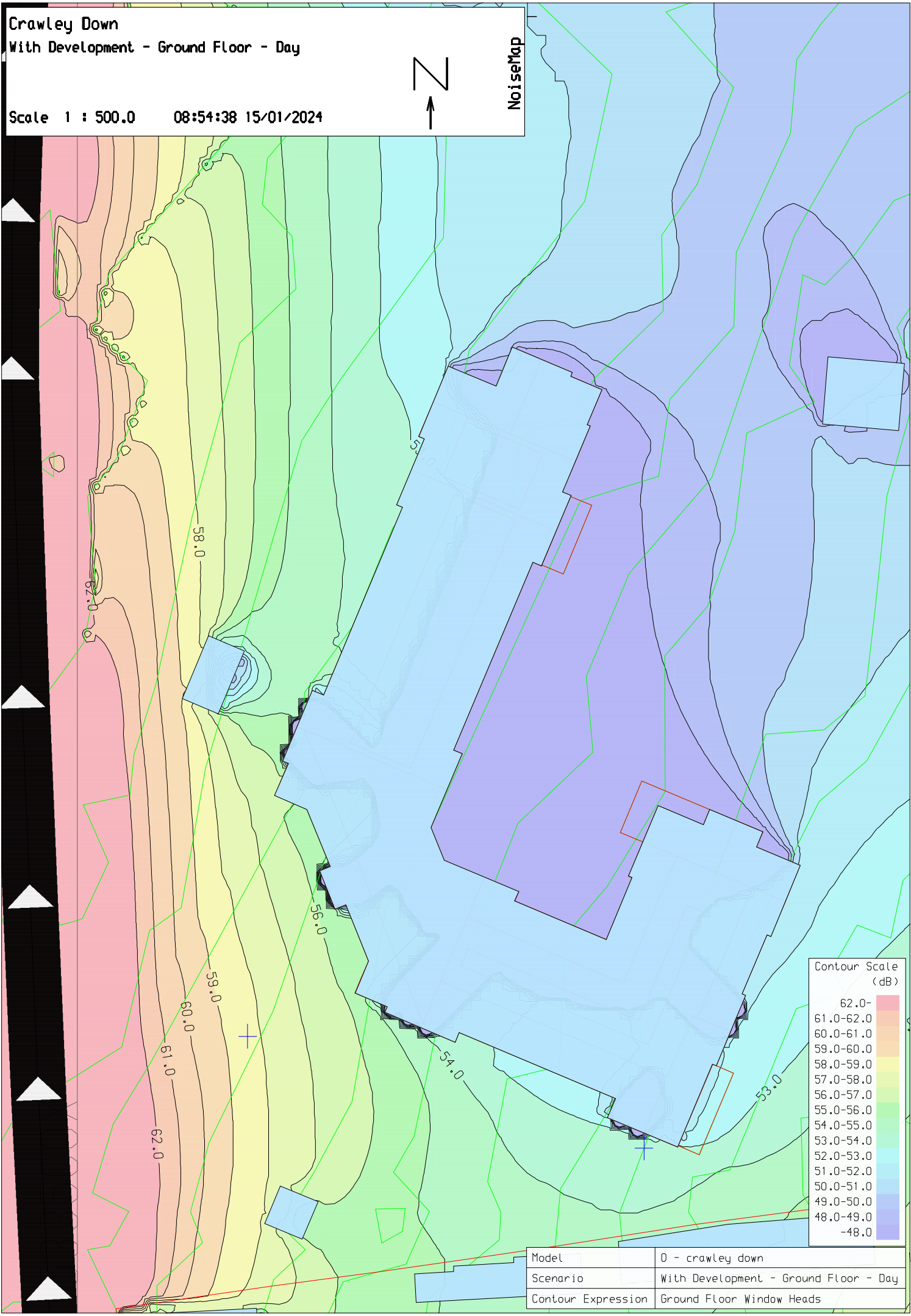
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NoiseMap



Contour Scale (dB)	
55.0-	
50.0-55.0	
-50.0	

Model	0 - crawley down
Scenario	With Development - Ground Floor - Day
Contour Expression	External Areas



Model	0 - crawley down
Scenario	With Development - Ground Floor - Day
Contour Expression	Ground Floor Window Heads

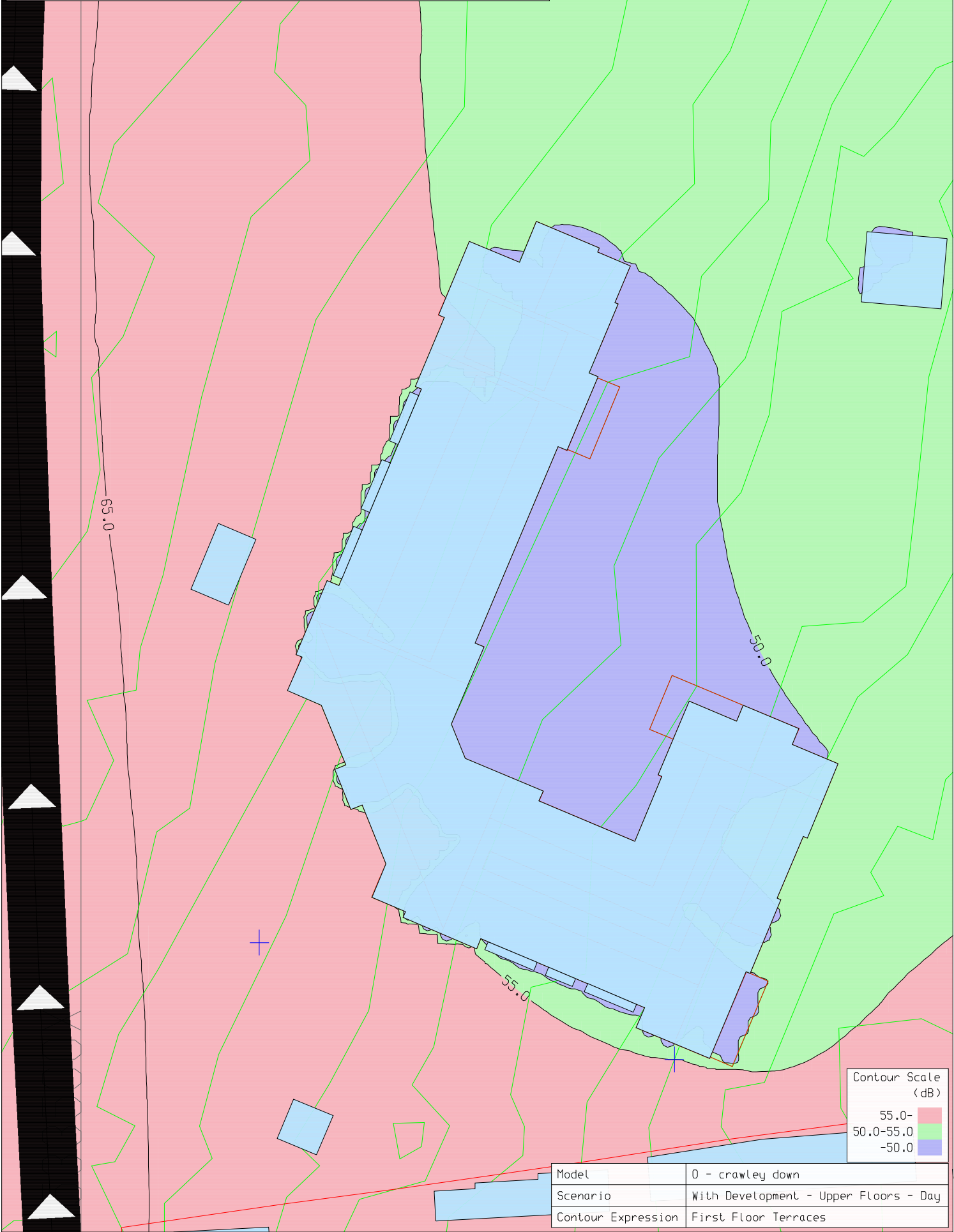
Crawley Down
With Development - Upper Floors - Day

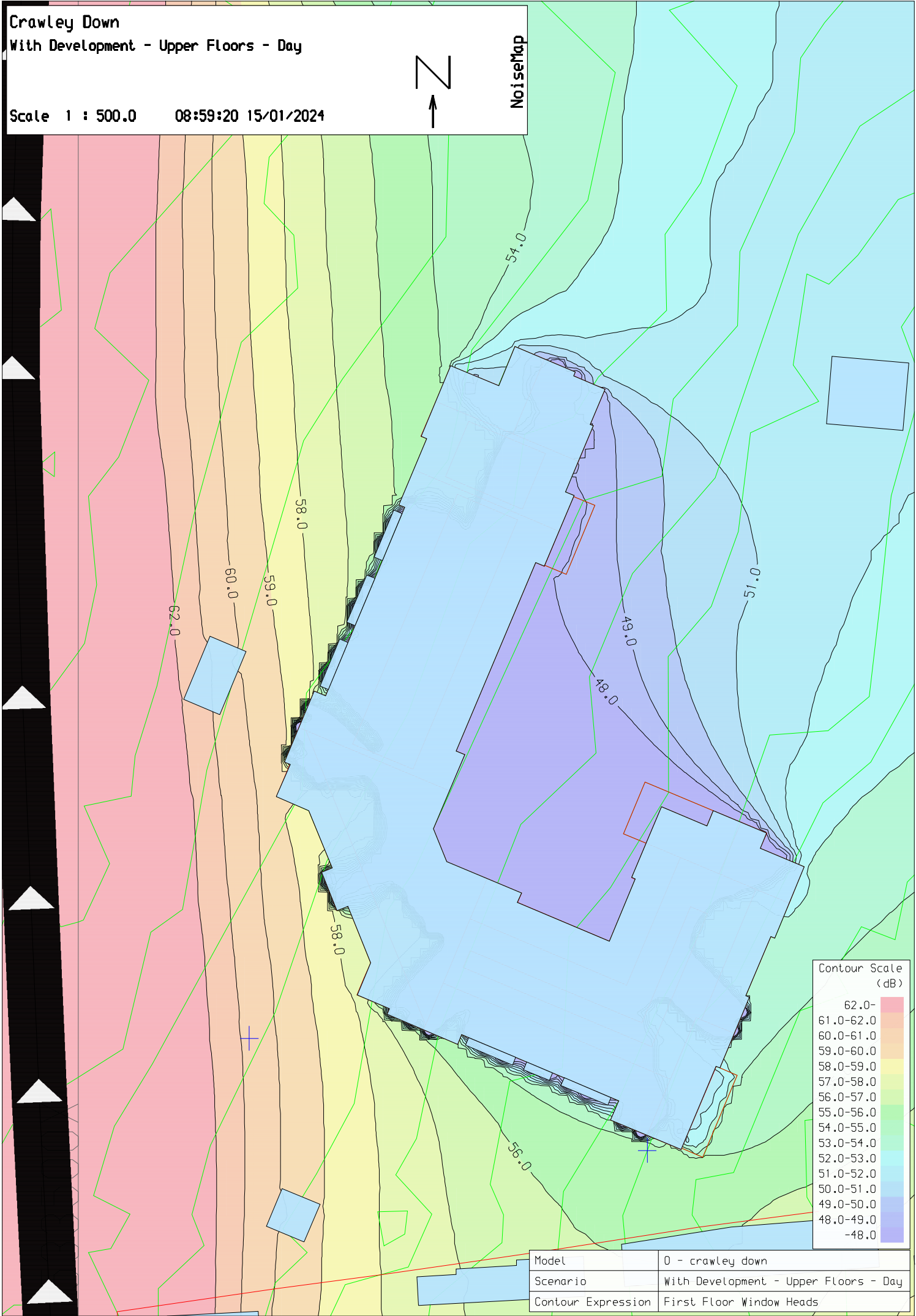
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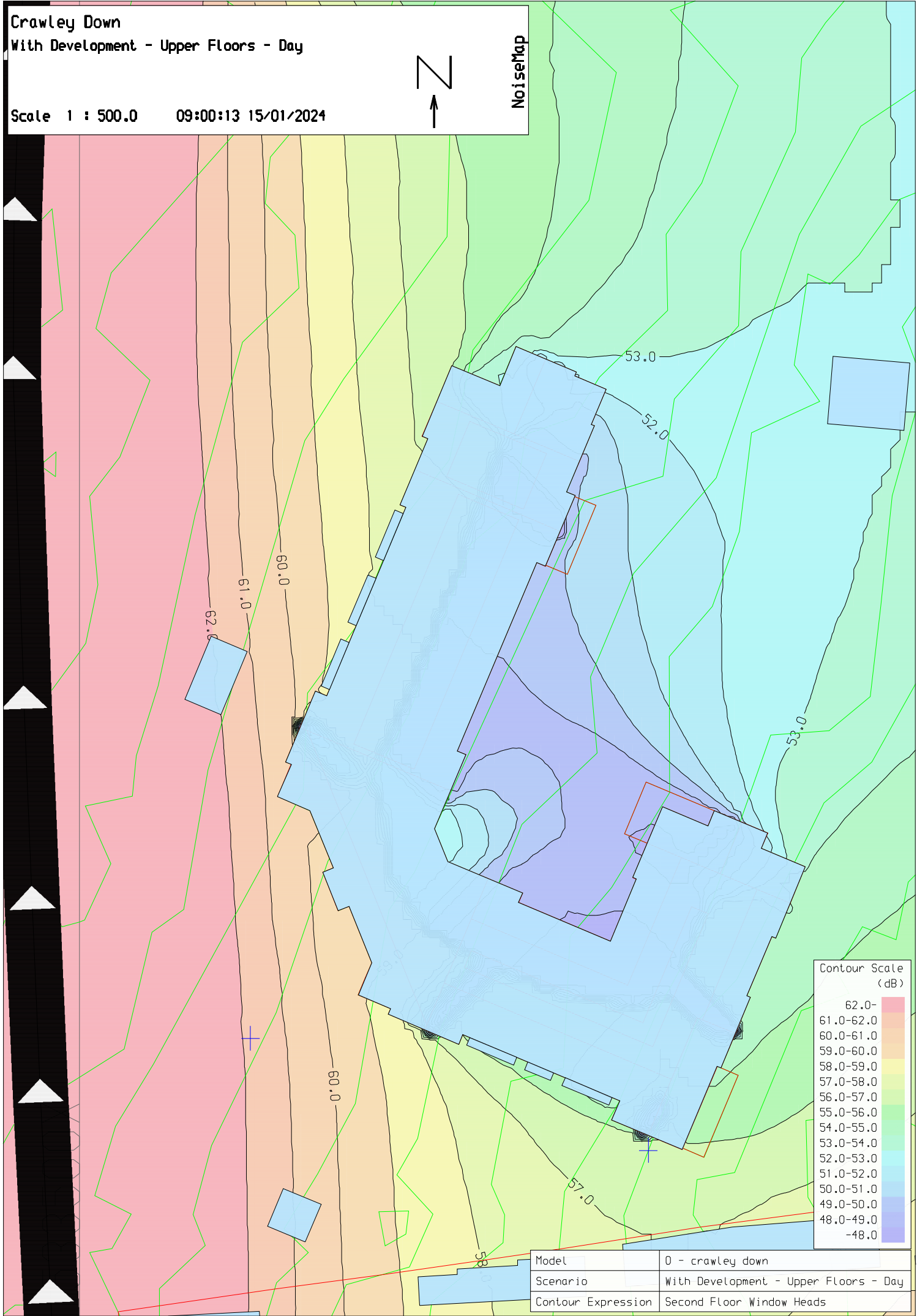
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NoiseMap



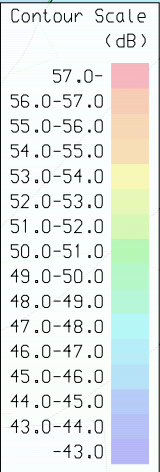
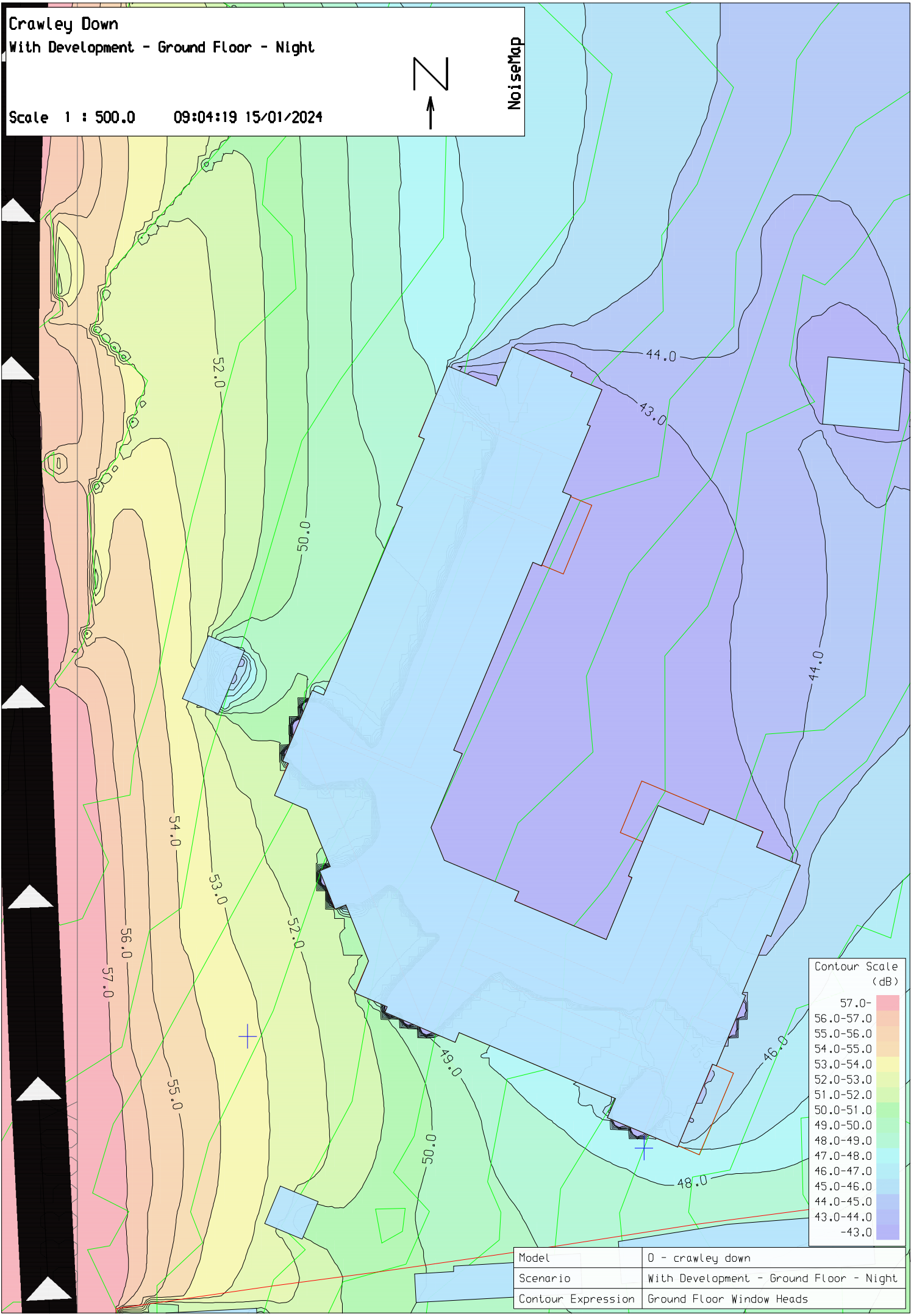




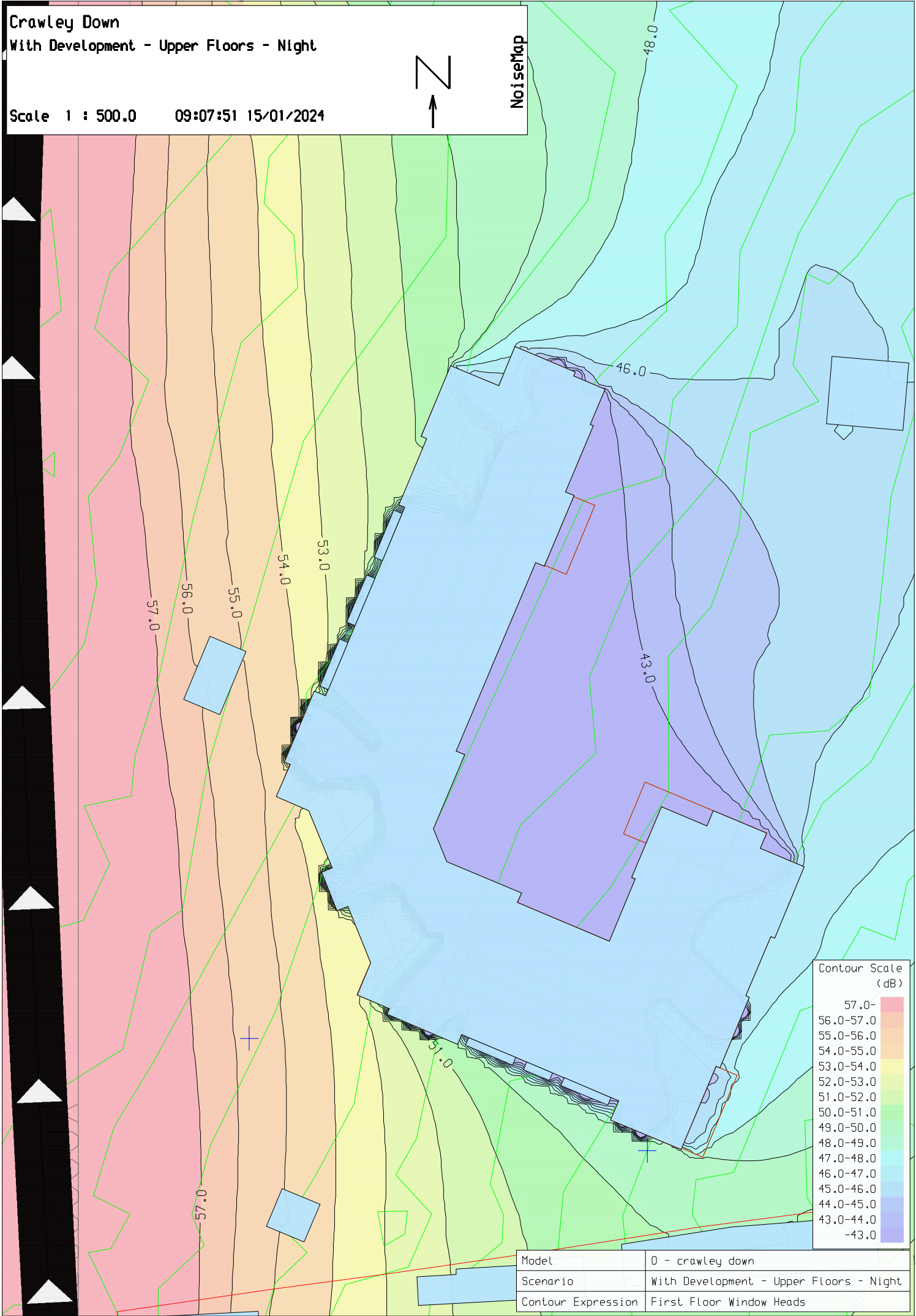
Model	0 - crawley down
Scenario	With Development - Upper Floors - Day
Contour Expression	Second Floor Window Heads

Figures 5A to 5C

Road traffic noise contours – Proposed development - Night



Model	0 - crawley down
Scenario	With Development - Ground Floor - Night
Contour Expression	Ground Floor Window Heads



Model	0 - crawley down
Scenario	With Development - Upper Floors - Night
Contour Expression	Second Floor Window Heads

Appendix A

Glossary of acoustical terms

Glossary

Below are explanations of terms as they are used in the PPG; they are not definitions.

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 Pa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A): decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

Hertz (Hz): unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.

$L_{A10,T}$: the A weighted level of noise exceeded for 10% of the specified measurement period (T). It gives an indication of the upper limit of fluctuating noise such as that from road traffic. $L_{A10,18h}$ is the arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06.00 to 24.00.

$L_{A90,T}$: the A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 it is used to define background noise level.

$L_{Aeq,T}$: the equivalent continuous sound level -the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is written as L_{eq} in connection with aircraft noise.

L_{Amax} : the highest A weighted noise level recorded during a noise event. The time weighting used (F or S) should be stated.

Additionally, the term **SPL** refers to the quantity Sound Pressure Level as discussed under **Decibel (dB)** above. This can be either a broad-band quantity including all octave-band figures or can refer to individual octave-bands for instance.

The above text is reproduced in full from PPG24

Appendix B

Noise monitoring results obtained at MPE

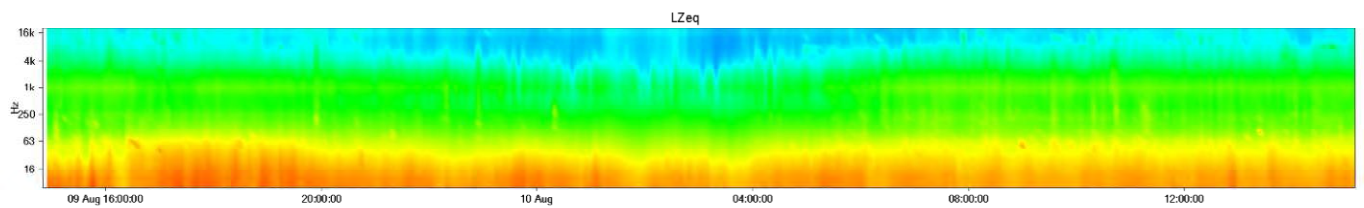
Project Report

Start: 2023-08-09 14:52:02

End: 2023-08-10 15:10:00



LAeq_dt LAeq_60' LAFmax_dt LAFmax_60' LAFmin_dt L 10.0 %
L 90.0 %



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	2023-08-09 14:52:02	1 00:17:58	59.2	85.8		
-Exclude (2)		00:17:58	60.2	79.3	63.6	51.0
-Extraneous Noise (1)		00:00:06	76.6	84.9	82.1	65.5
-HGV over Drain Cover (4)		00:00:29	71.1	85.2	74.3	63.9
☐ -HGV over Drain Cover	2023-08-10 06:02:43	00:00:11	68.3	74.7		
☐ -HGV over Drain Cover	2023-08-10 06:09:24	00:00:09	69.6	79.4		
☐ -HGV over Drain Cover	2023-08-10 06:23:59	00:00:05	72.5	79.8		
☐ -HGV over Drain Cover	2023-08-10 06:47:22	00:00:04	75.2	85.2		
-Overload (1)		00:00:01	66.6	73.6	66.6	66.6
Project Result		23:59:24	59.1	85.8	63.1	48.4

Markers

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Night (1)		07:59:31	55.1	79.1	58.4	47.4
☐ Night	2023-08-09 23:00:00	07:59:31	55.1	79.1		
Day (2)		15:59:53	60.2	85.8	63.7	51.1
☐ Day	2023-08-09 15:00:00	07:59:59	59.2	81.9		
☐ Day	2023-08-10 07:00:00	07:59:54	61.1	85.8		

Audit Intervals

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
60'	2023-08-09 14:00:00	00:00:00	---	---	---	---
60'	2023-08-09 15:00:00	01:00:00	60.9	75.1	64.1	52.6
60'	2023-08-09 16:00:00	01:00:00	60.4	81.9	63.3	53.8
60'	2023-08-09 17:00:00	01:00:00	59.3	73.9	62.4	53.5
60'	2023-08-09 18:00:00	01:00:00	60.1	74.9	63.7	53.4
60'	2023-08-09 19:00:00	01:00:00	59.4	78.6	63.1	51.9
60'	2023-08-09 20:00:00	00:59:59	57.8	72.3	62.1	50.5
60'	2023-08-09 21:00:00	01:00:00	57.1	74.3	61.5	48.9
60'	2023-08-09 22:00:00	01:00:00	56.8	80.9	60.1	48.0
60'	2023-08-09 23:00:00	01:00:00	54.7	76.7	58.3	47.9
60'	2023-08-10 00:00:00	01:00:00	52.8	79.1	51.5	47.2
60'	2023-08-10 01:00:00	01:00:00	52.3	73.4	51.6	47.4
60'	2023-08-10 02:00:00	01:00:00	51.8	71.7	51.0	47.8
60'	2023-08-10 03:00:00	01:00:00	51.3	70.3	50.7	45.8
60'	2023-08-10 04:00:00	01:00:00	54.5	73.2	55.7	48.0
60'	2023-08-10 05:00:00	01:00:00	56.3	76.3	59.7	49.2
60'	2023-08-10 06:00:00	00:59:31	59.7	74.4	64.1	50.0

60'	2023-08-10 07:00:00	01:00:00	61.6	74.4	65.0	53.6
60'	2023-08-10 08:00:00	01:00:00	61.9	85.8	64.8	54.0
60'	2023-08-10 09:00:00	01:00:00	61.3	84.4	64.3	52.5
60'	2023-08-10 10:00:00	00:59:54	61.2	83.6	63.9	52.2
60'	2023-08-10 11:00:00	01:00:00	61.0	78.9	63.9	52.2
60'	2023-08-10 12:00:00	01:00:00	60.2	77.4	63.5	52.2
60'	2023-08-10 13:00:00	01:00:00	60.3	82.3	63.5	52.3
60'	2023-08-10 14:00:00	01:00:00	60.8	77.4	63.8	52.8
60'	2023-08-10 15:00:00	00:00:00	---	---	---	---

Project Name: 2023-08-09_SLM_001 - 2m - Exc Drain Noise
Device Info: XL2, SNo. A2A-11063-E0, FW4.71 Type Approved
Mic Sensitivity: 46.7 mV/Pa
Range: 0 - 100 dB
Ln based on: LAeq_dt

Markers

MPW

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Night (1)		7:59:31	55.1	79.1	58.4	47.4
Night	2023-08-09 23:00:00	7:59:31	55.1	79.1		
Day (2)		15:59:53	60.2	85.8	63.7	51.1
Day	2023-08-09 15:00:00	7:59:59	59.2	81.9		
Day	2023-08-10 07:00:00	7:59:54	61.1	85.8		

Audit Intervals

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]	Event number
2'	2023-08-10 00:16:00	0:02:00	60.8	79.1	61.2	47.9	1
2'	2023-08-09 23:18:00	0:02:00	60.3	76.7	62.3	48.9	2
2'	2023-08-10 05:58:00	0:02:00	61.5	76.3	64.7	51.2	3
2'	2023-08-10 06:26:00	0:02:00	61.4	74.4	65.0	51.9	4
2'	2023-08-10 06:20:00	0:02:00	62.2	74.3	66.2	50.6	5
2'	2023-08-10 05:22:00	0:02:00	58.5	74.2	61.7	49.2	6
2'	2023-08-10 06:10:00	0:02:00	59.1	74.2	64.3	48.4	7
2'	2023-08-10 06:48:00	0:02:00	60.7	74.1	64.6	51.5	8
2'	2023-08-10 00:08:00	0:02:00	54.6	73.4	58.4	46.5	9
2'	2023-08-10 01:02:00	0:02:00	56.0	73.4	52.0	47.5	10
2'	2023-08-10 05:30:00	0:02:00	58.7	73.3	61.4	50.0	11
2'	2023-08-10 04:18:00	0:02:00	59.5	73.2	64.1	48.7	12
2'	2023-08-10 05:54:00	0:02:00	58.7	73.1	62.0	49.2	13
2'	2023-08-10 04:16:00	0:02:00	55.6	72.4	54.2	47.6	14
2'	2023-08-10 04:56:00	0:02:00	57.1	72.2	61.7	49.3	15
2'	2023-08-09 23:48:00	0:02:00	54.9	72.1	55.4	48.3	
2'	2023-08-10 05:46:00	0:02:00	59.2	71.9	64.5	50.4	
2'	2023-08-10 02:30:00	0:02:00	57.5	71.7	59.2	49.3	
2'	2023-08-10 06:52:00	0:02:00	61.9	71.6	65.1	53.2	
2'	2023-08-10 06:58:00	0:02:00	61.1	71.6	65.6	52.1	
2'	2023-08-10 05:26:00	0:02:00	59.4	71.5	63.7	49.7	
2'	2023-08-10 04:00:00	0:02:00	54.3	71.4	55.0	47.8	
2'	2023-08-09 23:32:00	0:02:00	56.9	71.1	61.7	47.8	
2'	2023-08-10 04:04:00	0:02:00	55.3	70.9	53.9	47.0	
2'	2023-08-10 04:36:00	0:02:00	56.4	70.9	58.0	48.3	
2'	2023-08-10 04:44:00	0:02:00	56.4	70.9	59.3	48.8	
2'	2023-08-10 06:42:00	0:02:00	60.5	70.7	64.0	53.6	
2'	2023-08-10 01:44:00	0:02:00	55.3	70.6	58.9	47.3	
2'	2023-08-10 06:46:00	0:01:56	60.0	70.5	64.2	51.1	
2'	2023-08-10 06:40:00	0:02:00	61.4	70.4	65.2	54.0	
2'	2023-08-10 03:42:00	0:02:00	52.4	70.3	49.6	45.6	
2'	2023-08-10 04:28:00	0:02:00	55.7	70.1	54.8	49.2	
2'	2023-08-10 06:56:00	0:02:00	60.0	70.1	64.7	50.3	
2'	2023-08-10 06:44:00	0:02:00	61.9	69.9	66.1	51.8	
2'	2023-08-10 05:24:00	0:02:00	56.7	69.8	61.0	48.4	
2'	2023-08-10 06:24:00	0:01:56	59.5	69.8	63.6	50.7	
2'	2023-08-10 06:50:00	0:02:00	60.9	69.8	65.4	50.8	
2'	2023-08-10 06:38:00	0:02:00	60.8	69.6	64.4	55.0	
2'	2023-08-10 04:50:00	0:02:00	55.2	69.5	56.2	48.8	
2'	2023-08-10 01:10:00	0:02:00	54.2	69.4	54.5	48.8	
2'	2023-08-10 02:20:00	0:02:00	54.6	69.4	55.4	49.2	
2'	2023-08-10 04:26:00	0:02:00	54.5	69.4	56.5	48.5	
2'	2023-08-10 06:06:00	0:02:00	56.6	69.4	61.5	49.9	
2'	2023-08-10 06:28:00	0:02:00	59.9	69.4	64.6	50.4	
2'	2023-08-09 23:08:00	0:02:00	57.1	69.3	62.3	48.5	

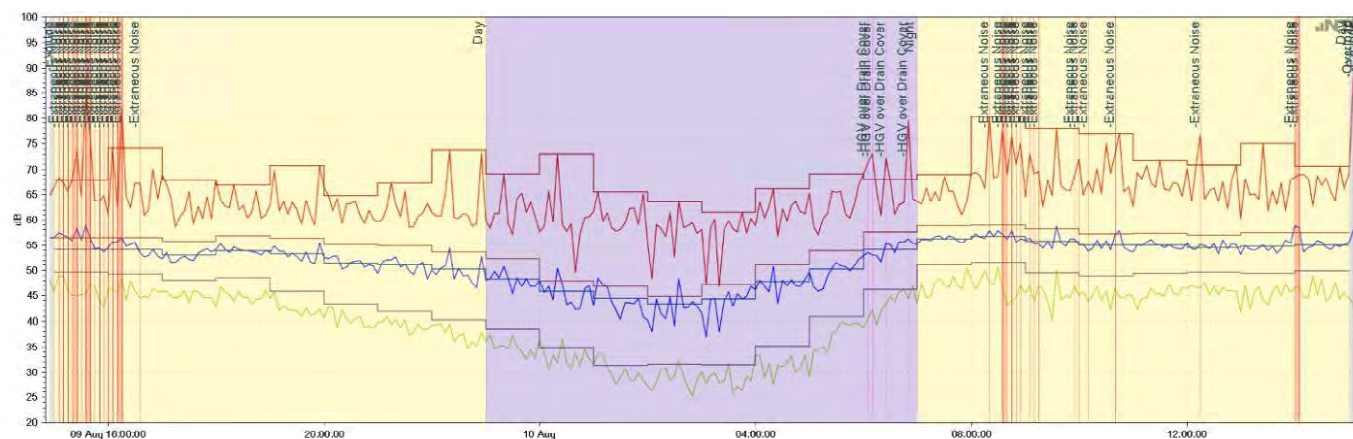
Appendix C

Noise monitoring results obtained at MPW

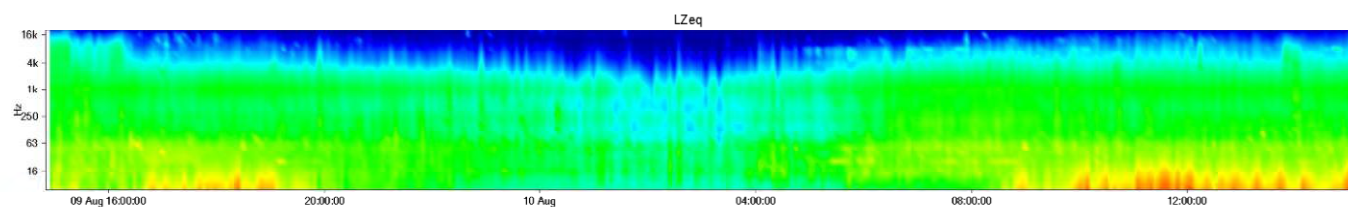
Project Report

Start: 2023-08-09 14:52:02

End: 2023-08-10 15:10:00



— LAeq_dt
 — LAeq_60'
 — LAFmax_dt
 — LAFmax_60'
 — LAFmin_dt
 — L 10.0 %
 — L 90.0 %



Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Recorded	2023-08-09 14:52:02	1 00:17:58	53.5	87.8		
-Exclude (2)		00:17:58	57.4	87.8	59.4	47.6
-Extraneous Noise (137)		00:18:14	60.9	84.7	63.1	54.7
-HGV over Drain Cover (4)		00:00:29	65.5	79.4	69.2	59.9
☐ -HGV over Drain Cover	2023-08-10 06:02:43	00:00:11	63.6	71.3		
☐ -HGV over Drain Cover	2023-08-10 06:09:24	00:00:09	65.1	73.0		
☐ -HGV over Drain Cover	2023-08-10 06:23:59	00:00:05	65.4	72.2		
☐ -HGV over Drain Cover	2023-08-10 06:47:22	00:00:04	69.0	79.4		
-Overload (1)		00:00:01	79.3	87.8	79.3	79.3
Project Result		23:41:17	53.1	80.2	56.7	38.2

Markers

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Night (1)		07:59:31	48.8	73.0	53.4	33.7
☐ Night	2023-08-09 23:00:00	07:59:31	48.8	73.0		
Day (2)		15:41:46	54.3	80.2	57.2	46.4
☐ Day	2023-08-09 15:00:00	07:45:05	52.8	74.1		
☐ Day	2023-08-10 07:00:00	07:56:41	55.4	80.2		

Audit Intervals

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
60'	2023-08-09 14:00:00	00:00:00	---	---	---	---
60'	2023-08-09 15:00:00	00:47:33	54.1	67.9	56.4	49.6
60'	2023-08-09 16:00:00	00:57:32	54.1	74.1	56.5	49.2
60'	2023-08-09 17:00:00	01:00:00	53.0	67.9	55.7	48.0
60'	2023-08-09 18:00:00	01:00:00	53.9	66.9	56.8	48.5
60'	2023-08-09 19:00:00	01:00:00	53.3	70.7	56.3	45.8
60'	2023-08-09 20:00:00	01:00:00	51.4	64.8	55.1	43.3
60'	2023-08-09 21:00:00	01:00:00	51.0	67.2	54.8	41.9
60'	2023-08-09 22:00:00	01:00:00	50.2	73.8	53.6	40.3
60'	2023-08-09 23:00:00	01:00:00	48.2	69.1	52.3	38.4
60'	2023-08-10 00:00:00	01:00:00	45.8	73.0	47.8	34.9
60'	2023-08-10 01:00:00	01:00:00	44.5	65.5	46.8	31.3
60'	2023-08-10 02:00:00	01:00:00	43.3	63.5	44.8	31.5
60'	2023-08-10 03:00:00	01:00:00	44.3	61.5	47.1	31.4
60'	2023-08-10 04:00:00	01:00:00	47.8	66.1	51.0	35.1
60'	2023-08-10 05:00:00	01:00:00	50.2	69.1	53.9	40.9
60'	2023-08-10 06:00:00	00:59:31	54.2	68.0	57.5	46.1

60'	2023-08-10 07:00:00	01:00:00	56.2	69.0	58.8	51.1
60'	2023-08-10 08:00:00	00:59:18	56.7	80.2	58.9	51.5
60'	2023-08-10 09:00:00	00:59:41	55.7	77.9	58.2	49.5
60'	2023-08-10 10:00:00	00:59:29	55.0	76.9	57.2	48.8
60'	2023-08-10 11:00:00	01:00:00	55.0	71.6	57.3	49.3
60'	2023-08-10 12:00:00	00:59:56	54.5	70.8	56.9	49.6
60'	2023-08-10 13:00:00	00:59:04	54.8	75.0	57.4	49.3
60'	2023-08-10 14:00:00	00:59:13	55.0	70.6	57.4	49.8
60'	2023-08-10 15:00:00	00:00:00	---	---	---	---

Project Name: 2023-08-09_SLM_001 - 2m - Exc Drain Noise
Device Info: XL2, SNo. A2A-09159-E0, FW4.71 Type Approved
Mic Sensitivity: 41.6 mV/Pa (User calibrated 2023-08-09 14:35, WP30(h))
Range: 0 - 100 dB
Ln based on: LAeq_dt

Markers

MPE

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]
Night (1)		7:59:31	48.8	73.0	53.4	33.7
Night	2023-08-09 23:00:00	7:59:31	48.8	73.0		
Day (2)		15:41:46	54.3	80.2	57.2	46.4
Day	2023-08-09 15:00:00	7:45:05	52.8	74.1		
Day	2023-08-10 07:00:00	7:56:41	55.4	80.2		

Audit Intervals

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	L 10.0 % [dB]	L 90.0 % [dB]	Event number
2'	2023-08-10 00:16:00	0:02:00	54.1	73.0	55.6	35.8	1
2'	2023-08-09 23:18:00	0:02:00	53.8	69.1	55.4	39.3	2
2'	2023-08-10 05:58:00	0:02:00	56.1	69.1	58.7	47.2	3
2'	2023-08-10 06:46:00	0:01:56	54.7	68.0	58.5	47.7	4
2'	2023-08-10 06:26:00	0:02:00	56.1	67.6	58.6	50.8	5
2'	2023-08-10 06:20:00	0:02:00	56.2	67.1	59.1	48.7	6
2'	2023-08-10 05:54:00	0:02:00	53.1	66.9	58.3	41.2	7
2'	2023-08-10 04:18:00	0:02:00	53.3	66.1	58.0	40.4	8
2'	2023-08-10 06:48:00	0:02:00	54.4	66.0	57.3	48.5	9
2'	2023-08-10 06:24:00	0:01:56	53.7	65.8	56.2	48.1	10
2'	2023-08-10 05:22:00	0:02:00	52.0	65.7	54.9	42.2	11
2'	2023-08-10 05:30:00	0:02:00	52.6	65.7	57.2	41.9	12
2'	2023-08-10 00:08:00	0:02:00	48.0	65.6	54.0	34.7	13
2'	2023-08-10 06:10:00	0:02:00	53.0	65.6	56.4	43.9	14
2'	2023-08-10 01:02:00	0:02:00	49.9	65.5	51.0	37.0	15
2'	2023-08-10 05:26:00	0:02:00	53.4	65.4	57.4	43.1	
2'	2023-08-09 23:36:00	0:02:00	49.8	65.3	53.4	38.2	
2'	2023-08-10 04:56:00	0:02:00	50.5	65.3	54.3	34.3	
2'	2023-08-10 01:50:00	0:02:00	43.2	65.1	44.2	35.6	
2'	2023-08-10 04:16:00	0:02:00	48.7	64.7	51.4	29.5	
2'	2023-08-09 23:32:00	0:02:00	50.1	64.2	54.5	37.4	
2'	2023-08-10 06:52:00	0:02:00	55.9	64.2	58.4	51.1	
2'	2023-08-10 06:22:00	0:01:59	52.5	64.1	55.6	46.0	
2'	2023-08-10 06:58:00	0:02:00	55.1	63.7	59.0	48.3	
2'	2023-08-10 02:30:00	0:02:00	50.4	63.5	55.4	34.2	
2'	2023-08-10 04:44:00	0:02:00	49.4	63.5	52.5	36.1	
2'	2023-08-09 23:48:00	0:02:00	48.4	63.4	51.3	40.8	
2'	2023-08-10 04:00:00	0:02:00	47.7	63.4	49.4	39.2	
2'	2023-08-10 06:42:00	0:02:00	55.0	63.4	57.2	50.8	
2'	2023-08-10 06:44:00	0:02:00	56.0	63.4	59.2	50.1	
2'	2023-08-10 05:46:00	0:02:00	52.8	63.0	57.7	42.1	
2'	2023-08-10 06:38:00	0:02:00	56.3	63.0	58.5	53.3	
2'	2023-08-10 06:50:00	0:02:00	55.7	63.0	58.9	48.6	
2'	2023-08-10 04:04:00	0:02:00	48.4	62.9	51.5	31.2	
2'	2023-08-10 06:08:00	0:01:51	50.4	62.9	54.1	44.6	
2'	2023-08-10 04:36:00	0:02:00	49.8	62.8	54.3	36.9	
2'	2023-08-10 06:56:00	0:02:00	55.0	62.7	58.7	46.4	
2'	2023-08-10 04:10:00	0:02:00	47.3	62.6	50.5	42.0	
2'	2023-08-10 06:06:00	0:02:00	50.9	62.6	55.1	44.6	
2'	2023-08-10 01:44:00	0:02:00	48.0	62.3	52.3	34.3	
2'	2023-08-10 05:24:00	0:02:00	50.4	62.3	54.6	41.7	
2'	2023-08-10 01:36:00	0:02:00	44.8	62.2	46.4	31.8	
2'	2023-08-10 06:40:00	0:02:00	56.0	62.2	58.5	50.4	
2'	2023-08-10 04:26:00	0:02:00	47.4	62.1	50.4	33.3	
2'	2023-08-10 04:28:00	0:02:00	49.5	62.1	52.5	38.5	

Appendix D

Attenuation of LAmax noise levels with distance

Consideration of three highest night-time maxima recorded at MPW and MPE

Start time of 2 minute monitoring period	00:16:00	23:18:00	05:58:00	Average
LAm _{ax} recorded at MPW	79.1 dB(A)	76.7 dB(A)	76.3 dB(A)	Difference
LAm _{ax} recorded at MPE	73.0 dB(A)	69.1 dB(A)	69.1 dB(A)	
Difference, LAm _{ax} at MPW minus LAm _{ax} at MPE	6.1 dB	7.6 dB	7.2 dB	7.0 dB

Propagation distance from Turners Hill Road to MPW

Propagation distance from Turners Hill Road to MPE

Line	Point	Average
Source	Source	of these
4.6 dB	9.2 dB	6.9 dB

Predicted attenuation with distance from MPW to MPE

Actual attenuation with distance from MPW to MPE from above maxima

Attenuation with distance for a line source equates to

Attenuation with distance for a point source equates to

Therefore

Attenuation with distance for in this case equates to approximately

Therefore

Propagation distance at which attenuation of maxima with distance is

Propagation distance at which attenuation of maxima with distance is

Propagation distance at which attenuation of maxima with distance is

Propagation distance at which attenuation of maxima with distance is

3.0 dB greater than at MPW	36.5 m
2.0 dB greater than at MPW	31.3 m
1.0 dB greater than at MPW	26.8 m
0.0 dB greater than at MPW	23.0 m