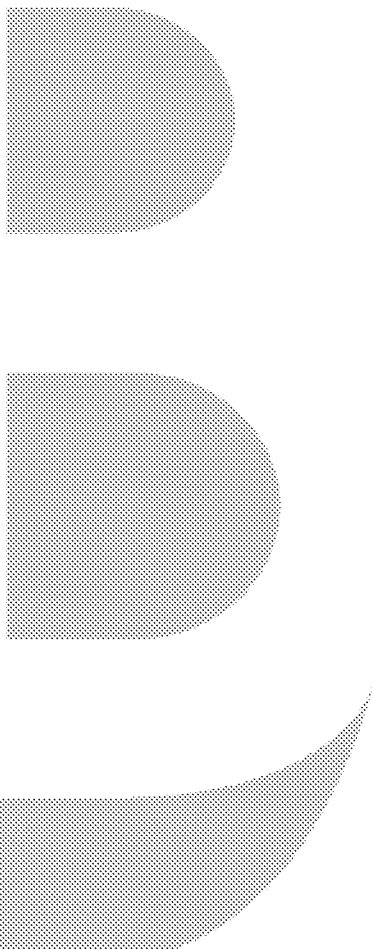


9. Noise & Vibration

9.1 Noise and Vibration Assessment

Appendix 9.1

Noise & Vibration Assessment





Armstrong House
3 Bassett Avenue
Southampton
SO16 7DP



WESTERGATE, WEST SUSSEX

NOISE AND VIBRATION PRELIMINARY ASSESSMENT

Technical Report: R10022-1 Rev 2

Date: 19th September 2023

For: Cala Homes South Home Counties
The Dorking Business Park
Station Road
Dorking
RH4 1HJ

24 Acoustics Document Control Sheet

Project Title: Westergate, West Sussex – Noise and Vibration Preliminary Assessment

Report Ref: R10022-1 Rev 2

Date: 19th September 2023

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Document Status and Approval Schedule

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CONTENTS	PAGE
1.0 INTRODUCTION	4
2.0 SITE DESCRIPTION	4
3.0 CRITERIA	4
4.0 NOISE MEASUREMENTS	7
5.0 VIBRATION MEASUREMENTS	11
6.0 TRAFFIC FLOW DATA	13
7.0 PRELIMINARY NOISE ASSESSMENT & OUTLINE MITIGATION	13
8.0 PRELIMINARY VIBRATION ASSESSMENT	15
9.0 CONCLUSIONS	16
FIGURES	18
APPENDIX A – ACOUSTIC TERMINOLOGY	22
APPENDIX B – NOISE MEASUREMENT RESULTS	23
APPENDIX C – VIBRATION MEASUREMENT RESULTS	27

1.0 INTRODUCTION

- 1.1 24 Acoustics Ltd has been instructed by Cala Homes South Home Counties to obtain environmental noise and vibration levels for a proposed development site at Westergate, West Sussex.
- 1.2 This report presents the results of a noise and vibration survey, undertaken between 20th and 27th April 2023, and provides preliminary comments and recommendations to ensure a suitable acoustic environment is provided to future dwellings.
- 1.3 All sound pressure levels quoted in this report are in dB relative to 20 µPa.

2.0 SITE DESCRIPTION

- 2.1 The site is located in Westergate, approximately 5 miles east of Chichester, in a mixed residential and agricultural area. Residential properties lie to the west, on Westergate Street, and to the north with Eastergate Primary School located to the northwest.
- 2.2 A rail line follows the site's southern boundary with farmland and residential properties further south.
- 2.3 The site's topography is relatively uniform with no significant variation in ground height relative to the surrounding area.
- 2.4 A hybrid application is proposed to develop the site for residential use, with up to 400 dwellings comprising a mixture of houses and apartments (outline application), accessed via a new link road off Westergate Lane to the west (full application).
- 2.5 The site location is shown in Figure 1 with the proposed site layout shown in Figure 2.

3.0 CRITERIA

NPPF/NPSE/PPG

- 3.1 The National Planning Policy Framework (NPPF) [Reference 1] states (paragraph 185) in relation to noise that planning policies and decisions should aim to:
- 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;

- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

3.2 The NPPF refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term vision 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 aims:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life.

3.3 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

"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."

3.4 The Planning Practice Guidance (PPG) [Reference 3] is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states that noise can over-ride other planning concerns but should not be considered in isolation from the other economic, social and environmental dimensions of the proposed development.

ProPG

3.5 The Professional Practice Guidance on Planning and Noise (ProPG) [Reference 4] was published jointly by the Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health in May 2017. The guidance relates to the consideration of existing sources of transportation noise upon proposed new residential development and strives to:

- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- Encourage the process of good acoustic design in and around new residential developments;
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- Improve understanding of how to determine the extent of potential noise impact and effect; and
- Assist the delivery of sustainable development.

3.6 The guidance describes a recommended approach for new residential development, which includes four key elements of the assessment process, identified below:

- (i) Good acoustic design process;
- (ii) Internal noise level guidelines;
- (iii) External amenity area noise assessment;
- (iv) Assessment of other relevant issues.

3.7 It is important to note that the guidance in ProPG does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy.

BS 8233 and World Health Organisation

3.8 BS 8233:2014 [Reference 5] provides design guidance for dwelling houses, flats and rooms in residential use and recommends that internal noise levels in dwellings do not exceed 35 dB $L_{Aeq,16 \text{ hour}}$ in living rooms and bedrooms during the day, 40 dB $L_{Aeq, 16 \text{ hour}}$ in dining rooms during the day and 30 dB $L_{Aeq, 8 \text{ hour}}$ in bedrooms at night.

3.9 BS 8233 also notes that "Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{Amax, f_r} depending on the character and number of events per night."

- 3.10 The World Health Organisation (WHO) [Reference 6] provides guidance on desirable internal noise levels to minimise the risk of sleep disturbance. The WHO 2000 guidelines suggest internal noise levels not exceeding 30 dB $L_{Aeq, 8 \text{ hour}}$ or regularly exceeding 45 dB $L_{Amax, f}$ for 'a good night's sleep'.

BS 6472-1: 2008 Guide to Evaluation of Human Exposure to Vibration in Buildings

- 3.11 The assessment of human response to vibration within buildings is currently guided by BS 6472-1 [Reference 7].
- 3.12 Where vibration occurs as a series of events, as in the case of train pass-bys, BS 6472 indicates that Vibration Dose Values (VDVs) should be used. Human response to vibration in buildings is assessed in terms of VDV's defined over daytime and night-time periods.
- 3.13 The human body is most sensitive to vibration in the vertical direction (head to foot). The standard defines values of VDV which are likely to cause varying degrees of adverse comment and these are summarised in Table 1.

Place and Time	Vibration Dose Value, $m/s^{1.75}$		
	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential 16-hour day (07:00 to 23:00)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential 8-hour night (23:00 to 07:00)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 1: Vibration Dose Values and Subjective Response

4.0 NOISE MEASUREMENTS

- 4.1 Long term environmental noise and vibration measurements were obtained between 20th and 27th April 2023. Additionally, attended noise and vibration measurements were obtained at various locations around the site on the 27th April, during afternoon hours. The following equipment was utilised:

- 3 x Rion precision sound level meter Type NL-52;
- Svan precision sound and vibration level meter Type 958;
- Brüel & Kjær acoustic calibrator Type 4231.

- 4.2 The long-term noise monitoring equipment was located as follows:

- Location 1 – To the southern site boundary, facing the rail line, at a height of 1.5m above local ground level in free-field conditions. Approximately 10m from the centre of the railway.
- Location 2 – To the southwest site boundary, near to residential properties on Westergate Street/ Lidsey Road at a height of 3m above local ground level in free-field conditions;
- Location 3 – To the west of the site, near to residential properties on Westergate Street, at a height of 2m above local ground level in free-field conditions;
- Location 4 – To the north of the site, approximately 100m from Eastergate Primary School's playing fields, at a height of 2 m above local ground level in free-field conditions.

4.3 Attended measurements were undertaken at a series of locations across the site to assist in determining the variation in noise levels with distance from the relevant sources.

4.4 Measurement locations are shown in Figure 1.

4.5 Measurements were undertaken in 1 minute samples in terms of the overall free-field A-weighted L_{eq} , L_{10} , L_{90} and $L_{max,f}$ noise levels. Measurements were made in accordance with BS 7445:1991 "Description and measurement of environmental noise Part 2 – Acquisition of data pertinent to land use" [Reference 8].

4.6 Calibration was checked before and after the survey in accordance with the manufacturer's instructions. No significant drift in calibration was recorded. Calibration of 24 Acoustics' equipment is traceable to National Standards.

4.7 Each instrument was fitted with an environmental weather shield during the survey. Weather conditions during the measurements were variable with short periods of rain and wind speeds exceeding 5 m/s. Measurements affected by meteorological conditions have been removed from the design levels.

Noise Survey Results

4.8 The results of the long-term noise surveys are shown graphically in Appendix B and are summarised in Tables 2, 3, 4 and 5.

Location 1 (south): Measured Sound Pressure Level			
Date (April 2023)	Daytime (07:00 to 23:00 hours)	Night-time (23:00 to 07:00 hours)	
	Ambient dB L _{Aeq} , 16 hour	Ambient dB L _{Aeq} , 8 hour	Typical dB L _{Amax} , f
Thursday 20th	61	58	86
Friday 21st	61	57	82
Saturday 22nd	61	55	82
Sunday 23rd	56	58	85
Monday 24th	61	58	85
Tuesday 25th	61	57	83
Wednesday 26th	61	57	85
Thursday 27th	61	-	-
Design Level	61	57	86

Table 2: Location 1 – Summary of Measured Noise Levels.

- 4.9 Measurement results at Location 1 were predominantly influenced by train movements on the adjacent rail line. The train types were found to predominantly comprise passenger carriages with occasional night-time freight movements (between 1 and 6 freight trains per night).

Location 2 (southwest): Measured Sound Pressure Level			
Date (April 2023)	Daytime (07:00 to 23:00 hours)	Night-time (23:00 to 07:00 hours)	
	Ambient dB L _{Aeq} , 16 hour	Ambient dB L _{Aeq} , 8 hour	Typical dB L _{Amax} , f
Thursday 20th	-	44	63
Friday 21st	49	46	67
Saturday 22nd	49	47	67
Sunday 23rd	47	47	67
Monday 24th	48	45	64
Tuesday 25th	51	45	66
Wednesday 26th	51	44	65
Thursday 27th	-	-	-
Design Level	49	45	67

Table 3: Location 2 – Summary of Measured Noise Levels.

- 4.10 Measurement results at Location 2 were predominantly influenced by local road traffic. Night-time measurement results were significantly affected by early morning birdsong between 04:30 to 07:00 hours. Ambient and maximum night-time noise levels with periods of birdsong omitted were 40 dB $L_{Aeq, 8 \text{ hour}}$ and 59 dB $L_{Amax, f}$.

Location 3 (west): Measured Sound Pressure Level			
Date (April 2023)	Daytime (07:00 to 23:00 hours)	Night-time (23:00 to 07:00 hours)	
	Ambient dB $L_{Aeq, 16 \text{ hour}}$	Ambient dB $L_{Aeq, 8 \text{ hour}}$	Typical dB $L_{Amax, f}$
Thursday 20th	-	47	68
Friday 21st	48	48	71
Saturday 22nd	49	48	69
Sunday 23rd	48	49	71
Monday 24th	48	49	72
Tuesday 25th	48	52	71
Wednesday 26th	49	50	69
Thursday 27th	-	-	-
Design Level	48	48	72

Table 4: Location 3 – Summary of Measured Noise Levels.

- 4.11 Measurement results at Location 3 were predominantly influenced by local road traffic. Night-time measurement results were significantly affected by early morning birdsong between 04:30 to 07:00 hours. Ambient and maximum night-time noise levels with periods of birdsong omitted were 36 dB $L_{Aeq, 8 \text{ hour}}$ and 51 dB $L_{Amax, f}$.

Location 4 (north): Measured Sound Pressure Level			
Date (April 2023)	Daytime (07:00 to 23:00 hours)	Night-time (23:00 to 07:00 hours)	
	Ambient dB L _{Aeq} , 16 hour	Ambient dB L _{Aeq} , 8 hour	Typical dB L _{Amax} , f
Thursday 20th	-	48	68
Friday 21st	51	49	71
Saturday 22nd	53	50	73
Sunday 23rd	50	51	75
Monday 24th	52	49	70
Tuesday 25th	50	51	75
Wednesday 26th	56	55	71
Thursday 27th	-	-	-
Design Level	52	51	75

Table 5: Location 4 – Summary of Measured Noise Levels.

- 4.12 Measurement results at Location 4 were predominantly influenced by the local road network. Night-time measurement results were significantly affected by early morning birdsong between 04:30 to 07:00 hours. Ambient and maximum night-time noise levels with periods of birdsong omitted were 35 dB L_{Aeq} 8 hour and 51 dB L_{Amax} f.
- 4.13 Attended daytime measurement results toward the centre of the site were 49 to 50 dB L_{Aeq} 30 min. The main noise source toward the centre of the site was distant road traffic with occasional distant rail movements. Noise from playground activities at Eastergate Primary School was noticeable at the northern site boundary although overall levels were found to be low.
- 4.14 Noise levels measured across the site have been utilised in calibrating a preliminary acoustic model.

5.0 VIBRATION MEASUREMENTS

- 5.1 Vibration levels were measured using the following equipment.

- Dynatron tri-axial accelerometer Type 323A;
- Svantek (Class 1) precision sound level meter x 2 Type 958;
- Brüel and Kjær acoustic calibrator Type 4231.

- 5.2 Long term vibration measurements were obtained to the south of the site at Location 1, shown in Figure 1, with attended vibration levels undertaken further within the site. The attended measurement location was selected to be representative of the location of the closest proposed building to the railway line as determined from the concept masterplan shown in Figure 2. Measurements were undertaken in terms of the Vibration Dose Value (as defined in BS 6472) in $\text{m/s}^{1.75}$ in three axes of motion (defined as X (longitudinal), Y (lateral) and Z (vertical), all relative to the surroundings).
- 5.3 Measured long term Vibration Dose Values at Location 1 are shown in Appendix C and summarised in Table 6. Some data sets which were influenced by local activity have been removed prior to analysis.

Date (April)	Period	Direction of Motion and Vibration Dose Value, $\text{m.s}^{-1.75}$		
		X	Y	Z
Thursday 20th	Day	0.01	0.02	0.13
	Night	0.01	0.02	0.10
Friday 21st	Day	0.02	0.03	0.14
	Night	0.01	0.02	0.09
Saturday 22nd	Day	0.02	0.03	0.14
	Night	0.01	0.02	0.09
Sunday 23rd	Day	0.01	0.02	0.11
	Night	0.01	0.02	0.09
Monday 24th	Day	0.02	0.03	0.13
	Night	0.01	0.02	0.09
Tuesday 25th	Day	0.02	0.02	0.12
	Night	0.01	0.02	0.08
Wednesday 26th	Day	0.02	0.02	0.12
	Night	0.01	0.02	0.09
Thursday 27th	Day	0.03	0.04	0.11
	Night	-	-	-

Table 6: Daytime and Night-time Vibration Survey Results (VDV)

6.0 TRAFFIC FLOW DATA

- 6.1 Traffic flow data for the proposed link road has been provided by the scheme's transport consultant (WSP) and is summarised below for the future design year 2038:

Westergate Link Road – Traffic Flows AAWT 18 hour		
Direction	2038 Traffic Flow (vehicles per day)	HGV Percentage
Eastbound	670	1 %
Westbound	1696	1 %

Table 7: Daytime and Night-time Vibration Survey Results (VDV)

- 6.2 The above values have been used in the acoustic model to determine the noise levels from the future link road incident at the closest proposed dwellings. The traffic flow values in Table 7 include contributions from surrounding committed developments.
- 6.3 Note, night-time traffic flow levels are not available. Therefore, based on 24 Acoustics' experience and measurement results from other noise surveys in the area, the noise model assumes a night-time link road noise level 6 dBA lower than the predicted daytime level.

7.0 PRELIMINARY NOISE ASSESSMENT & OUTLINE MITIGATION

- 7.1 Due to the distances and significant screening provided by existing buildings in the area, noise from current road traffic was not significant and standard thermal glazing and trickle ventilators will likely be acceptable to the majority of the development.
- 7.2 Noise levels to the south of the site were primarily influenced by train pass-bys on the neighbouring rail line.
- 7.3 A preliminary acoustic model has been developed to determine the noise levels across the proposed site from the new link road and rail movements. Note, for completeness, the predicted traffic flows for the future design year (2038) on Westergate Street have also been included in the noise model.
- 7.4 Figures 3 and 4 show the predicted L_{Aeq} road traffic and rail noise contours across the proposed development site for the daytime, at a height of 1.5 m above local grade, and night-time at a height of 4 m above local grade.

7.5 Resultant noise levels at the proposed dwellings closest to the link road and rail line with direct line of sight are summarised below and do not include mitigation:

- Link Road – Nearest proposed dwellings:
 - 60 to 62 dB L_{Aeq} 16 hour (daytime);
 - 54 to 56 dB L_{Aeq} 8 hour (night-time);
- Rail line - Nearest proposed dwellings:
 - 55 to 57 dB L_{Aeq} 16 hour (daytime);
 - 51 to 53 dB L_{Aeq} 8 hour (night-time);
 - 74 to 75 dB $L_{Amax f}$ (night-time).

7.6 Based on the predicted road traffic noise levels, properties overlooking the new link road will require enhanced glazing and acoustically rated or mechanical ventilation (e.g. MVHR, acoustic vents).

7.7 Based on the measured and predicted rail line noise levels, it is recommended that consideration be given to a noise barrier along the southern boundary of the site to minimise rail noise levels. It is recommended that the barrier provides line of sight screening from the highest habitable room windows to the surrounding road network. Assuming two-storey buildings to the site boundaries, an outline barrier height of 3m is recommended.

7.8 Additionally, depending on building layout and orientation, façades of the closest dwellings overlooking the rail line will require enhanced glazing and acoustically rated or mechanical ventilation (e.g. MVHR, acoustic vents) to achieve acceptable internal noise levels.

7.9 During refinement of the site master plan, it is recommended to consider overall noise mitigation and the principles of good acoustic design. This should include optimised building orientation (e.g. habitable room windows facing away from the noise source) with buildings' locations considered in conjunction with the orientation and locations of external amenity areas (e.g. gardens located to the rear of buildings, screened from noise sources).

8.0 PRELIMINARY VIBRATION ASSESSMENT

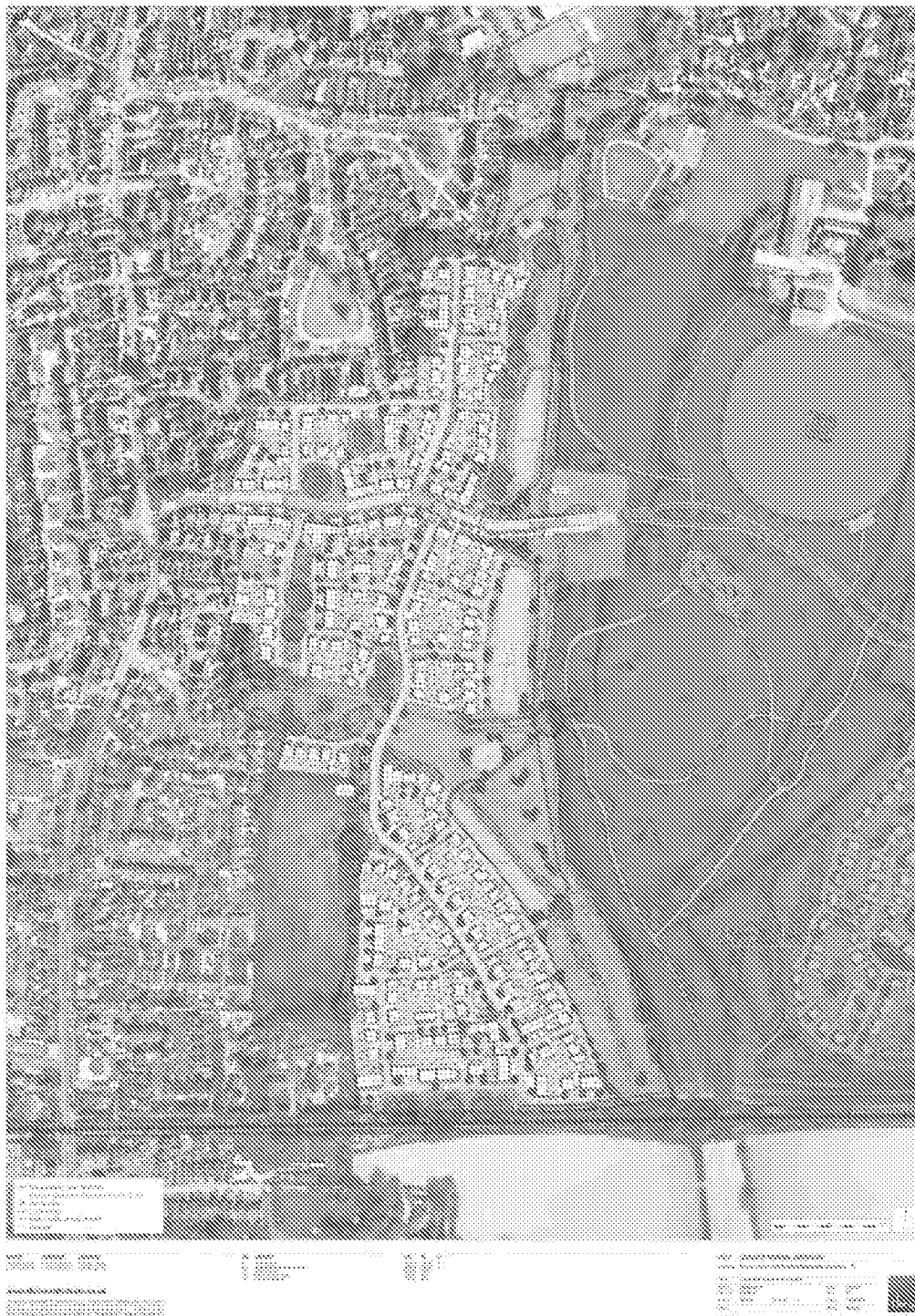
- 8.1 During the site visits, vibration from train pass-bys was not perceptible throughout the majority of the site.
- 8.2 The measured vibration levels close to the rail line on the undeveloped site are low, with even lower levels measured further back from the rail line at a location representative of the nearest proposed properties.
- 8.3 In practice, the vibration level inside the building will not be the same as that measured on the undeveloped site. This will depend upon the nature of the construction, foundation types, the materials used and the mass and stiffness of individual building elements.
- 8.4 In some circumstances, vibration levels can be amplified by the building elements, which can result in higher levels of vibration being experienced within the building itself, relative to those measured on the undeveloped site. Levels up to 4 times the free field ground level can occur. Correcting for distance and applying a 4 times correction to the measured vibration levels provides maximum VDV_s of no more than 0.3 m/s^{1.75} during daytime periods and 0.2 m/s^{1.75} during night-time periods in all axes of motion, which is an indication of a low probability of adverse comment under BS 6472.
- 8.5 Once the site layout and the proximity of proposed dwellings to the railway line is finalised, the requirement for any further vibration survey work should be reviewed.

9.0 CONCLUSIONS

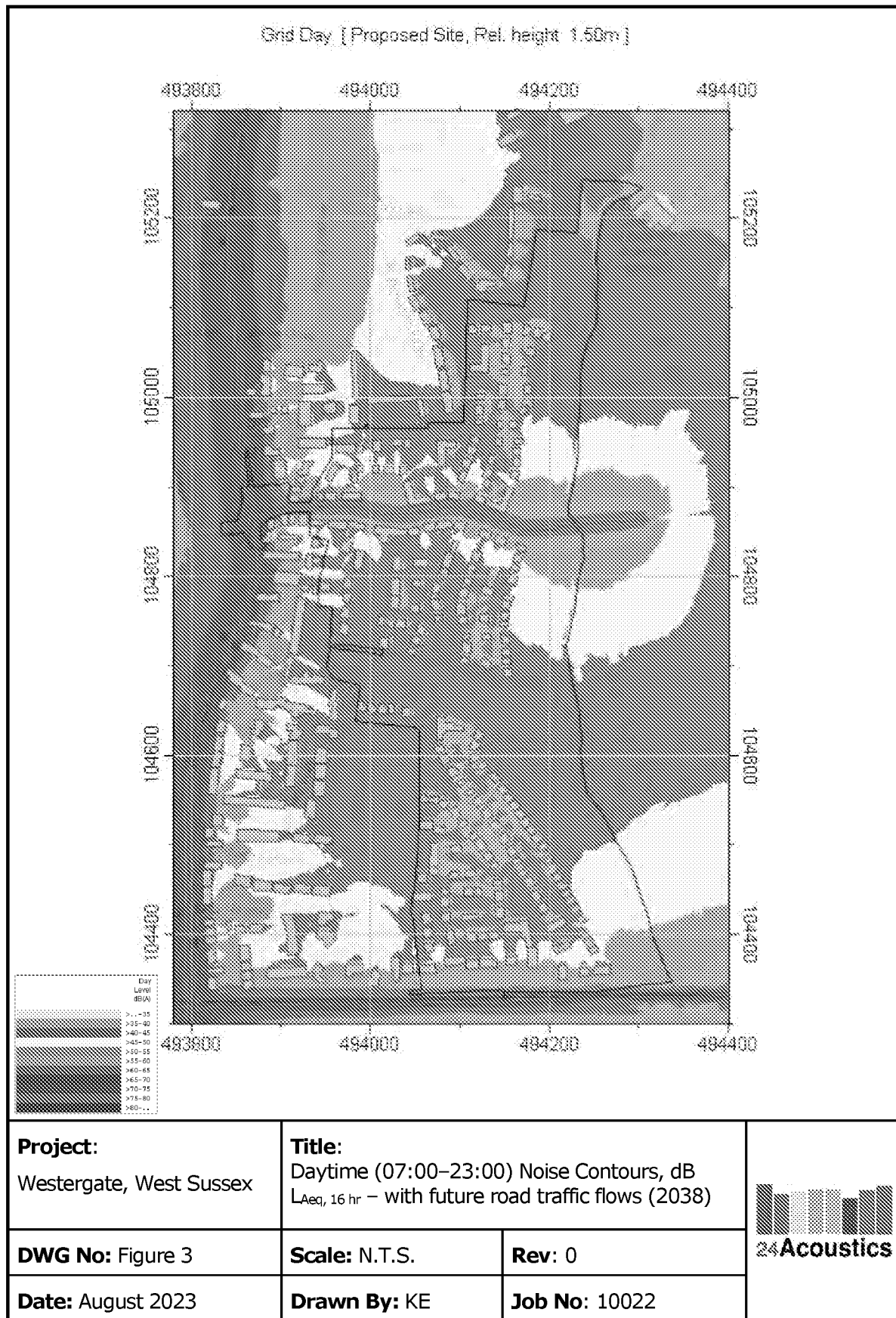
- 9.1 24 Acoustics Ltd has been instructed by Cala Homes South Home Counties to obtain ambient noise and vibration levels at a proposed development site at Westergate, West Sussex.
- 9.2 An environmental noise and vibration survey has been undertaken to determine the existing ambient noise and vibration levels due to road traffic and rail movements.
- 9.3 An assessment of likely noise levels from the proposed link road has been undertaken based on predicted traffic flows provided by the scheme's transport consultant.
- 9.4 Based on the measured and predicted noise levels, outline mitigation recommendations have been provided to ensure that suitable noise and vibration criteria are achieved within the new development.
- 9.5 Subject to appropriate mitigation, it is considered that an appropriate acoustic environment can be provided at the proposed residential properties.
- 9.6 Based on the measured vibration levels, it is concluded that adverse comment due to vibration from rail line sources would be low.

REFERENCES

1. Department for Levelling Up, Housing and Communities. National Planning Policy Framework, 2023.
2. DEFRA, Noise Policy Statement for England, March 2010.
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6. World Health Organisation, Guidelines for Community Noise, 2000.
7. British Standards Institution. British Standard 6472: Guide to Evaluation of Human Exposure to Vibration in Buildings, Part 1: Vibration Sources Other than Blasting: 2008.
8. British Standards Institution. British Standard 7445:1991 Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use, 1991.



Project: Westergate, West Sussex	Title: Indicative Layout Plan		 24Acoustics
DWG No: Figure 2	Scale: N.T.S.	Rev: 0	
Date: September 2023	Drawn By: KE	Job No: 10022	





APPENDIX A – ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dBA weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dB is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dB. The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dB corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

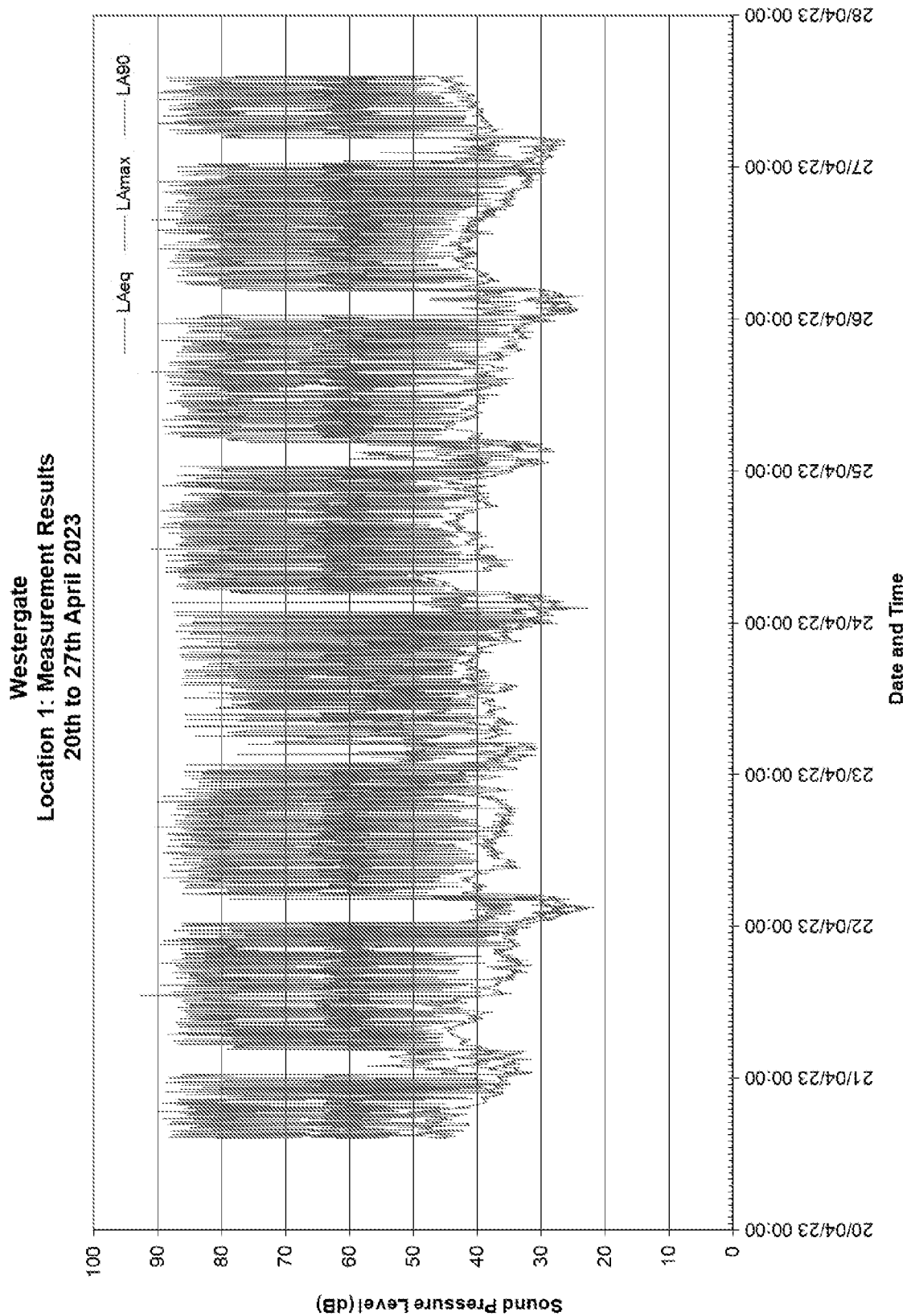
iii) The L_{A10} noise level

This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

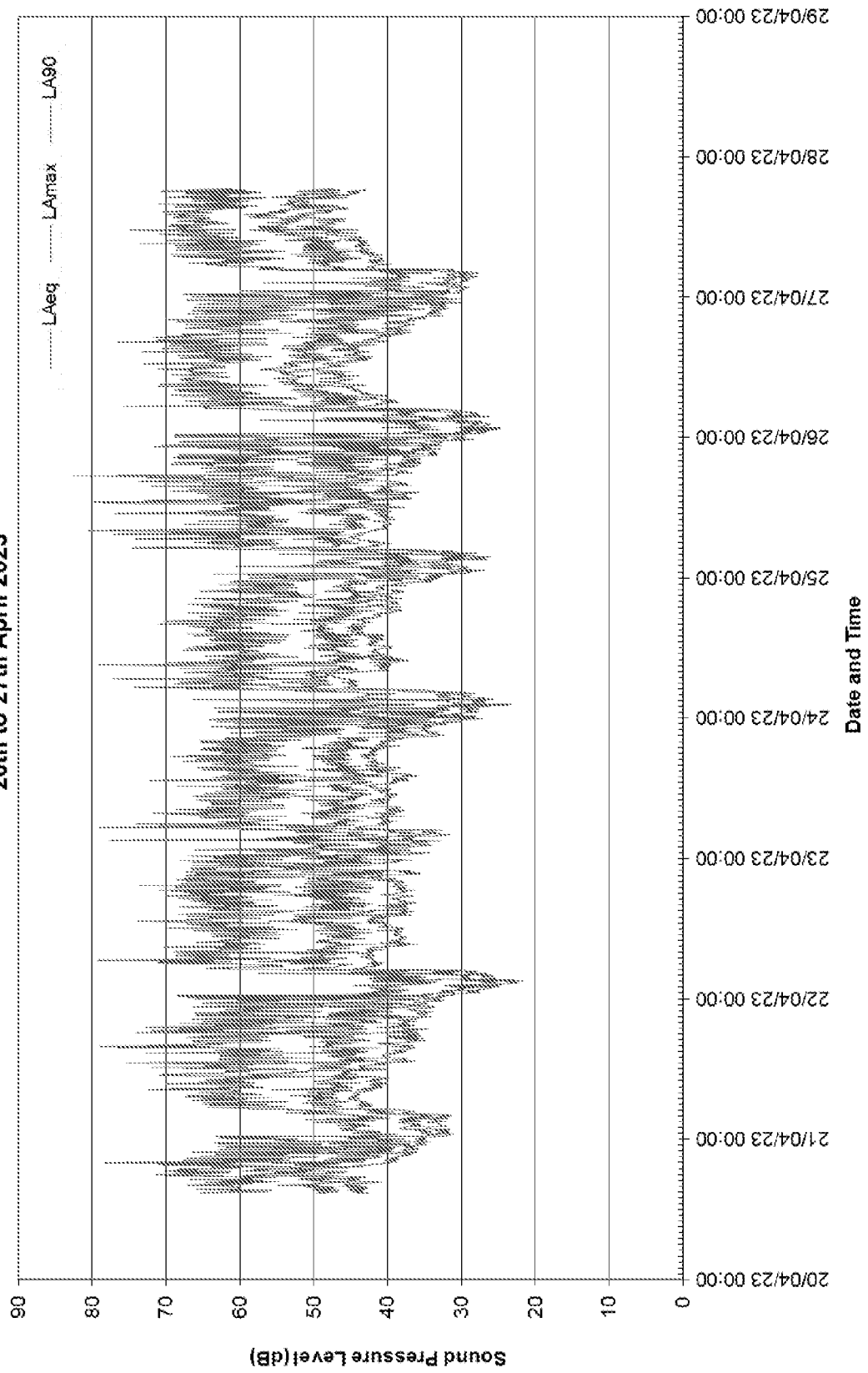
iv) The L_{A90} noise level

This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.

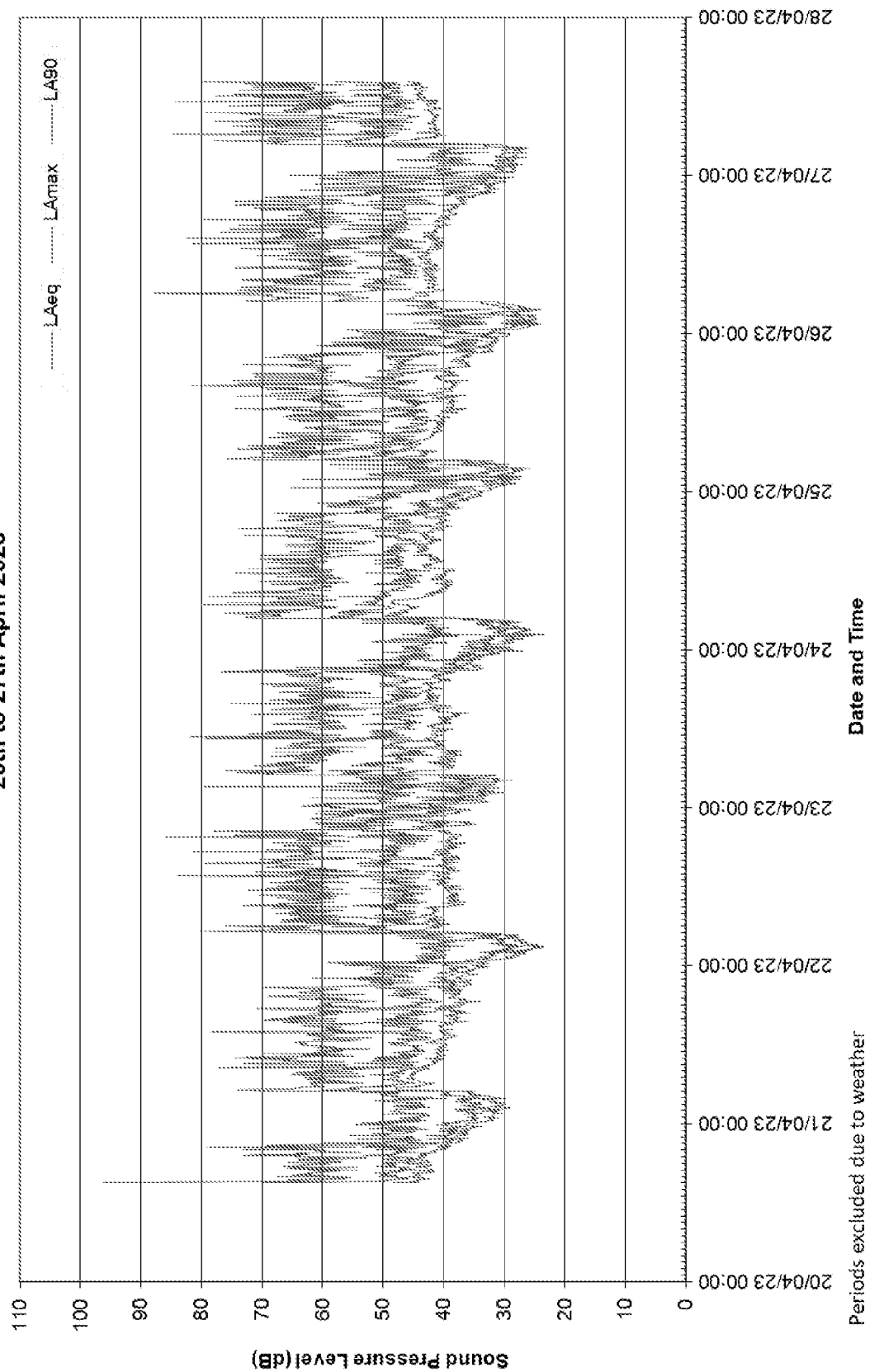
APPENDIX B – NOISE MEASUREMENT RESULTS



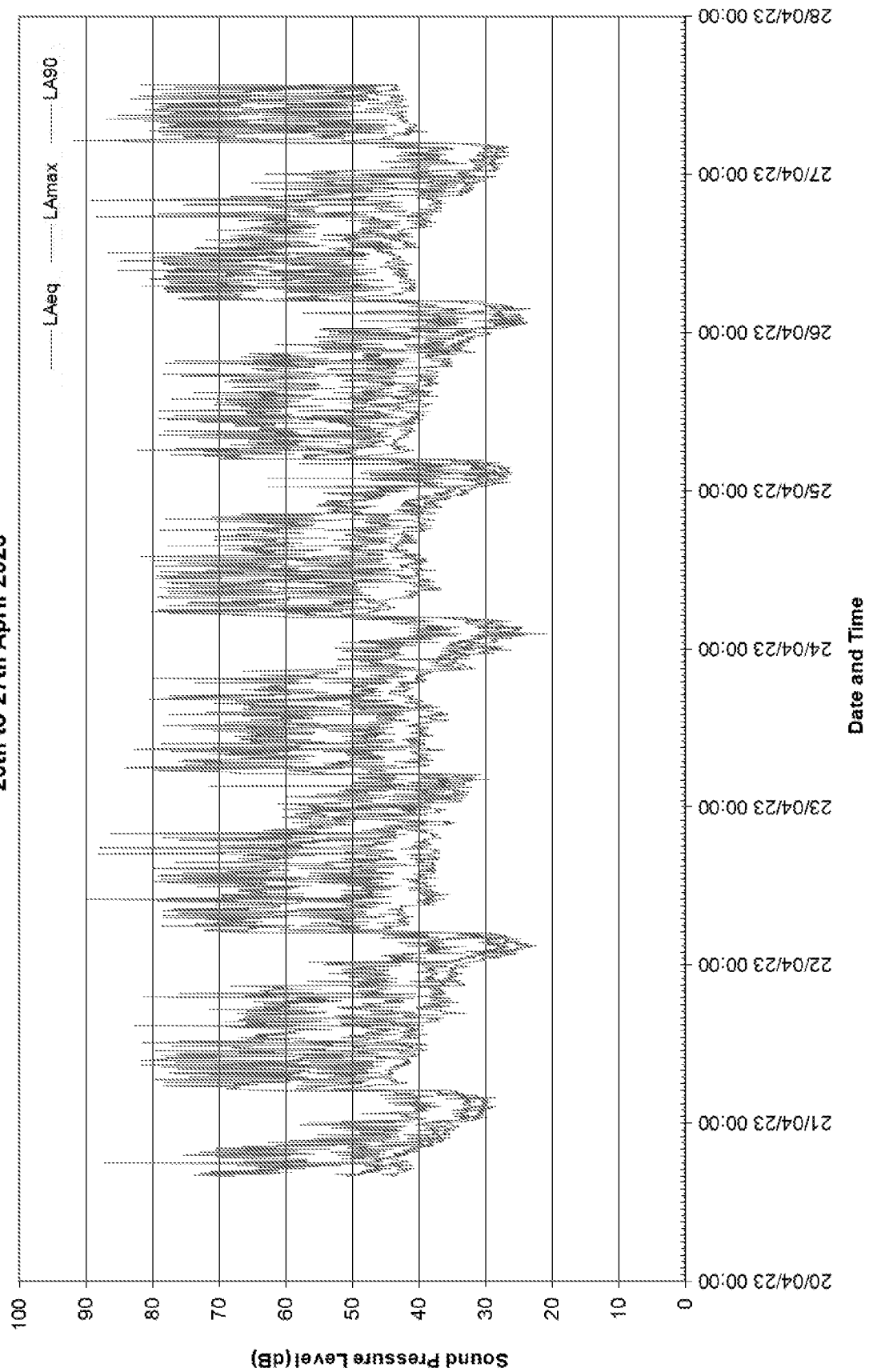
**Westergate
Location 2: Measurement Results
20th to 27th April 2023**



**Westergate
Location 3: Measurement Results
20th to 27th April 2023**



**Westergate
Location 4: Measurement Results
20th to 27th April 2023**



APPENDIX C – VIBRATION MEASUREMENT RESULTS

