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GEARS LTD

LAND AT THE FORMER SOUTHERN WATER SITE, ST RICHARD'S ROAD, DEAL, KENT

NOISE IMPACT ASSESSMENT

14 FEBRUARY 2020

1290-AF-00001-01

GEARS LTD
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DOCUMENT REFERENCE: 1290-AF-00001-01

REVIEW AND AUTHORISATION			
Authored and approved by Adrian Finn	**Position** Director	**Signature** 	**Date** 14/02/2020

AMENDMENT HISTORY			
Issue	**Status**	**Description**	**Date**
01	Draft	Report issued as draft	14/02/2020

CONTENTS **PAGE NO.**

1. INTRODUCTION

1.1.1 Gears Ltd. commissioned AF Acoustics Ltd. to undertake a noise impact assessment for a former Southern Water Site, in Deal, that Gears Ltd wish to construct 14 new, 2 storey properties on the site. The noise impact assessment is required to aid in the discharge of condition 11 of planning reference DOV/17/01056/E.

> *'Prior to above ground works, details of the noise generating plant on the adjacent Southern Water site and a scheme of sound insulation measures shall be submitted to and approved in writing by the Local Planning Authority. The reasonable internal unoccupied noise levels detailed inTable 5 of British Standard 8233:1999 shall be met. These levels are: Living rooms during the day (7am - 11pm) 40dB L Aeq (1 hour) Bedrooms at night (11pm - 7am) 35dB L Aeq (8 hour) Individual noise events in bedrooms shall not exceed 45dB L A(max) measured with Fast Time Weighting. The sound insulation measures shall be incorporated in accordance with approved details and prior to first occupation of the residential units hereby approved and shall be maintained as such. Reason: As no such details have been provided and in the interest of residential amenity.'*

1.1.2 This report presents the results of the baseline noise survey, undertaken to establish the existing noise levels affecting the site. The survey results have been used to assess the suitability of the site for residential use and to set noise level targets for any proposed fixed plant.

1.1.3 Where necessary and feasible, mitigation measures have been identified with the aim of providing a suitable internal acoustic environment for future occupants.

2. SITE DESCRIPTION

2.1 Location

2.1.1 The site is located at land at the Former Southern Water Site, St Richard's Road, Deal, Kent and is shown in Figure 2.1 below.

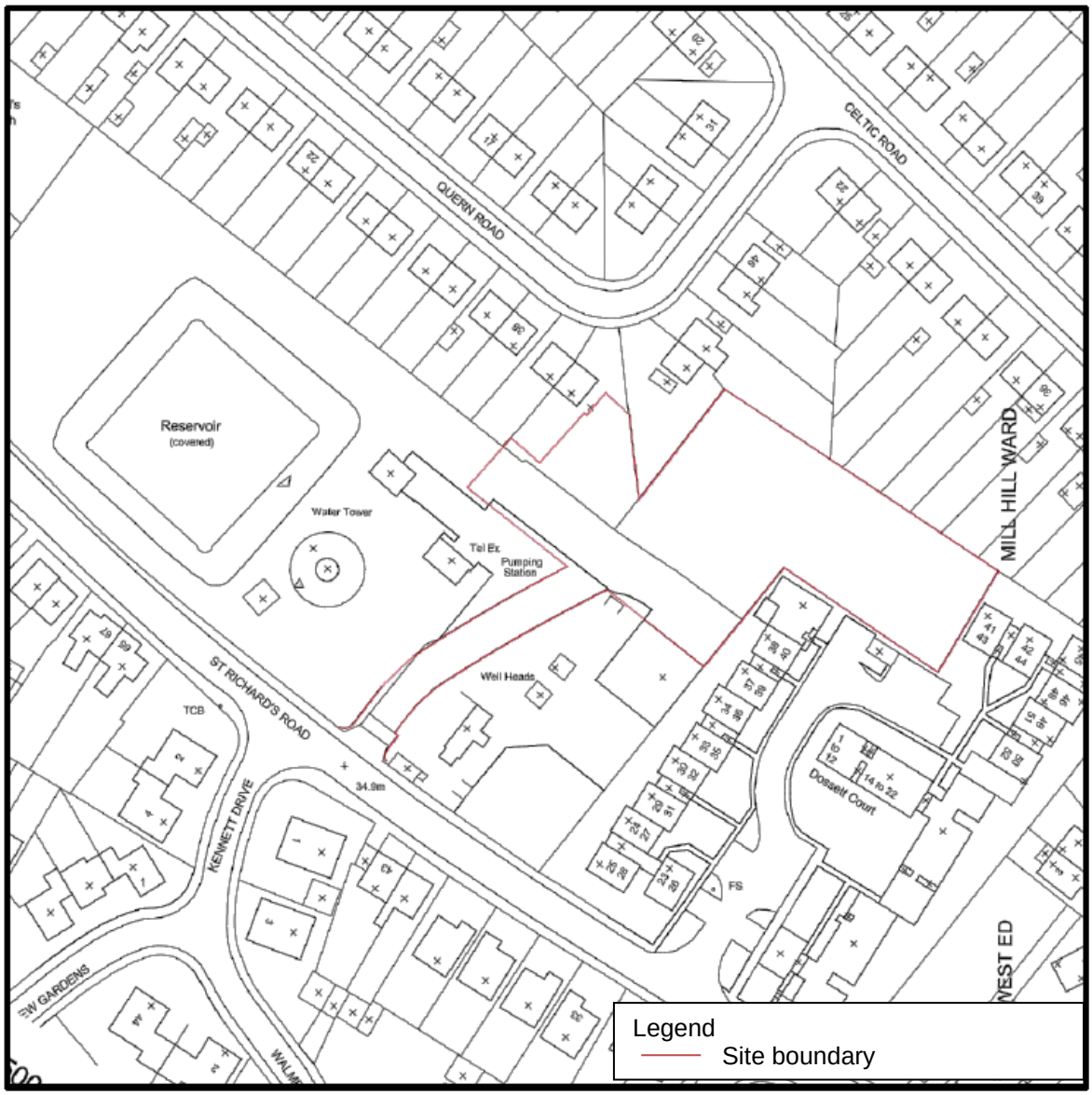

FIGURE 2.1: LOCATION MAP

2.1.2 The proposed development is set to consist 14 new, 2 storey properties on the site.

3. GUIDANCE

3.1 Noise Policy Statement for England (NPSE)

3.1.1 The Noise Policy Statement for England (March 2010), sets out the long term vision of Government noise policy.

3.1.2 The vision of the NPSE is to 'Promote good health and a good quality of life through the effective management and control of noise within the context of Government policy on sustainable development.' This vision is supported by three key aims:

- avoid significant adverse impacts on health and quality of life;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

3.1.3 The NPSE should apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise but does not apply to noise in the workplace (occupational noise).

3.1.4 The NPSE had adopted the following concepts, to help consider whether noise is likely to have 'significant adverse' or 'adverse' effects on health and quality of life:

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 noise.

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

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

3.1.5 However, the NPSE goes on to state that:

'*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.*'

3.2 National Planning Policy Framework

3.2.1 The Ministry of Housing, Communities and Local Government revised the National Planning Policy Framework (NPPF) in July 2018. This framework updated the previous NPPF released in 2012 which previously replaced most national planning policy, circulars and guidance, including Planning Policy Guidance 24: Planning and Noise.

3.2.2 The NPPF defines the Government's planning policy for England and sets out the framework, within which local authorities must prepare their local and neighbourhood plans, reflecting the needs and priorities of their communities. Paragraph 170 of the NPPF requires Local Authorities to develop local policies and make decisions which aim to prevent 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.

3.2.3 Paragraph 180 of the NPPF requires that planning policies 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:

> *'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'*

3.2.4 Paragraph 182 of NPPF introduces the "Agent of Change" principle and states that planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities and that 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.

3.3 BS 8233:2014

3.3.1 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' contains a number of design criteria and guideline levels for the protection of new or planned development against external noise. The guidelines are designed to achieve desirable resting/ sleeping conditions in bedrooms and good listening conditions in other rooms. Those criteria which are most relevant to the residential environment are reproduced in Table 3.1.

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

TABLE 3.1: DESIGN TARGETS FOR INDOOR AMBIENT NOISE LEVELS

3.3.2 It should also be noted that BS 8233:2014 states 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 $L_{Amax,F}$ depending on the character and number of events per night." However, no numerical values for internal $L_{Amax,F}$ levels in dwellings are stated within BS 8233.

3.3.3 With regards to external amenity areas, BS 8233 recommends that "it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments." The Standard also states that these guideline values are not always achievable in all circumstances and therefore a compromise between elevated noise levels and 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.

3.3.4 In addition, BS 8233 states that "other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

3.4 World Health Organisation Noise Guidelines

3.4.1 The guidelines presented in the World Health Organization (WHO) document reflect conclusions drawn up after consideration of international research evidence on the health effects of exposure to noise. The guidelines define the goal of noise management as 'to maintain low noise exposures such that human health and well-being are protected', with 'specific objectives to develop criteria for the maximum safe exposure levels and to promote noise assessment and control as part of environmental health programmes'.

3.4.2 These WHO guideline values are based on precautionary limits for community noise in specific environments and are re-produced below.

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB L_{AFMAX}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

TABLE 3.2: WHO COMMUNITY NOISE GUIDELINE VALUES

3.4.3 It should be noted that the above values generally apply to 'anonymous' or everyday levels of environmental noise from road traffic, trains and aircraft. Human reaction to tonal and low frequency noise may be underestimated by the dB(A) noise level and hence lower limits may apply.

3.5 British Standard 4142:2014

3.5.1 BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' describes methods for rating and assessing sound from "fixed installations which comprise mechanical and electrical plant and equipment", amongst other sources of noise.

3.5.2 The methodology contained within BS 4142:2014 uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

3.5.3 A summary of the approach set out within BS 4142:2014 is set out below:

- establish the specific sound level of the source(s);
- measure the representative background sound level, typically by measurement close to the receptor location;
- rate the specific sound level to account for any distinguishing characteristics;
- estimate the impact by subtracting the background sound level from the rating level; and
- consider the initial estimate of impact, in the context of the noise and its environment.

3.5.4 An initial estimate of the impact of the specific sound is obtained by subtracting the background sound level from the rating level. Using this approach, BS 4142 states:

> "Typically, the greater this difference, the greater the magnitude of impact
> *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context*
> A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context
> The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

3.5.5 Certain acoustic features can increase the significance of the impact over that expected from a basic comparison between specific sound level and the background sound level. These features include tonality and impulsivity, as well as additional characteristics and intermittency of the sound.

3.5.6 If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor.

3.5.7 The specific sound level is rated to account for distinguishing characteristics by using the penalties below:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

3.5.8 Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor.

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

3.5.9 For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

3.5.10 If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

3.5.11 If a subjective assessment is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

- 15 dB in the low frequency one-third octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency one-third octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency one-third octave bands (500 Hz to 10000 Hz)

3.5.12 If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

3.6 Dover District Council Criteria

3.6.1 A noise impact assessment is required to aid in the discharge of condition 11 of planning reference DOV/17/01056/E.

3.6.2 The following condition was imposed on the site.

> '*Prior to above ground works, details of the noise generating plant on the adjacent Southern Water site and a scheme of sound insulation measures shall be submitted to and approved in writing by the Local Planning Authority. The reasonable internal unoccupied noise levels detailed inTable 5 of British Standard 8233:1999 shall be met. These levels are: Living rooms during the day (7am - 11pm) 40dB L Aeq (1 hour) Bedrooms at night (11pm - 7am) 35dB L Aeq (8 hour) Individual noise events in bedrooms shall not exceed 45dB L A(max) measured with Fast Time Weighting. The sound insulation measures shall be incorporated in accordance with approved details and prior to first occupation of the residential units hereby approved and shall be maintained as such.*
> *Reason: As no such details have been provided and in the interest of residential amenity.'*

4. NOISE SURVEY AND MEASUREMENTS

4.1 Unattended Noise Survey

4.1.1 A noise survey was undertaken by Adrian Finn MIOA of AF Acoustics.

4.1.2 The duration of the survey was between 15:45 on 6 February and 11:30 on 10 February 2020. The measurement location was located at 1.5m on the ground approximately 5m in front of the pumping station, with direct view of the fan inlets/outlets. This measurement location is labelled as LT1 in Figure 4.1. The measured noise levels are considered free field levels.

4.1.3 Initial inspection of the site revealed that the noise profile at the monitoring location was dominated by road traffic noise from the nearby St Richard's Road. Plant noise from the pumping station was subjectively barely audible at the measurement location.

4.1.4 The sound level meter had calibration checks before and after the measurement surveys to generate a calibration level of 114 dB at 1 kHz. The equipment calibration was verified before and after the survey and no calibration drift was observed. The microphone was fitted with a windshield.

4.1.5 The equipment used is shown in Table 4.1.

Location	Name	Serial Number	Last Calibrated
LT1	Norsonic 118 Class 1 Sound Level Meter	31382	15 February 2018
LT1	Norsonic 1206 Pre-amplifier	30416	15 February 2018
LT1	Gras 40AF Microphone	150690	15 February 2018
LT1	Norsonic 1251 Sound Calibrator	30900	6 March 2019

TABLE 4.1: MEASUREMENT EQUIPMENT

4.2 Location

4.2.1 The monitoring location is shown below in Figure 4.1.

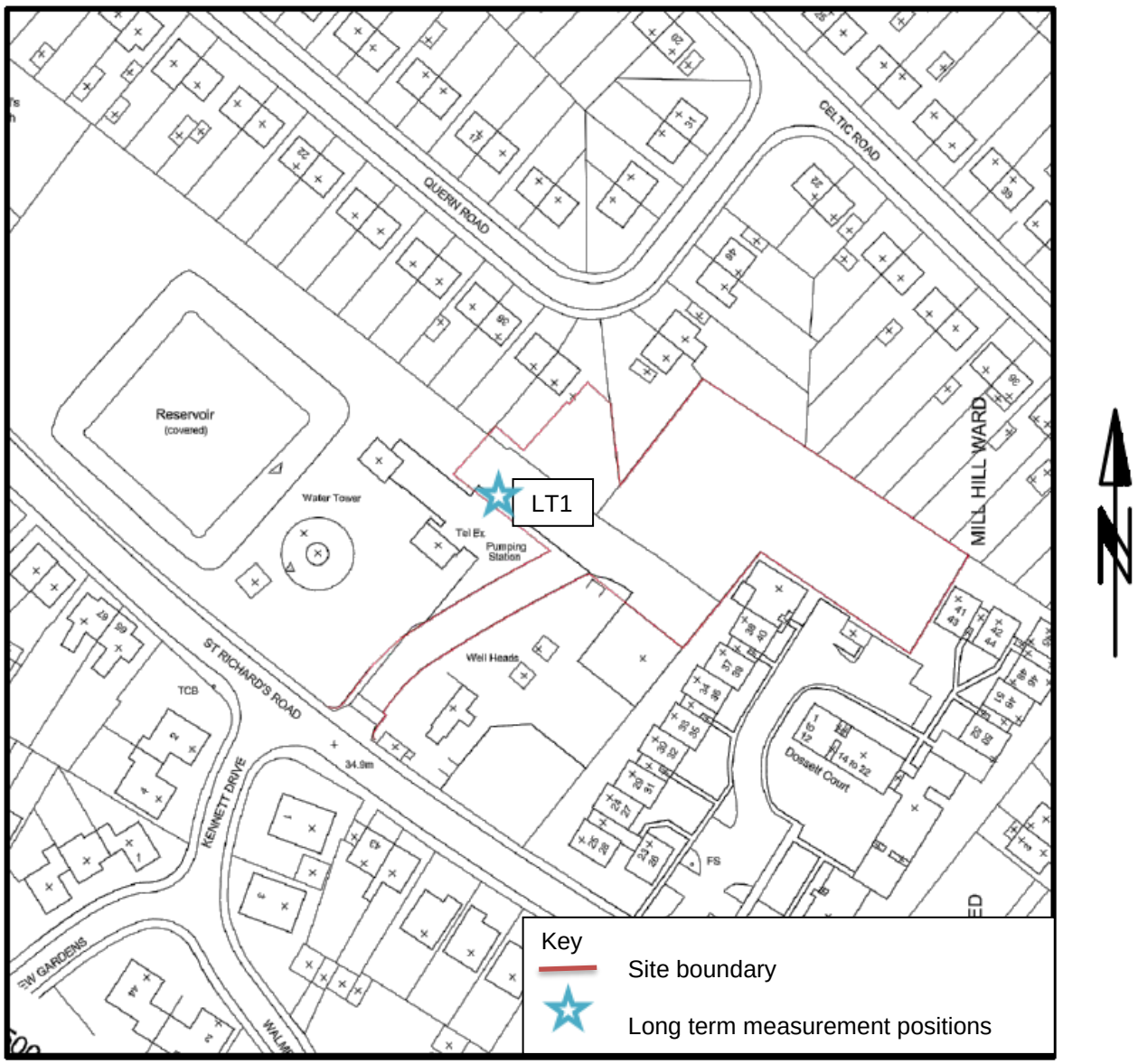

FIGURE 4.1: NOISE MONITORING LOCATION

4.3 Measurement Weather Conditions

4.3.1 Weather data was taken during the unattended measurement period. Due to high winds and rain from a storm which started approximately 23:00 on Saturday 8 February 2020 the noise data measured after this period has been excluded.

4.4 Results

4.4.1 The results of the continuous noise monitoring survey are presented in graphical form in Figure A2 of Appendix A and summarised in Table 4.2 below.

4.4.2 There was construction works taking place on site between 08:00 and 16:30 on Friday 7 February 2020. These measured noise levels have been excluded from the results.

Time period	Date	Measured Noise Levels (dB re 2.0 x 10^{-5} Pa)		
		$L_{Amax,F}$	$L_{Aeq,T}$	$L_{A90,T}$
Daytime (07:00-23:00hrs)	Thursday 06/02/2020	77	49	38
Night-time (23:00-07:00hrs)		68	43	33
Daytime[1] (07:00-23:00hrs)	Friday 07/02/2020	77	49	43
Night-time (23:00-07:00hrs)		68	46	40
Daytime (07:00-23:00hrs)	Saturday 07/02/2020	72	50	44

TABLE 4.2: SUMMARY OF UNATTENDED NOISE MEASUREMENTS, LT1

Note: 1 = site works were taking place between 08:00 and 16:30 during this measurement period and have been excluded

5. SITE SUITABILITY ASSESSMENT

5.1 External Noise Levels

5.1.1 This section provides an assessment of the suitability of the site for residential use with respect to noise.

5.1.2 A summary of the daytime and night-time noise levels at LT1 is presented in section 4.4.

5.1.3 The measured noise levels are considered indicative of incident noise levels affecting all façades of the proposed development. These levels have been used to determine the mitigation measures required to provide an adequate internal noise environment for future residents.

5.2 External Building Fabric Design

5.2.1 The glazing assessment has been based on the measured daytime and night-time noise levels, as presented in Table 4.2 and the proposed layout, shown in Figure A1.

5.2.2 When assessing the sound insulation performance of an external building fabric system, it is generally regarded that the glazing element is the weakest path for external noise intrusion into internal areas. It is assumed that the non-glazed areas of any façade systems may incorporate sufficient acoustic treatment behind such that the glazing remains the weakest path for external noise intrusion. As such, the acoustic performance of the glazing will be the most critical element in determining the overall sound insulation performance of the external façade.

5.2.3 Table 5.1 presents the sound insulation performance specifications recommended for the external building fabric system along with typical constructions capable of achieving the internal ambient noise criteria set out in BS8233:2014 and reproduced in Table 3.1.

Façade Element	Living room and Bedroom	
	Sound Insulation Performance, dB $R_W + C_{tr}$	Example Constructions
External wall Fabric	45	Approx. 300mm cavity wall system
Glazing	25	4mm glass / 6mm airspace / 4mm glass
These values have been based on: Living room 82m^3 room volume with 48m^2 external façade and a 3.6m^2 window. Bedroom a 24m^3 room volume with 19m^2 external façade and a 1.8m^2 window Calculations were carried out using reverberation time (RT60) of 0.5 seconds across all frequency bands.		

TABLE 5.1: SOUND INSULATION PERFORMANCE AND INDICATIVE CONSTRUCTIONS FOR THE BUILDING ENVELOPE ELEMENTS

Note: The acoustic specification for the windows are given in Appendix C.

5.2.4 Typical glazing configurations are quoted for guidance only and alternatives may be utilised, in any case, acoustic performance of the system proposed must be demonstrated to the satisfaction of the acoustic consultant. The sound reduction performance quoted above must be achieved by the glazing system taken as a whole in its installed condition. The specification, therefore, applies to the glazing, the frames and all seals on any openable parts of the systems and any required ventilation or condensation control mechanisms. This list is not exhaustive: no part of the glazing system shall cause the above figures not to be achieved.

5.2.5 On the basis that the glazing achieves the above sound insulation performance, internal noise levels should be achieved with windows closed and open. If partially open windows are relied upon for background ventilation, the insulation would be reduced to approximately 15 dB, however, the internal noise levels would still be met.

5.2.6 The above details meet the requirements of condition 11 of Dover District Council, planning reference DOV/17/01056/E.

5.3 External Amenity Areas

5.3.1 It is understood that there will be gardens will be provided for each unit within the development.

5.3.2 The measured noise levels shown in Table 4.2 show the noise criterion of 55 dB $L_{Aeq,16h}$ will be achieved for these external amenity areas.

6. CONCLUSION

6.1.1 Gears Ltd. commissioned AF Acoustics Ltd. to undertake a noise impact assessment for a former Southern Water Site, in Deal, that Gears Ltd wish to construct 14 new, 2 storey properties on the site. The noise impact assessment is required to aid in the discharge of condition 11 of planning reference DOV/17/01056/E.

6.1.2 The primary aim of the assessment has been to establish the suitability of the site for residential use, in terms of achieving an adequate internal and external acoustic environment for future occupants, and to set a design noise level target for any external fixed plant.

6.1.3 A baseline noise survey was undertaken in February 2020. From this survey, and in accordance with the relevant criteria, the daytime and night-time ambient and background noise levels have been determined, as well as the maximum noise levels at night.

6.1.4 Based on the measured noise levels and the internal noise criteria adopted in accordance with the relevant standards, an assessment of the acoustic performance of the glazed elements of the external building fabric has been undertaken. The ventilation strategy has also been outlined.

6.1.5 To meet the target internal noise criteria within all habitable rooms, the sound insulation performance of the glazing elements of all façades should achieve 25 dB $R_W + C_{tr}$. Passive ventilation will be suitable for all plots. Subject to the glazing specification, the proposals are considered acceptable in accordance with BS 8233.

6.1.6 An assessment of the external amenity areas has also been undertaken. It is anticipated that the external amenity areas will achieve the external noise criterion.

6.1.7 The assement shows that the site will meet the requirements of condition 11 of Dover District Council, planning reference DOV/17/01056/E.

6.1.8 The limitations to this report are presented in Appendix D.

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APPENDIX A: FIGURES

FIGURE A1: PROPOSED PLANS

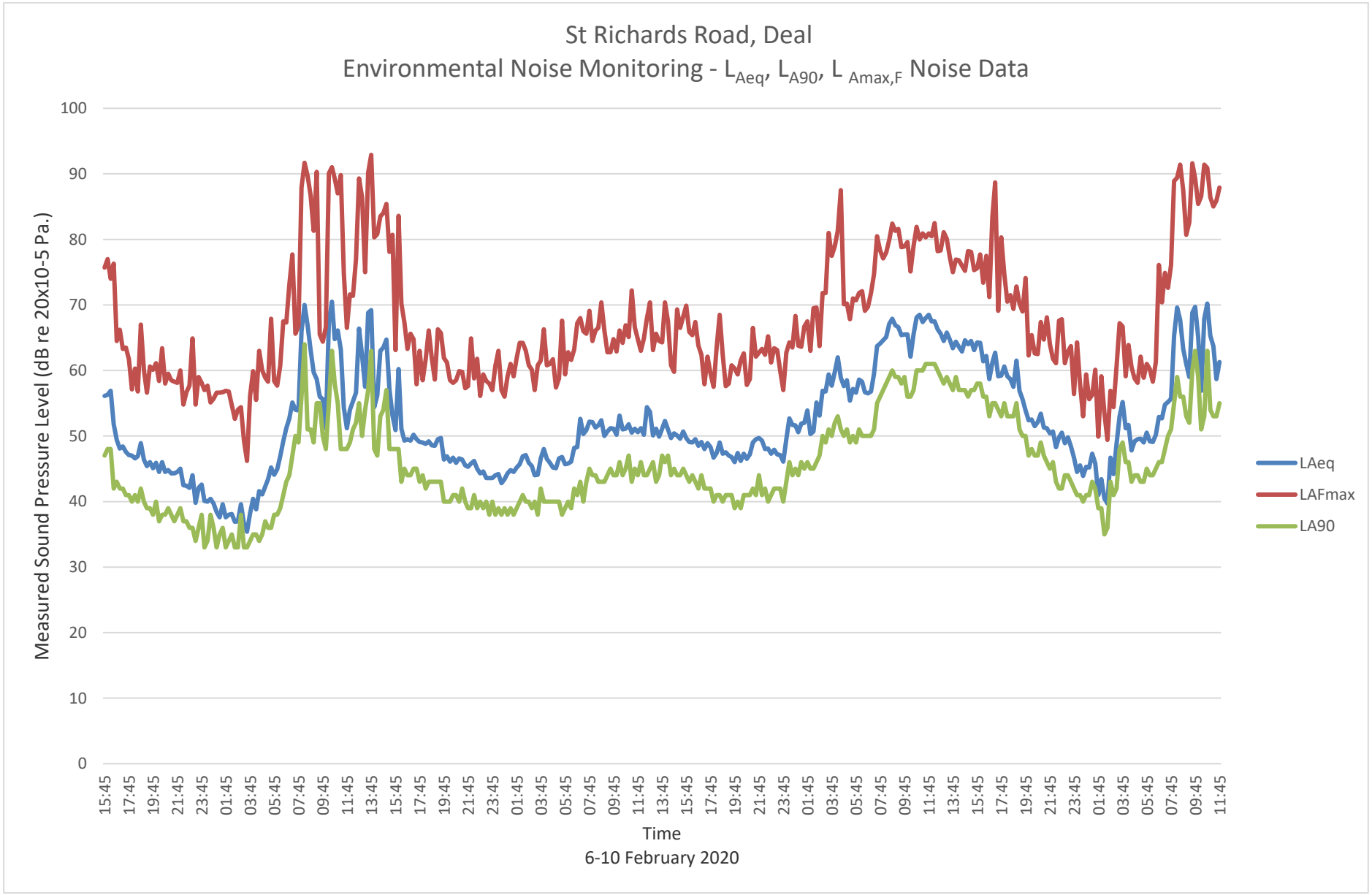

FIGURE A2: NOISE MEASUREMENT RESULTS

APPENDIX B: TABLES

BS8233 Façade Sound Insulation Calculation

Reference: BS8233-001

Project	St Richards Road, Deal	Date	13-Feb-2020
Façade	Front	By	AF
Room	Living Room	Checked	GF

Symbol	Description	Ref	Units	Single Figure Rating	Octace Band Centre Frequency, Hz				
					125	250	500	1000	2000
S_f	Total façade area of room		m^2	48.3					
S_{wi}	Area of windows in façade		m^2	3.6					
S_{ew}	Area of external wall in façade		m^2	44.7					
S_{rr}	Area of ceiling exposed to external noise		m^2	0.0					
S	Total area of elements through which sound enters room		m^2	48.3					
A_0	Reference absorption area given in BS EN 20140-10		m^2	10.0					
	A-weighted free-field equivilent sound pressure level at measurement position		dB						
	Total propogation and angle of view correction from measurement to façade		dB	0.0					
$L_{Aq,ff}$	A-weighted free-field equivilent sound pressure level outside façade		dB						
$L_{TRAFFIC}$	Normalised road traffic noise spectrum derived from BS1793-3		dB						
$L_{eq,ff}$	Linear free-field equivilent sound pressure level outside façade		dB	**54.1**	**52**	**47**	**42**	**45**	**42**
$D_{n,e}$	Vent: "hit and miss" trickle (4000mm2)	80	dB		34	27	37	35	34
R_{wi}	Sound reduction index of windows - 4/6/4 Glazing Pilikington	110	dB		21	17	25	35	37
R_{ew}	Sound reduction index of the external wall - Brick and block external wall (BS82	9	dB		40	44	45	51	56
R_{rr}	Sound reduction index of the roof/ceiling	94	dB		28	34	40	45	49
α	Room average alpha co-efficients (acoustically hard room)		-						
S_{room}	Room surface area		m2						
A	Equivilent absorption area of room		m^2		26	26	26	26	26
$L_{eq,2}$	Linear Internal reverberant sound pressure level in room		dB	29.1	26	26	13	10	7
	A-weighting Network				-16	-9	-3	0	1
$L_{eq,3}$	A-weighted internal reverberant sound pressure level in room		dB(A)	19.3	10.1	16.7	9.8	10.4	8.4
	Internal Criteria		dB(A)	**35.0**					
	Excess over criteria		dB(A)						

TABLE B1: INTERNAL NOISE CALCULATIONS FOR DAYTIME

BS8233 Façade Sound Insulation Calculation

Reference: BS8233-001

Project	St Richards Road, Deal	Date	24-Jan-2020
Façade	Front	By	AF
Room	Bedroom	Checked	GF

Symbol	Description	Ref	Units	Single Figure Rating	Octace Band Centre Frequency, Hz				
					125	250	500	1000	2000
S_f	Total façade area of room		m^2	19.0					
S_{wi}	Area of windows in façade		m^2	1.8					
S_{ew}	Area of external wall in façade		m^2	17.2					
S_{rr}	Area of ceiling exposed to external noise		m^2	0.0					
S	Total area of elements through which sound enters room		m^2	19.0					
A_0	Reference absorption area given in BS EN 20140-10		m^2	10.0					
	A-weighted free-field equivilent sound pressure level at measurement position		dB						
	Total propogation and angle of view correction from measurement to façade		dB	0.0					
$L_{Aq,ff}$	A-weighted free-field equivilent sound pressure level outside façade		dB						
$L_{TRAFFIC}$	Normalised road traffic noise spectrum derived from BS1793-3		dB						
$L_{eq,ff}$	Linear free-field equivilent sound pressure level outside façade		dB	**56.2**	**54**	**49**	**47**	**44**	**39**
$D_{n,e}$	Vent: "hit and miss" trickle (4000mm2)	80	dB		34	27	37	35	34
R_{wi}	Sound reduction index of windows - 4/6/4 Glazing Pilikington	110	dB		21	17	25	35	37
R_{ew}	Sound reduction index of the external wall - Brick and block external wall (BS82	9	dB		40	44	45	51	56
R_{rr}	Sound reduction index of the roof/ceiling	94	dB		28	34	40	45	49
α	Room average alpha co-efficients (acoustically hard room)		-						
S_{room}	Room surface area		m2						
A	Equivilent absorption area of room		m^2		8	8	8	8	8
$L_{eq,2}$	Linear Internal reverberant sound pressure level in room		dB	34.1	31	30	20	15	10
	A-weighting Network				-16	-9	-3	0	1
$L_{eq,3}$	A-weighted internal reverberant sound pressure level in room		dB(A)	24.1	15.4	21.2	17.1	14.5	10.9
	Internal Criteria		dB(A)	**30.0**					
	Excess over criteria		dB(A)						

TABLE B2: INTERNAL NOISE CALCULATIONS FOR NIGHTTIME

APPENDIX C: ACOUSTIC SPECIFICATION FOR WINDOWS

Windows, including all glazed elements, fixed, and openable sections, related framework mullions, transoms and where applicable, furniture, all as are intended to be included within living rooms and bedrooms shall provide an airborne sound insulation index rating of not less than the following:

Room Type	Glazing Sound Reduction
All	25 dB $R_W + C_{tr}$

Performance shall be as measured in accordance with BS EN ISO 140-3:1995 and rated in accordance with BS EN ISO 717-1:1997, and evidence to this effect shall be published as part of the tender response.

	Octave Band Centre Frequency					
	125	250	500	1k	2k	4k
	Sound Reduction Index (R), dB					
25 dB $R_w + C_{tr}$	21	17	25	35	37	21

APPENDIX D: TERMINOLOGY RELATING TO NOISE

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20_{μ}Pa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power Level (Lw)	is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by 20 $\log_{10}$ (s_1 / s_2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20_{μ}Pa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound
$L_{90,T}$	L_{90} is the noise level exceeded for 90% of the period T (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
Specific Noise	The noise source under investigation for assessing the likelihood of complaints.
Rating Level	The specific noise level plus any adjustment for the characteristic features of the noise.
Free field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade	At a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX E: LIMITATIONS TO THE REPORT

This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of AF Acoustics Ltd. AF Acoustics Ltd accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/or AF Acoustics Ltd and agree to indemnify AF Acoustics Ltd for any and all loss or damage resulting therefrom. AF Acoustics Ltd accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

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