



REPORT REFERENCE:

IMP5939-1

INDUSTRIAL NOISE IMPACT ASSESSMENT INSTALLATION OF NEW INDUSTRIAL PLANT

British Standard 4142:2014

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SURVEY DATE:

25th February – 2nd March 2021

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1 EXECUTIVE SUMMARY

1.1 Instruction

Impact Acoustics Ltd have been instructed by Peter Hewlinds Designs to undertake a background noise survey at the proposed premises at Hewlins House, Croft Lane, Hayling Island, PO11 0LT to understand the level of impact in relation to the proposed new Air Source Heat Pump and calculate the resultant noise level at the nearest affected windows at the residential premises adjacent to the development and carry out assessments to BS4142: 2014.

1.2 Scope of Report

The measurements have been undertaken in accordance with British Standard 4142:2014 and ISO 1996 – Part 2: 2017 to establish if the proposed site has a demonstrable adverse effect in terms of noise that outweigh the benefits of the development. This report aims to establish the following:

- Existing background noise levels at the residential façade (L_{A90});
- Noise levels from the Proposed Plant (L_{Aeq});
- Impact on the nearest noise sensitive property.

1.3 Summary of Report

1.3.1 Measured Background Noise Levels

Continuous background noise measurements were undertaken between 25th February – 2nd March 2021 at Assessment Position 1. The representative day time background noise levels (0700 - 2300) was found to be $L_{A90,1 \text{ hour}}$ 40dB and night time background noise levels (2300 - 0700) was found to be $L_{A90,15 \text{ min}}$ 31dB This has been evaluated from the recorded data.

Daytime Equivalent Existing Background Noise Levels 7 days (0700 - 2300)	Measured Levels at Representative to Assessment Position 1	$L_{A90, t}$ 40 dB
Night time Equivalent Existing Background Noise Levels 7 days (2300 - 0700)	Measured Levels at Representative to Assessment Position 1	$L_{A90, t}$ 31 dB

Representative Background Position 1		L_{Aeq}	
		Day	Night
		(0700 - 2300)	(2300 - 0700)
1	25/02/2021	48.3	44.0
1	26/02/2021	49.7	44.6
1	27/02/2021	50.8	46.9
1	28/02/2021	51.2	44.7
1	01/03/2021	51.0	44.4

1.3.2 Criterion on Noise Source and Context of Site

A working noise criterion factoring the main assessment methodologies has been set out below in accordance with the National Planning Policy Framework. Criterion has been set on the contextualisation of the environment where the plant is being proposed. From assessment and attendance at site; the site is considered partially urban and there is a busy road that has a constant steady state flow of traffic (as shown in the baseline time history) which forms the dominant residual noise climate (Average Daytime LAeq,16 hour circa 48-52dB(A)). It is therefore considered the below criterion applicable in order to safeguard the nearby residential amenity from noise emissions associated with the development and in accordance with local planning policy.

1.3.3 Daytime (0700 - 2300)

Operating Hours	Criterion	Maximum Rating Level (LAeq,1 HOUR)	Colour Code
Daytime (0700 -2300)	No Observed Effect Level	30	
	Low Impact	40	
	Adverse Effect	45	
	Significant Adverse Effect	50	

1.3.4 Night time (2300 – 0700)

Operating Hours	Criterion	Maximum Rating Level (LAeq,15min)	Colour Code
Night time (2300 - 0700)	No Observed Effect Level	30	
	Low Impact	31	
	Adverse Effect	35	
	Significant Adverse Effect	40	

NOTE 1: the above is permissible rating level (specific noise level + source characteristic) which accounts for audible characteristics associated with proposed source.

1.4 Proposed Plant

1.4.1 Plant Source Levels

Items of Equipment	Operating Hours	Measured Level @ 1m from Outlet (LAeq,T)	Maximum Sound Power Level
ASHP @ 1m from outlet	24/7	Lp(A) 62 dBA	Lw(A) 73 dBA
Sound Power Level – British Standard 3744: 2010 (Engineering Grade 2 Accuracy)			

1.5 Assessment (Pre Mitigation)

1.5.1 Night time (2300 - 0700)

Rating Level	44 dB	9.1	The acoustic feature correction is added to the specific noise level
Background Noise Level $L_{A90,1 \text{ hour}}$	31 dB	8.1	Modal Background Noise Level (2300 - 0700)
Assessment Level	+13 dB	11	The background level is subtracted from the rating level.
Conclusion BS 4142:2014 ^[1]	+10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact		
Assessment	-13 dB		
Conclusion	The assessment level is 'Significant Adverse Impact'		
	Recommendation: Mitigate		

1.6 Mitigation Recommendations

It is recommended that a single acoustic louvre is fitted to the aperture to reduce the airborne noise emissions in line with the following transmission loss:

Transmission Loss	63	125	250	500	1.0k	2.0k	4.0k	8.0k
Acoustic Louvre Single	-6	-7	-8	-10	-15	-18	-16	-14

1.7 Assessment (Post Mitigation)

1.7.1 Night time (2300 - 0700)

Rating Level	28 dB	9.1	The acoustic feature correction is added to the specific noise level
Background Noise Level $L_{A90,1 \text{ hour}}$	31 dB	8.1	Modal Background Noise Level (2300 - 0700)
Assessment Level	-3 dB	11	The background level is subtracted from the rating level.
Conclusion BS 4142:2014 ^[1]	+10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact		
Assessment	-3 dB		
Conclusion	The assessment level is 'No observed Effect Level / Low Impact'		
	(additional) Meets internal absolute noise criterion with partially open window		

1.8 Conclusions

The operation of the proposed plant has been assessed to establish if the development will have a demonstrable adverse effect in terms of noise that outweigh the benefits of the development. Measurements have been undertaken in accordance with British Standard 4142:2014 and ISO 1996 – Part 2: 2017. This report has established the existing background noise levels at the closest residential façade to the proposed plant locations and the assessment of the impact of the site operation on nearby residential properties. The resulting emissions from the plant running on a worst case scenario show no conflict with ‘no observed affect level’ criteria and give a strong indication that complaint and impact on the local amenity is unlikely during operational hours post mitigation.

1.9 NPPF 2019

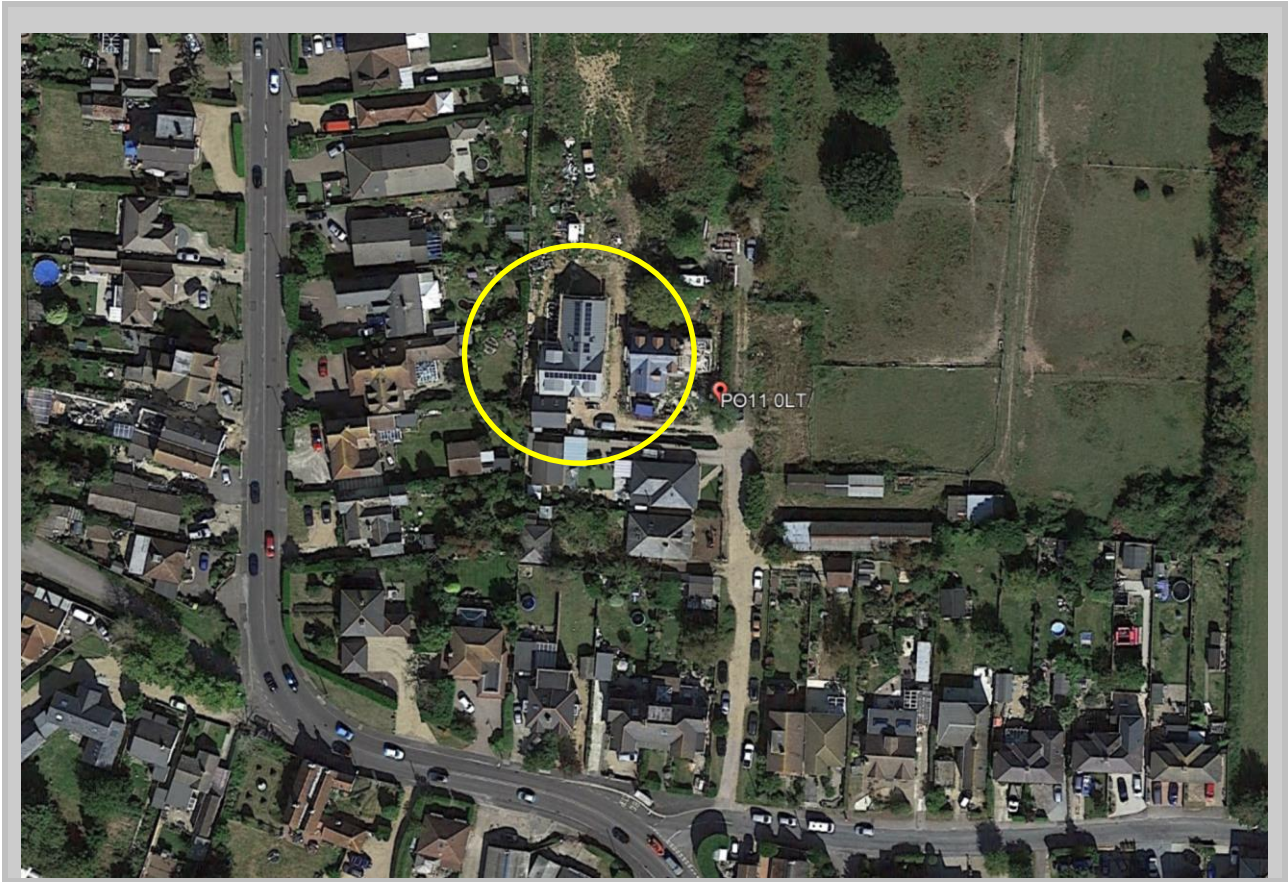
National Planning Policy Framework 2019 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

1.10 Planning Approval Recommendation

Based on the calculations and assessments made within this report it is the professional opinion of Impact Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2019, NPPF & NPSE and that, with regards to sound, planning permission can be granted post mitigation.

2 SITE LOCATION

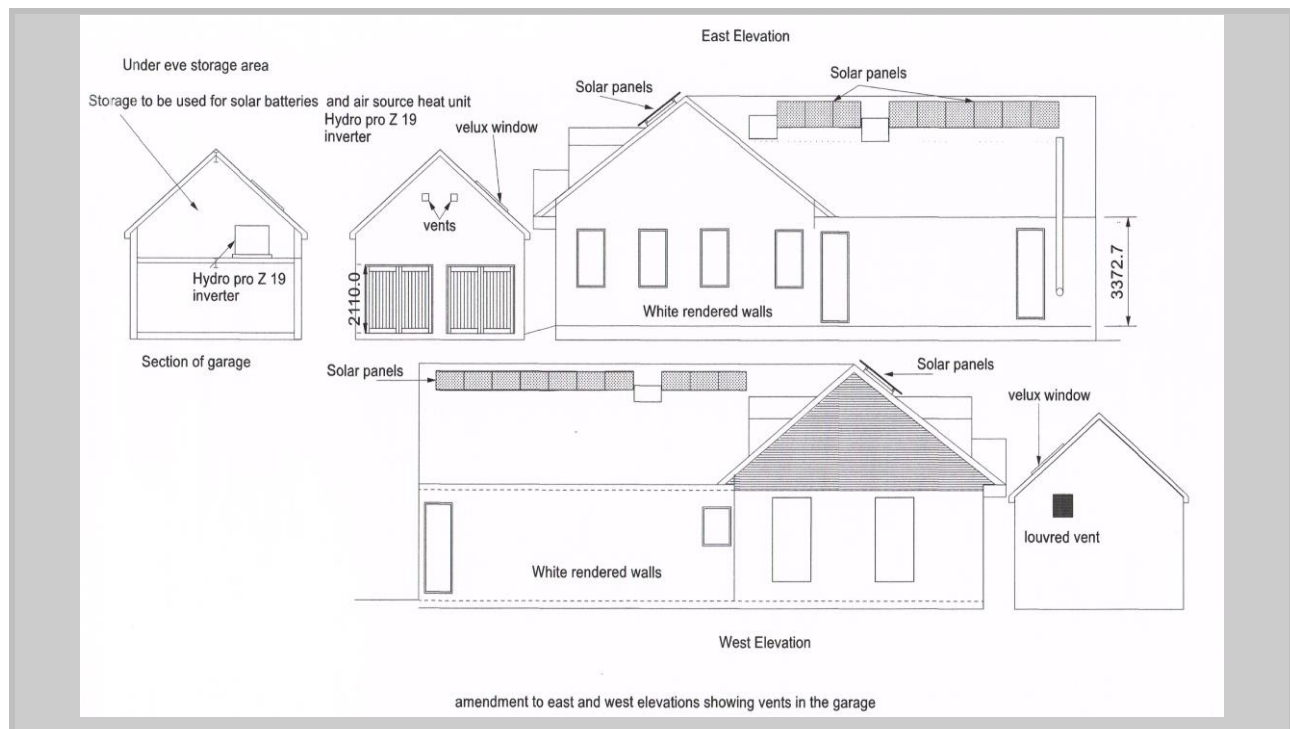
2.1 Position of Site in Wider Area



2.2 Assessment Positions



2.3 Proposed Plant Locations



2.3.1 Plant Source Levels

Items of Equipment	Operating Hours	Measured Level @ 1m from Outlet (LAeq,T)	Maximum Sound Power Level
ASHP @ 1m from outlet	24/7	Lp(A) 62 dBA	Lw(A) 73 dBA

Sound Power Level – British Standard 3744: 2010 (Engineering Grade 2 Accuracy)

2.3.2 Inputted Source Levels

Frequency spectrum

Spectrum

☐ 1/3 octave from to

☒ Octave 31Hz 16.0kHz

Values

dB(A)	31Hz	63Hz	125Hz	250Hz	500Hz	1.0kHz	2.0kHz	4.0kHz	8.0kHz	16.0kHz
	73.09	-	70.50	66.50	64.90	61.10	53.60	47.60	45.80	30.60

< >

OK Cancel Help

Inputted Data in SoundPLAN Modelling

3 APPARATUS

3.1 Equipment Calibration

The equipment was calibrated using a sound pressure level of 114.0 dB at an octave band centre frequency of 1000Hz with reference to $2 \times 10^{-5} \text{ Nm}^{-2}$ before and after the tests and the equipment set to have no inaccuracy greater than 0.2 dB.

All the following equipment was calibrated in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service (UKAS) on the following dates. Calibration schedules are implemented within Impact Acoustics Ltd in accordance with UKAS directive LAB 23.

3.2 Position 1

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Norsonic	118	31471	2 YEARS	08.08.2019	08.08.2021
12.5mm Microphone (with windshield)	Norsonic	1220	41075	2 YEARS	08.08.2019	08.08.2021
Microphone Pre – Amplifier	Norsonic	1201	30327	2 YEARS	08.08.2019	08.08.2021

The noise meter was calibrated before and after the assessment period and found to be within the tolerance of the manufacturer's guidance. Full Calibration certificates are available upon request.

4 BACKGROUND NOISE LEVELS

4.1.1 Measured Background Noise Levels

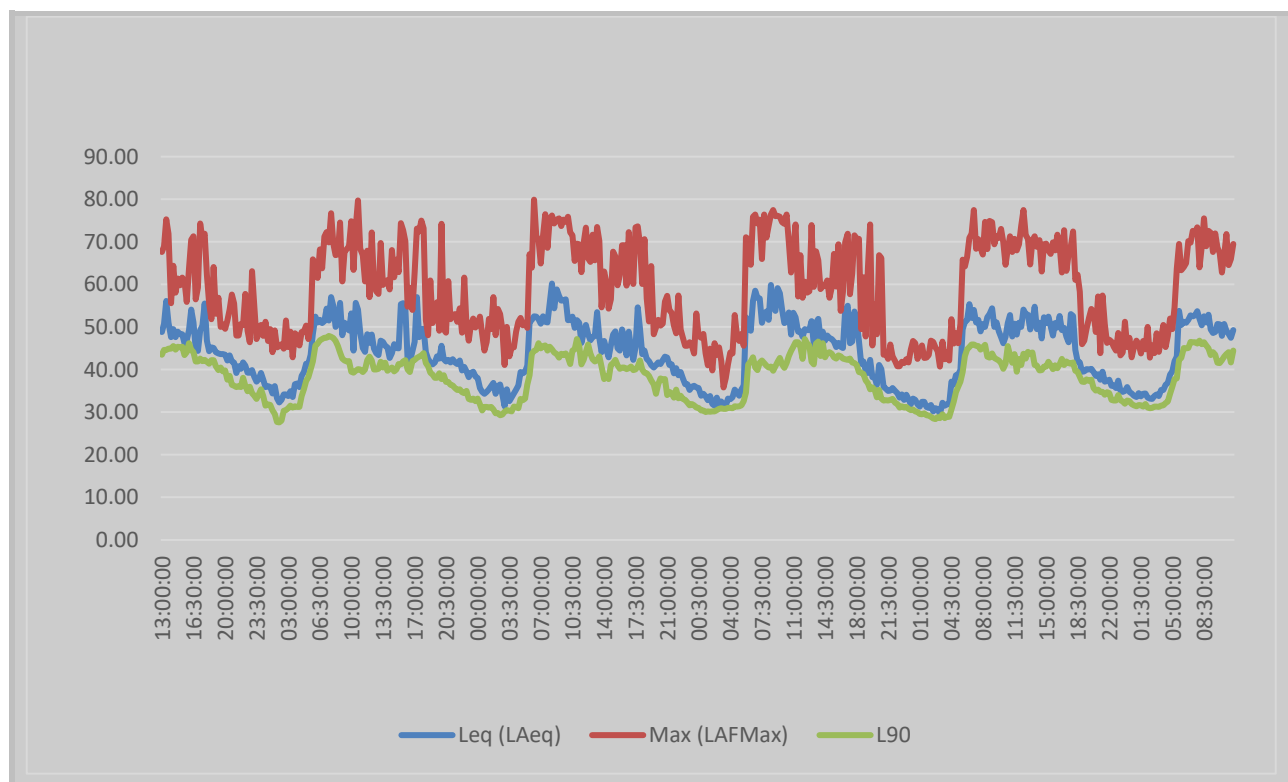
Continuous background noise measurements were undertaken between 25th February – 2nd March 2021 at Assessment Position 1. The representative day time background noise levels (0700 - 2300) was found to be $L_{A90,1 \text{ hour}}$ 40dB and night time background noise levels (2300 - 0700) was found to be $L_{A90,15 \text{ min}}$ 31dB. This has been evaluated from the recorded data.

Daytime Equivalent Existing Background Noise Levels 7 days (0700 - 2300)	Measured Levels at Representative to Assessment Position 1	$L_{A90, t}$ 40 dB
Night time Equivalent Existing Background Noise Levels 7 days (2300 - 0700)	Measured Levels at Representative to Assessment Position 1	$L_{A90, t}$ 31 dB

		LAeq	
Representative Background Position 1		Day	Night
		(0700 - 2300)	(2300 - 0700)
1	25/02/2021	48.3	44.0
1	26/02/2021	49.7	44.6
1	27/02/2021	50.8	46.9
1	28/02/2021	51.2	44.7
1	01/03/2021	51.0	44.4

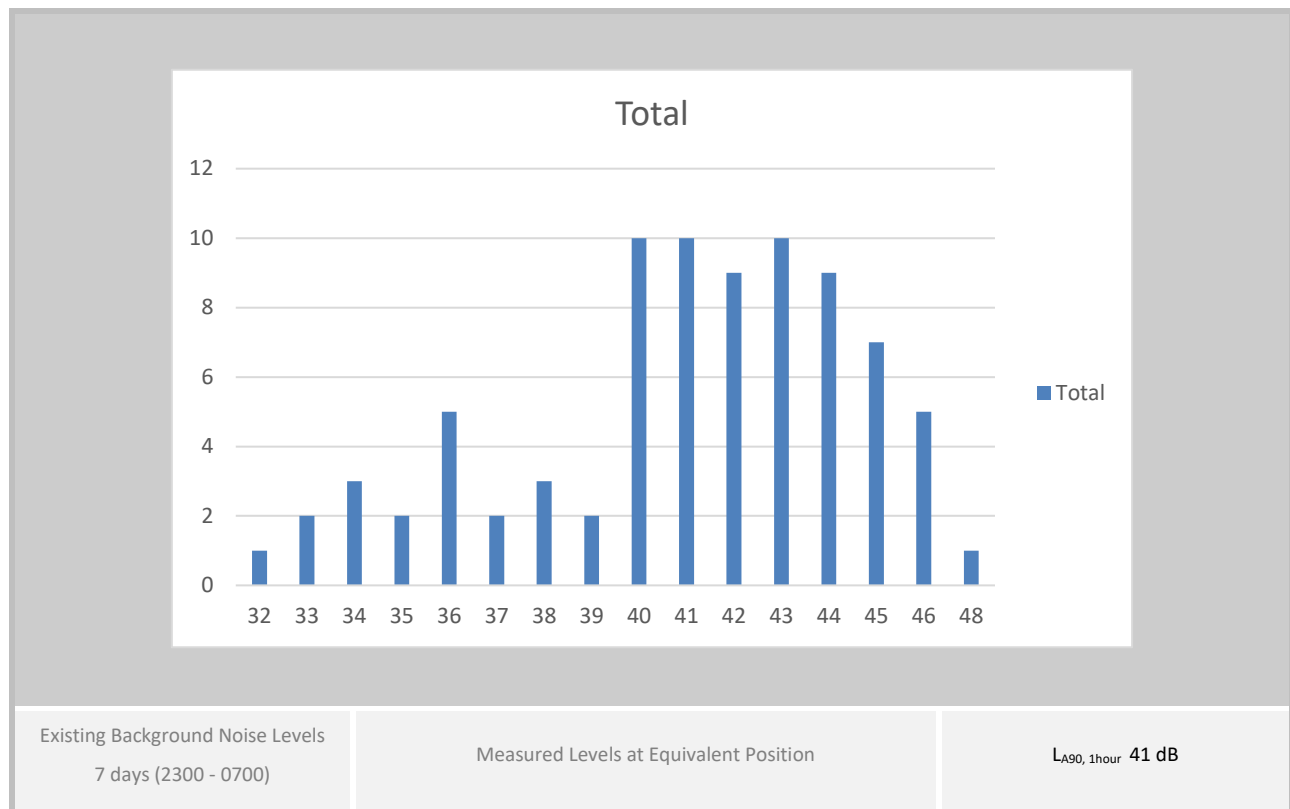
Full baseline results are shown in appendix A

4.1.2 Overall Baseline

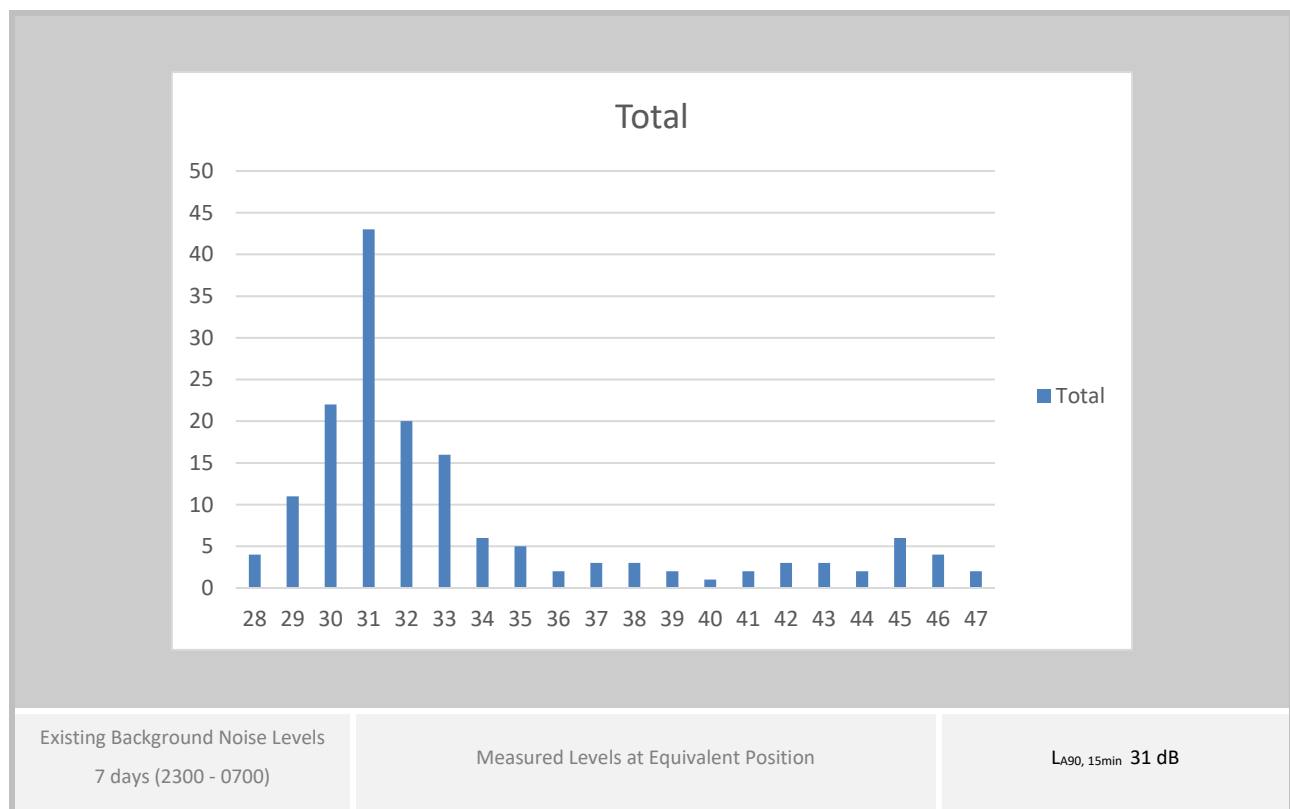


4.2 Modal Background Analysis during Operating Times

4.2.1 Day Time (0700 - 2300 Monday to Sunday)



4.2.2 Night time (2300 - 0700 Monday to Sunday)



5 CRITERION

5.1 Local Authority Criterion

In view of the above, I must remind you of the requirements of condition 11 again, as follows;

*Condition 11: As there are other residential properties in close proximity to this site, any proposal relating to the installation of potential noise generating plant / equipment such as air source heat pumps, swimming pool pumps and filtration systems, air conditioning units and the like, shall be agreed and approved in writing by the Local Planning Authority prior to any development taking place. **Reason:** in the interests of protecting the occupants of nearby residential properties from noise and vibration nuisance and having due regard to policy CS16 of the Havant Borough Core Strategy 2011 which forms part of the Local Development Framework and National Planning Policy Framework, March 2012.*

Any acoustic reports should be based on the principles of the BS4142 - 2014 requirements Noise resulting from the use of any/all plant, machinery or equipment should not exceed the principle of No Observable Effect Level (NOEL), when measured according to the above standard.

Local Authority Criterion ref: 20/00143/CMP

5.2 National Planning Policy Framework (“NPPF”)

5.2.1 Scope of Document

The National Planning Policy Framework (“NPPF”) published in March 2012 sets out the Government’s National Planning Policies for England and how these can be applied by local communities when developing their local plans or deciding planning application to best reflect the needs and priorities of the local communities. Current planning law requires Local Authorities to determine planning applications in accordance with the local development plan unless there are material considerations which require them to reach a different decision.

5.2.2 Section 109 (Policy Aims)

Section 109 of the NPPF which falls under the title “*Conserving and enhancing the natural environment*” provides the following aims:

“The planning system should contribute to and enhance the natural and local environment by:

Protecting and enhancing valued landscapes, geological conservation interests and soils;

Recognising the wider benefits of ecosystem services;

Minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government’s commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and

Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

5.2.3 Section 123 (Policy Aims)

Section 123 of the NPPF also falls under the title “*Conserving and enhancing the natural environment*” and provides the following aims:

“Planning Policies and decisions should aim to:

Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established...”

5.3 British Standard 4142:2014 ("BS4142")

5.3.1 Scope of BS 4142:2014

In the assessment of the site, consideration has been given to the scope of British Standard 4142:2014, which in section 1, details applicability of this standard to rating assessing sound of an industrial and/or commercial nature.

"The determination of noise amount to a nuisance is beyond the scope of this British Standard.

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

It is considered appropriate that both the background noise levels and the rating noise levels obtained fall within the scope of British Standard 4142:2014 by using outdoor sound levels to assess the effect of sound on local residents.

5.3.2 Assessment Position

The assessment position(s) were established as the residential properties directly adjacent to the proposed development.

5.3.3 Sound Power Levels

Sound power levels have been formed through measurement of plant

5.3.4 Calculations

The specific noise levels are calculated at the assessment position using the calculations detailed within ISO 9613 Part 1 and 2: 1996. These calculations take the manufacturers sound power levels, account for a variety of factors including source directivity, distance, atmospheric absorption, ground absorption and the effects of any barriers and determine the resultant noise levels at the assessment position.

5.3.5 Assessment Position

In line with the requirements of British Standard 4142:2014 the background noise levels should be measured at a position representative of the assessment position.

5.3.6 Rating Levels (Character Corrections)

It is appropriate to add a character correction where there is a new source that cannot be measured in line with BS4142:2014. There are 3 methods for approaching this.

- a) Subjective method
- b) Objective method (for tonality)
- c) Reference method

For full details of how to utilise each method see Appendix B of this report.

5.4 ISO 1996 – Part 2:2007

5.4.1 Scope of ISO 1996 – Part 2:2007

Part 2 of ISO 1996 describes the determination and assessment of environmental noise levels through either direct measurement, by extrapolation of measurement results, or by means of calculation.

5.4.2 Measurement Time Interval

The selection of the measurement time interval has been chosen in accordance to this standard. The measurements have been taken over a continuous period and includes both the day and night time period.

5.4.3 Instrumentation

The instrumentation and all components associated with the instrument used to measure the sound levels comply with the instrumentation system given in section 5.1 of this standard.

5.4.4 Calculation Methods

Although there are no internationally recognised calculation methods other national standards have been used for this assessment.

5.5 Night Noise Guidelines (“NNGL”)

The European Union and the World Health Organisation jointly published a document entitled “Night Noise Guidelines” in 2009 (“NNGL”). The overall goal of the document was detailed within the summary pages:

“The goal of the NNGL project was to provide and expand scientific advice to the European Commission and its Member States in developing future legislation in the area of night noise exposure, control and surveillance. The key objective of the project was to reach a consensus of experts and key stakeholders on the following subjects:

a) Guideline values for night noise to protect the public from adverse health effects.....”

5.5.1 No Observed Adverse Effect Level (NOAEL)

The section entitled “*Threshold for Observed Effects*” within the executive summary of the NNGL a list of the absolute level at which there is sufficient evidence available for the no observed adverse effect level (NOAEL):

Effect of Noise	Description	Indicator	Threshold (NOAEL)
Biological Effects	EEG awakening	L _{Amax,inside}	35 dB
	Motility, onset of motility	L _{Amax,inside}	32 dB
	Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep	L _{Amax,inside}	35 dB
Sleep Quality	Waking up in the night and / or too early in the morning	L _{Amax,inside}	42 dB

5.5.2 Vulnerable Groups

In setting the LOAEL and the SOAEL within the scope of the NPSE consideration has been made for the statement made under the title “*Vulnerable Groups*” which indicates that young children, elderly adults and shift workers should be considered vulnerable groups and more likely to be effected by unwanted noise.

5.5.3 Attenuation of an Open Window

The NNGL indicates an attenuation of around 10 – 15 dB(A) through an open window. It could therefore be appropriate to consider an overall reduction of 10 dB(A) through a partially open window.

5.6 Proposed Criterion

5.6.1 Relative to Background

Having regard to the guidance within BS4142:2014 it is considered the following are the appropriate criteria against which the plant noise emissions should be assessed to ensure they do not have an adverse effect on the local community. The criteria level for this assessment has been set at the level defined as “*low adverse impact*” within BS4142:2014. The criteria level has been set at above the minimum level where a change is perceptible and well below the level which will have an adverse impact.

5.6.2 Criterion on Noise Source and Context of Site

A working noise criterion factoring the main assessment methodologies has been set out below in accordance with the National Planning Policy Framework. Criterion has been set on the contextualisation of the environment where the plant is being proposed. From assessment and attendance at site; the site is considered partially urban and there is a busy road that has a constant steady state flow of traffic (as shown in the baseline time history) which forms the dominant residual noise climate (Average Daytime LAeq,16 hour circa 48-52dB(A)). It is therefore considered the below criterion applicable in order to safeguard the nearby residential amenity from noise emissions associated with the development and in accordance with local planning policy.

5.6.3 Daytime (0700 - 2300)

Operating Hours	Criterion	Maximum Rating Level (LAEQ,1 HOUR)	Colour Code
Daytime (0700 -2300)	No Observed Effect Level	30	
	Low Impact	40	
	Adverse Effect	45	
	Significant Adverse Effect	50	

5.6.4 Night time (2300 – 0700)

Operating Hours	Criterion	Maximum Rating Level (LAEQ,15min)	Colour Code
Night time (2300 - 0700)	No Observed Effect Level	30	
	Low Impact	31	
	Adverse Effect	35	
	Significant Adverse Effect	40	

NOTE 1: the above is permissible rating level (specific noise level + source characteristic) which accounts for audible characteristics associated with proposed source.

6 ASSESSMENT OF OPERATION OF SITE

6.1 Calculation Formulas - ISO 9613:1996

6.1.1 Source Directivity (D_c)

A correction is made to account for the location of the source and the effect of additional reflective surfaces excluding the ground and is contained within section 6 of ISO 9613 - Part 2:1996.

Number of Surfaces	Correction in dB (D_c)
No Reflective Surfaces	+0 dB
1 Reflective Surface	+3 dB
2 Reflective Surfaces	+6 dB

6.1.2 Geometric Divergence (A_{div})

A correction is made for the distance between the source and assessment position using the following formula defined in section 7.1 of ISO 9613-Part 2:1996.

Formula	Symbols
$A_{div} = 20 \cdot \log_{10} (d/d_0) + 11$	A_{div} = Reduction due to Geometric Divergence (dB) d = Distance from source to receiver (m) d_0 = reference distance (1m)

6.1.3 Barrier Effect (A_{bar})

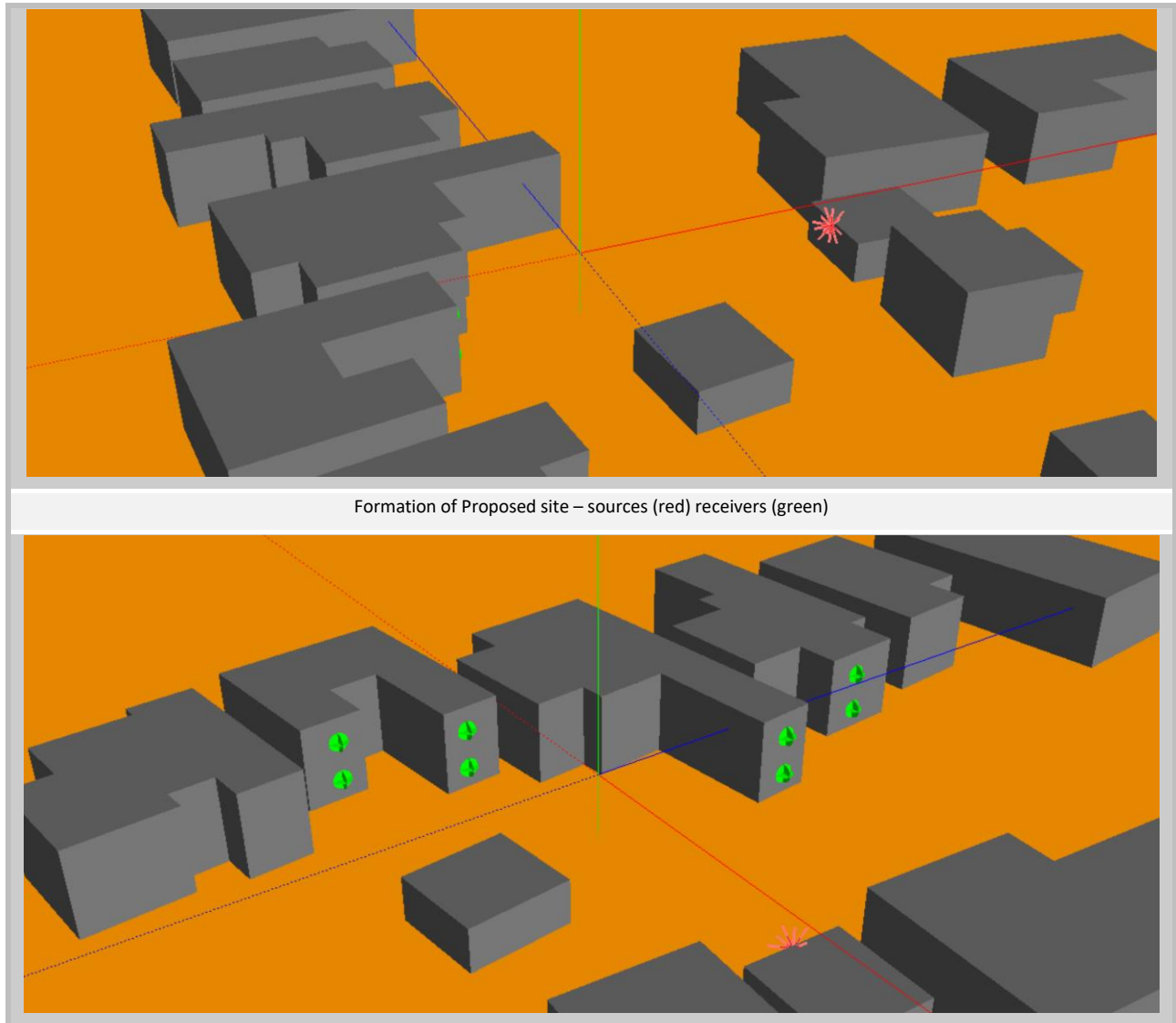
A correction is made for any barrier in the direct line of site between the source and the assessment position and is detailed in section 7.4 of ISO 9613-Part 2:1996. For clarity the K_{met} meteorological correction has been ignored and C_2 equals 40 and C_3 equals 1.

Formula	Symbols
$A_{bar} = 10 \cdot \log_{10} [3 + (40 \cdot \delta / \lambda) - A_g]$ *Note1 where $\delta = a + b - r$ and $\lambda = c / f$	A_{bar} = Effective barrier attenuation (dB) A_g = Total Ground Absorption (dB) *Note 1: Only apply the A_g correction if $A_g > 0$ δ = Path difference (m) a = Distance from source to barrier head (m) b = Distance from barrier head to assessment position (m) r = Distance from source to assessment position (m) λ = Wavelength of sound (m) c = Speed of sound – Assumed to be 342 ms^{-1} f = Octave band centre frequency (Hz)

6.1.4 SoundPLAN Model (ISO9613-2)

Specialist noise modelling software has been used to predict the resulting noise emissions from the site in accordance with ISO9613-2. All sources sound powers have been entered with source heights and ground topography/cover. For receivers; both first and second floor levels have been considered.

6.1.4.1 Site



7 CALCULATIONS AND ASSESSMENTS

7.1 Summary of Calculations

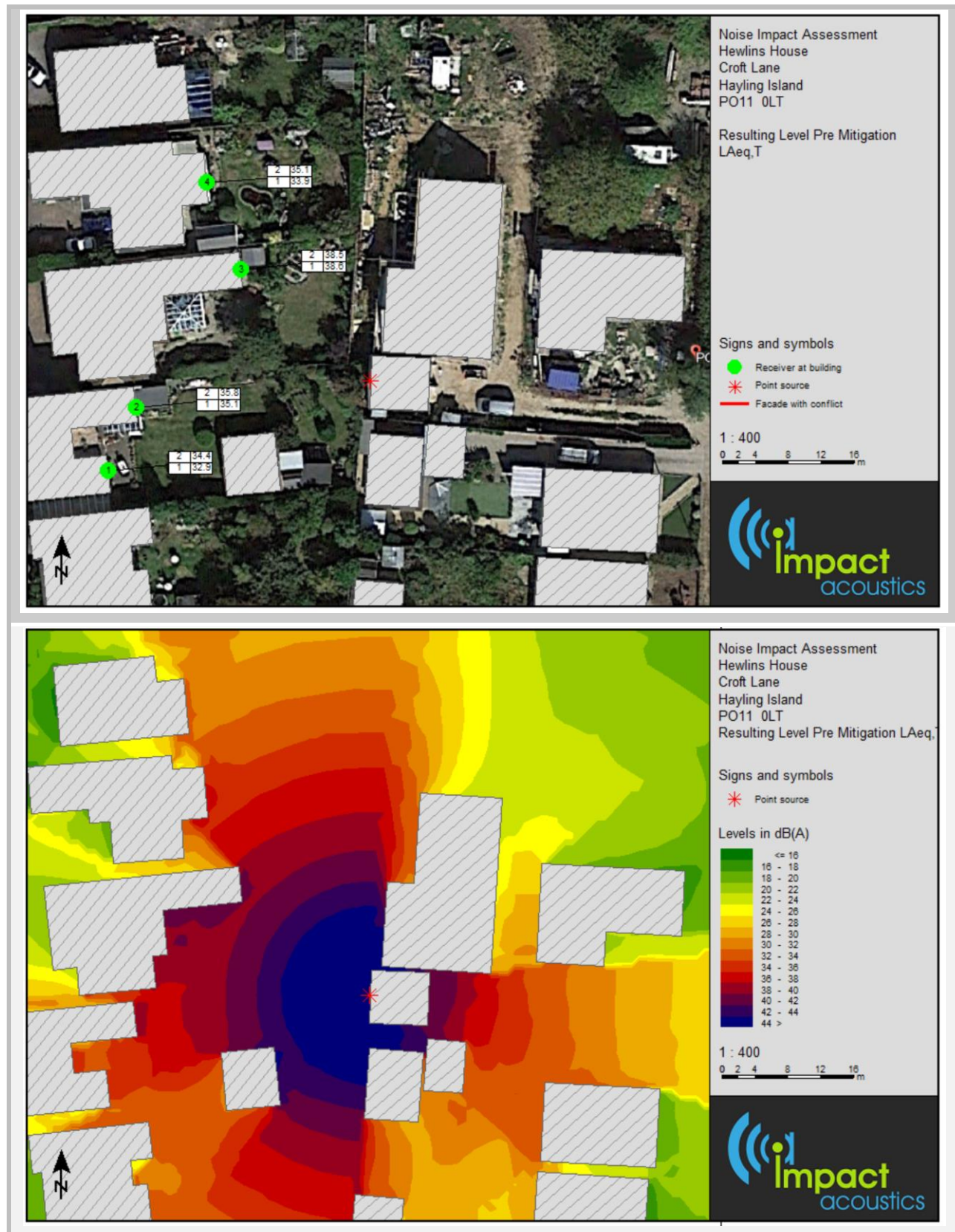
The resulting specific noise source has been calculated and predicted using noise modelling software in accordance with ISO9613-2 and the parameters set out above.

				Level w/o. NP
No.	Receiver name	Building	Floor	Specific
		side		dB(A)
1	No 112 (1)	East	GF	32.9
1	No 112 (1)	East	1.Fl	34.4
2	No 112 (2)	East	GF	35.1
2	No 112 (2)	East	1.Fl	35.8
3	No 114	East	GF	38.6
3	No 114	East	1.Fl	38.5
4	No 116	East	GF	33.9
4	No 116	East	1.Fl	35.1
1	No 112 (1)	East	GF	32.9

7.1.1 Calculation Summary

ASHP Calc	63.0	125.0	250.0	500.0	1.0k	2.0k	4.0k	8.0k	LwA dB	dB(A)
Fan Sound Power Level	81.5	77.5	75.9	72.1	64.6	58.6	56.8	41.6	72.8	
Directivity	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Calculated Discharge Level	84.5	80.5	78.9	75.1	67.6	61.6	59.8	44.6	75.8	
Geometric Divergence (20m)	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0		
Resulting Specific Noise Source	47.5	43.5	41.9	38.1	30.6	24.6	22.8	7.6		38.8

7.1.2 3D Noise Map (ISO9613-2 predicted with SoundPLAN)



7.2 Assessments (Pre Mitigation)

7.2.1 Night Time (2300 - 0700)

Rating Industrial Noise affecting Mixed Industrial and Residential Areas			
British Standard 4142:2014 Night Time (2300 - 0700)			
Source	Operating Times		Source Position
	(2300 - 0700) 7 days per week Worst case scenario		See Plans
Assessment Position	As Report		
Background Position	At a position representative to the assessment position		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,1\text{ hour}}$	39 dB	7	Calculated using ISO 9613:1996 _[3] .
Tonality	+2 dB	8.1	Tonality Characteristic
Intermittency	+3 dB	8.1	Intermittency Characteristic
Rating Level	44 dB	9.1	The acoustic feature correction is added to the specific noise level
Background Noise Level $L_{A90,15min}$	31 dB	8.1	Modal Background Noise Level (2300 - 0700)
Assessment Level	+13 dB	11	The background level is subtracted from the rating level.
Conclusion BS 4142:2014 _[1]	+10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact		
Assessment	+13 dB		
Conclusion	The assessment level is ‘Significant Adverse Impact’		
	Recommendations: Mitigate		

7.2.2 Tonal Penalty

A +2 dB penalty has been applied to the specific noise level to allow for any minor tonal elements that may be present from the proposed plant.

7.2.3 Intermittency Penalty

A +3 dB penalty has been applied to the specific noise level to allow for any minor intermittent elements that may be present from the proposed plant.

7.3 Mitigation Recommendations

It is recommended that a single acoustic louvre is fitted to the aperture to reduce the airborne noise emissions in line with the following transmission loss:

Transmission Loss	63	125	250	500	1.0k	2.0k	4.0k	8.0k
Acoustic Louvre Single	-6	-7	-8	-10	-15	-18	-16	-14

7.4 Summary of Calculations (Post Mitigation)

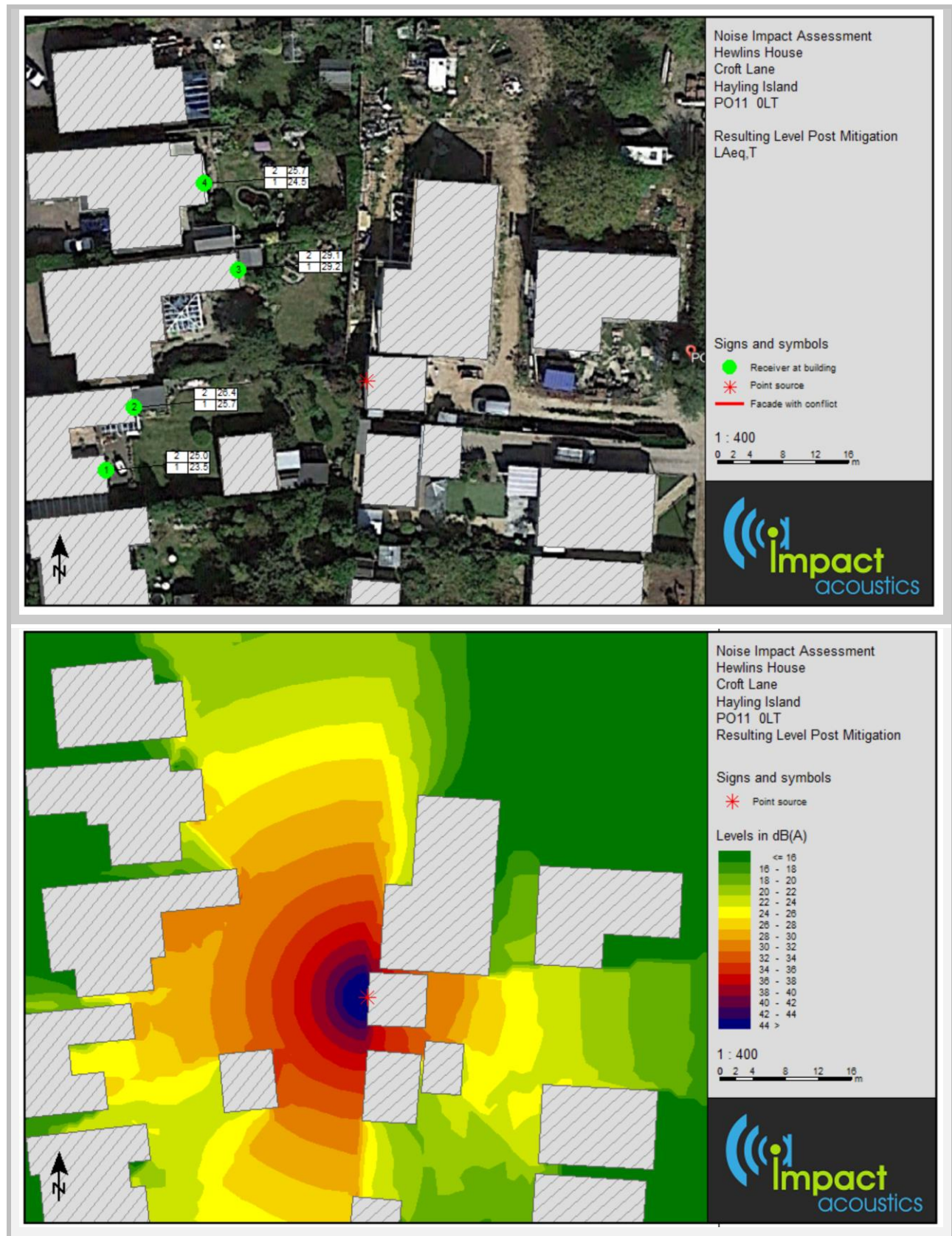
The resulting specific noise source has been calculated and predicted using noise modelling software in accordance with ISO9613-2 and the parameters set out above.

No.	Receiver name	Building	Floor	Level w. NP
		side		Specific
				dB(A)
1	No 112 (1)	East	GF	23.5
1	No 112 (1)	East	1.Fl	25
2	No 112 (2)	East	GF	25.7
2	No 112 (2)	East	1.Fl	26.4
3	No 114	East	GF	29.2
3	No 114	East	1.Fl	29.1
4	No 116	East	GF	24.5
4	No 116	East	1.Fl	25.7
1	No 112 (1)	East	GF	23.5

7.4.1 Calculation Summary

ASHP Calc	63.0	125.0	250.0	500.0	1.0k	2.0k	4.0k	8.0k	LwA dB	dB(A)
Fan Sound Power Level	81.5	77.5	75.9	72.1	64.6	58.6	56.8	41.6	72.8	
Louvre Attenuation	-6.0	-7.0	-8.0	-10.0	-15.0	-18.0	-16.0	-14.0		
Directivity	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Calculated Discharge Level	78.5	73.5	70.9	65.1	52.6	43.6	43.8	30.6	66.2	
Geometric Divergence (20m)	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0		
Resulting Specific Noise Source	41.5	36.5	33.9	28.1	15.6	6.6	6.8	-6.4		29.2

7.4.2 3D Noise Map (ISO9613-2 predicted with SoundPLAN)



7.5 Assessments (Post Mitigation)

7.5.1 Night Time (2300 - 0700)

Rating Industrial Noise affecting Mixed Industrial and Residential Areas			
British Standard 4142:2014 Night Time (2300 - 0700)			
Source	Operating Times		Source Position
	(2300 - 0700) 7 days per week Worst case scenario		See Plans
Assessment Position	As Report		
Background Position	At a position representative to the assessment position		
Item	Calculation	Clause	Commentary
Specific Noise Level $L_{Aeq,1\text{ hour}}$	29 dB	7	Calculated using ISO 9613:1996 _[3] .
Rating Level	29 dB	9.1	The acoustic feature correction is added to the specific noise level
Background Noise Level $L_{A90,15min}$	31 dB	8.1	Modal Background Noise Level (2300 - 0700)
Assessment Level	-2 dB	11	The background level is subtracted from the rating level.
Conclusion BS 4142:2014 _[1]	+10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact		
Assessment	-2 dB		
Conclusion	The assessment level is ‘No Observed Effect Level / Low Impact’		
	(additional) Meets internal absolute noise criterion with partially open window (NNGI)		

7.5.2 Assessment Conclusion

It can be seen from the above assessments that with the proposed new plant, an assessment conclusion of No Observed Effect Level / Low Impact will be expected during Night time usage and therefore no further remedial works will be required in order to ensure compliance with BS 4142: 2014.

8 CONCLUSIONS

8.1 Summary of Report

8.1.1 Measured Background Noise Levels

Continuous background noise measurements were undertaken between 25th February – 2nd March 2021 at Assessment Position 1. The representative day time background noise levels (0700 - 2300) was found to be $L_{A90,1 \text{ hour}}$ 40dB and night time background noise levels (2300 - 0700) was found to be $L_{A90,15 \text{ min}}$ 31dB. This has been evaluated from recorded data.

Daytime Equivalent Existing Background Noise Levels 7 days (0700 - 2300)	Measured Levels at Representative to Assessment Position 1	$L_{A90, t}$ 40 dB
Night time Equivalent Existing Background Noise Levels 7 days (2300 - 0700)	Measured Levels at Representative to Assessment Position 1	$L_{A90, t}$ 31 dB

Representative Background Position 1		LAeq	
		Day	Night
		(0700 - 2300)	(2300 - 0700)
1	25/02/2021	48.3	44.0
1	26/02/2021	49.7	44.6
1	27/02/2021	50.8	46.9
1	28/02/2021	51.2	44.7
1	01/03/2021	51.0	44.4

8.1.2 Criterion on Noise Source and Context of Site

A working noise criterion factoring the main assessment methodologies has been set out below in accordance with the National Planning Policy Framework. Criterion has been set on the contextualisation of the environment where the plant is being proposed. From assessment and attendance at site; the site is considered partially urban and there is a busy road that has a constant steady state flow of traffic (as shown in the baseline time history) which forms the dominant residual noise climate (Average Daytime LAeq,16 hour circa 48-52dB(A)). It is therefore considered the below criterion applicable in order to safeguard the nearby residential amenity from noise emissions associated with the development and in accordance with local planning policy.

8.1.3 Daytime (0700 - 2300)

Operating Hours	Criterion	Maximum Rating Level (LAeq,1 HOUR)	Colour Code
Daytime (0700 - 2300)	No Observed Effect Level	30	
	Low Impact	40	
	Adverse Effect	45	
	Significant Adverse Effect	50	

8.1.4 Night time (2300 – 0700)

Operating Hours	Criterion	Maximum Rating Level (LAEQ,15min)	Colour Code
Night time (2300 - 0700)	No Observed Effect Level	30	
	Low Impact	31	
	Adverse Effect	35	
	Significant Adverse Effect	40	

NOTE 1: the above is permissible rating level (specific noise level + source characteristic) which accounts for audible characteristics associated with proposed source.

8.2 Proposed Plant

8.2.1 Plant Source Levels

Items of Equipment	Operating Hours	Measured Level @ 1m from Outlet (LAeq,T)	Maximum Sound Power Level
ASHP @ 1m from outlet	24/7	Lp(A) 62 dBA	Lw(A) 73 dBA
Sound Power Level – British Standard 3744: 2010 (Engineering Grade 2 Accuracy)			

8.3 Assessment (Pre Mitigation)

8.3.1 Night time (2300 - 0700)

Rating Level	44 dB	9.1	The acoustic feature correction is added to the specific noise level
Background Noise Level LA90,1 hour	31 dB	8.1	Modal Background Noise Level (2300 - 0700)
Assessment Level	+13 dB	11	The background level is subtracted from the rating level.
Conclusion BS 4142:2014 ^[1]	+10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact		
Assessment	-13 dB		
Conclusion	The assessment level is 'Significant Adverse Impact'		
	Recommendation: Mitigate		

8.4 Mitigation Recommendations

It is recommended that a single acoustic louvre is fitted to the aperture to reduce the airborne noise emissions in line with the following transmission loss:

Transmission Loss	63	125	250	500	1.0k	2.0k	4.0k	8.0k
Acoustic Louvre Single	-6	-7	-8	-10	-15	-18	-16	-14

8.5 Assessment (Post Mitigation)

8.5.1 Night time (2300 - 0700)

Rating Level	28 dB	9.1	The acoustic feature correction is added to the specific noise level
Background Noise Level $L_{A90,1 \text{ hour}}$	31 dB	8.1	Modal Background Noise Level (2300 - 0700)
Assessment Level	-3 dB	11	The background level is subtracted from the rating level.
Conclusion BS 4142:2014 ^[1]	+10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact		
Assessment	-3 dB		
Conclusion	The assessment level is 'No observed Effect Level / Low Impact'		
	(additional) Meets internal absolute noise criterion with partially open window		

8.6 Conclusions

The operation of the proposed plant has been assessed to establish if the development will have a demonstrable adverse effect in terms of noise that outweigh the benefits of the development. Measurements have been undertaken in accordance with British Standard 4142:2014 and ISO 1996 – Part 2: 2017. This report has established the existing background noise levels at the closest residential façade to the proposed plant locations and the assessment of the impact of the site operation on nearby residential properties. The resulting emissions from the plant running on a worst case scenario show no conflict with 'no observed affect level' criteria and give a strong indication that complaint and impact on the local amenity is unlikely during operational hours post mitigation.

8.7 NPPF 2019

National Planning Policy Framework 2019 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

8.8 Planning Approval Recommendation

Based on the calculations and assessments made within this report it is the professional opinion of Impact Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2019, NPPF & NPSE and that, with regards to sound, planning permission can be granted post mitigation.

8.8.1 Uncertainty

In line with the requirements of section 10 of British Standard 4142: 2014 it is expected that the reported expanded uncertainty with a confidence limit of 95% and assuming a convergence of $k=2$ is likely to be $\pm 2.99\text{dB}$. Uncertainty, in this instance has been minimised by undertaking longer background noise measurements over a 96 hour period.

9 APPENDIX A – FULL BACKGROUND MEASUREMENT DATA

Date	Time	Lmax	min Laeq	min La90	Laeq,1hour	L90,1hour
25/02/2021	12:00	71.7	50.4	42.0	52.7	42.5
25/02/2021	13:00	75.3	48.8	43.5	52.6	44.4
25/02/2021	14:00	64.4	47.6	44.7	48.5	45.1
25/02/2021	15:00	61.6	46.2	43.4	47.5	44.6
25/02/2021	16:00	71.3	44.9	41.9	51.0	44.5
25/02/2021	17:00	74.3	44.4	41.9	51.6	42.2
25/02/2021	18:00	64.1	44.3	41.4	45.4	41.9
25/02/2021	19:00	56.9	43.6	39.6	43.8	40.2
25/02/2021	20:00	57.6	41.9	36.4	42.8	38.3
25/02/2021	21:00	55.5	39.2	35.9	40.5	36.0
25/02/2021	22:00	57.8	39.3	34.9	40.4	36.5
25/02/2021	23:00	63.1	37.2	33.1	38.4	34.0
26/02/2021	00:00	51.2	35.9	31.5	37.4	33.4
26/02/2021	01:00	49.5	33.3	27.7	35.1	30.1
26/02/2021	02:00	51.5	32.3	27.6	33.5	29.3
26/02/2021	03:00	48.9	33.6	30.9	34.9	31.2
26/02/2021	04:00	49.0	35.9	31.2	37.8	33.3
26/02/2021	05:00	65.9	41.4	37.3	44.7	39.7
26/02/2021	06:00	68.2	50.9	45.7	51.6	46.5
26/02/2021	07:00	76.7	51.4	47.5	54.2	47.7
26/02/2021	08:00	74.5	50.0	44.0	53.6	46.1
26/02/2021	09:00	69.0	48.1	41.9	49.7	42.2
26/02/2021	10:00	79.7	44.5	39.3	53.4	39.7
26/02/2021	11:00	68.4	44.2	39.4	47.0	40.5
26/02/2021	12:00	72.2	43.9	40.0	46.1	41.5
26/02/2021	13:00	69.7	43.4	40.2	45.8	41.1
26/02/2021	14:00	68.1	42.7	39.6	44.6	40.0
26/02/2021	15:00	74.4	45.0	40.0	52.9	41.2
26/02/2021	16:00	70.1	41.8	39.4	49.1	41.1
26/02/2021	17:00	75.0	46.5	42.3	52.4	42.8
26/02/2021	18:00	73.2	41.7	39.3	45.7	41.7
26/02/2021	19:00	55.8	41.2	38.1	42.2	38.5
26/02/2021	20:00	74.2	41.9	37.1	43.3	37.7
26/02/2021	21:00	53.0	41.3	35.2	41.8	35.9
26/02/2021	22:00	61.6	39.6	34.5	40.6	34.9
26/02/2021	23:00	52.0	38.2	32.6	38.9	33.0
27/02/2021	00:00	52.4	34.3	30.4	35.9	31.8
27/02/2021	01:00	57.0	34.8	30.6	35.9	31.0
27/02/2021	02:00	54.2	34.2	29.3	35.4	29.6
27/02/2021	03:00	50.0	31.4	30.1	33.5	30.3
27/02/2021	04:00	52.1	34.4	30.9	36.8	31.7
27/02/2021	05:00	67.1	39.1	32.8	46.0	36.0
27/02/2021	06:00	79.9	51.7	43.7	52.1	44.8
27/02/2021	07:00	76.5	50.8	44.5	51.5	45.2
27/02/2021	08:00	76.2	54.4	43.6	57.9	44.5
27/02/2021	09:00	75.5	56.2	42.8	56.6	43.4
27/02/2021	10:00	75.9	49.8	41.3	51.5	43.6
27/02/2021	11:00	69.7	46.3	41.2	49.8	44.7
27/02/2021	12:00	73.3	46.9	42.4	48.5	44.3

27/02/2021	13:00	73.5	44.1	40.6	49.6	42.0
27/02/2021	14:00	63.0	42.9	37.8	45.2	39.0
27/02/2021	15:00	67.7	44.5	40.2	47.1	41.3
27/02/2021	16:00	72.3	43.3	40.1	47.8	40.4
27/02/2021	17:00	73.6	42.3	39.9	49.7	40.3
27/02/2021	18:00	70.6	42.5	39.1	46.0	40.3
27/02/2021	19:00	64.3	40.5	34.3	41.2	37.0
27/02/2021	20:00	56.0	41.3	36.6	42.1	37.5
27/02/2021	21:00	57.3	39.1	33.4	41.2	34.2
27/02/2021	22:00	57.4	37.9	33.1	39.2	34.0
27/02/2021	23:00	46.4	35.2	31.6	36.1	32.2
28/02/2021	00:00	53.2	33.9	30.4	35.5	31.0
28/02/2021	01:00	48.4	32.8	30.0	33.7	30.2
28/02/2021	02:00	46.2	31.5	30.2	32.2	30.4
28/02/2021	03:00	42.0	31.3	30.8	32.2	30.9
28/02/2021	04:00	52.8	33.0	30.9	34.2	31.2
28/02/2021	05:00	71.1	33.9	31.4	46.5	32.7
28/02/2021	06:00	76.4	49.1	40.5	55.2	41.7
28/02/2021	07:00	76.4	51.0	39.9	55.1	41.3
28/02/2021	08:00	77.5	51.7	39.7	56.2	40.5
28/02/2021	09:00	76.1	53.8	40.8	56.8	41.7
28/02/2021	10:00	76.4	48.2	40.4	51.3	42.6
28/02/2021	11:00	74.1	48.9	45.3	51.3	45.9
28/02/2021	12:00	60.6	47.7	42.5	49.0	45.7
28/02/2021	13:00	73.9	45.9	41.2	50.6	44.6
28/02/2021	14:00	60.9	46.8	42.9	47.8	44.3
28/02/2021	15:00	67.2	45.3	42.6	46.7	43.4
28/02/2021	16:00	69.9	45.1	42.4	49.5	42.9
28/02/2021	17:00	71.9	46.2	41.5	52.0	42.0
28/02/2021	18:00	70.7	41.4	39.0	47.2	39.8
28/02/2021	19:00	74.1	38.2	35.4	40.2	36.5
28/02/2021	20:00	66.9	36.4	33.2	39.3	34.4
28/02/2021	21:00	45.9	35.0	32.7	35.4	32.8
28/02/2021	22:00	43.1	33.4	31.1	34.7	32.1
28/02/2021	23:00	42.4	32.9	30.8	33.6	31.1
01/03/2021	00:00	46.7	31.8	30.0	32.5	30.3
01/03/2021	01:00	45.7	31.2	29.3	31.9	29.5
01/03/2021	02:00	46.8	30.2	28.4	31.0	28.8
01/03/2021	03:00	46.6	29.6	28.6	31.1	28.9
01/03/2021	04:00	51.8	31.8	28.9	35.0	30.5
01/03/2021	05:00	65.8	38.7	34.7	44.5	37.2
01/03/2021	06:00	71.9	51.2	43.2	52.9	44.9
01/03/2021	07:00	77.5	49.0	44.7	51.8	45.4
01/03/2021	08:00	74.9	50.0	42.8	51.7	44.4
01/03/2021	09:00	74.6	49.0	42.1	51.6	42.8
01/03/2021	10:00	73.0	46.2	40.2	48.5	42.7
01/03/2021	11:00	71.3	47.8	39.5	50.4	42.3
01/03/2021	12:00	77.5	50.0	41.1	52.3	42.6
01/03/2021	13:00	71.3	49.4	41.1	52.5	43.4
01/03/2021	14:00	70.4	47.3	39.8	50.4	40.4
01/03/2021	15:00	69.9	48.0	40.1	50.7	40.9

01/03/2021	16:00	71.7	49.3	40.3	50.9	41.3
01/03/2021	17:00	72.7	46.4	41.1	50.0	41.5
01/03/2021	18:00	72.4	41.7	38.3	47.8	40.0
01/03/2021	19:00	52.2	39.5	37.1	39.8	37.3
01/03/2021	20:00	57.2	38.5	35.1	39.3	36.0
01/03/2021	21:00	57.4	37.2	34.1	38.0	34.6
01/03/2021	22:00	47.0	35.7	32.7	36.5	33.3
01/03/2021	23:00	51.2	34.8	32.0	35.7	32.9
02/03/2021	00:00	47.5	33.9	31.6	34.8	32.2
02/03/2021	01:00	46.8	33.6	31.3	34.0	31.5
02/03/2021	02:00	50.0	33.1	30.9	33.6	31.2
02/03/2021	03:00	48.5	33.8	31.2	34.3	31.3
02/03/2021	04:00	52.0	35.2	31.6	37.0	32.8
02/03/2021	05:00	69.5	39.6	36.0	48.5	39.2
02/03/2021	06:00	70.2	50.5	42.7	51.1	44.6
02/03/2021	07:00	73.4	52.5	46.1	52.9	46.4
02/03/2021	08:00	75.5	50.4	45.7	51.5	46.2
02/03/2021	09:00	72.6	48.6	43.4	50.3	44.0
02/03/2021	10:00	68.7	47.9	41.5	50.1	42.1
02/03/2021	11:00	71.8	47.5	41.7	48.6	43.6
02/03/2021	12:00	71.2	47.4	42.9	49.1	43.8

10 APPENDIX B – INFORMATION TO BE REPORTED

10.1 a) Competency

1)	Name	Role	Competency
	I.Broom	Noise Consultant	IoA Diploma Acoustics Noise Control Associate Member of the Institute of Acoustics (AMIOA)

10.2 b) Source under Investigation

1)	Description of Source	Type	Manufacturer	Model
	ASHP			
	Description of Source	Source Location	Hours of Operation	Mode of Operation
	ASHP	As plans	24/7	continuous
	Description of Premises	Hewlins House, Hayling Island		

10.3 c) Subjective Impression of Source at Assessment Position

1)	Dominance	The sources are unlikely to be dominant at assessment position
	Audibility	The source unlikely to be audible at the assessment position
2)	Residual Noise Sources	Traffic Noise and local commercial noise

10.4 d) Existing Contexts

1)	Type of Receptor	Period	Sensitivity	Description
	Residential	Day	Moderate	Noise can disturb outside amenity space Noise can disturb inside living space
		Night	High	Noise can disturb sleeping

10.5 e) Relative Positions

1)	Assessment Position	Hewlins House, Hayling Island		
		BS 4142:2014 Criteria	Details	Compliance with Criteria
		Section 6	1.0m from façade (external)	Assessment position is valid
2)	Source Measurement	It is believed the sound power levels were established in accordance with BS EN 13487:2003		
	Justification	Site is proposed		
3)	Background Measurement	At assessment positions in report		
	Justification	BS 4142:2014 Criteria	Details	Compliance with Criteria
		Section 6.2	3.5m to any reflecting surface	Does comply with Criteria
		Section 6.2	Height 1.2m to 1.5m	Does comply with Criteria
		Section 6.2	1 st floor 1m to facade	Does comply with Criteria
		Section 6.2	Measurement Height	1.5
			Distance to Reflecting Surface	3.5
4)	Topography, surfaces etc.	Hard		
5)	Relative Distances	See Report		

10.6 f) Noise Measurement Equipment Calibration

10.6.1 Continuous Measurement

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Norsonic	118	31471	2 YEARS	08.08.2019	08.08.2021
12.5mm Microphone (with windshield)	Norsonic	1220	41075	2 YEARS	08.08.2019	08.08.2021
Microphone Pre – Amplifier	Norsonic	1201	30327	2 YEARS	08.08.2019	08.08.2021

10.7 g) Noise Measurement Equipment Operation Test

1)	Ref. Level of Calibrator	94 dB@1000Hz
2)	Meter Reading Before	94 dB – Meter operation checked. Meter in good working order.
	Meter Reading After	94 dB - Meter operation checked. Meter in good working order.

10.8 h) Weather Conditions

1)	Weather Conditions	Dry
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10.9 i) Date and Time of Measurements

1)	Background Measurements	25 th February – 2 nd March 2021
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10.10 j) Measurement Time Interval

1)	Source Measurements	2 nd March 2021
	Background Measurements	Night Time
		(2300 -0700)
		T _m = 8 hours

10.11 k) Reference Time Interval

1)	Reference Time Interval	Night Time
		(2300 -0700)
		T _r = LAeq, 15min

10.12 l) Specific Noise Levels

1)	Measured Sound Levels	Night Time
		(2300 -0700)
		Data Sheet and extrapolation (prediction)
2)	Residual Noise Level	Not required
	Method of Determination	Not Applicable
3)	Ambient Noise Level	Not required
	Method of Determination	Not Applicable
4)	Specific Noise Level (highest)	L _{Aeq, 1 hour} 29 dB
	Method of Determination	Calculated using the measured sound power levels and noise modelling software in accordance with ISO9613-2
4)	Justification	Proposed Site
5)	Correction Applied	Not Applicable

10.13 m) Background Noise Levels

1)	Background Noise Levels	Night Time
		(2300 -0700)
		LA90,15min 31 dB
	Background Position	Representative to the Assessment Position

10.14 n) Rating Levels

1)	Specific Noise Level	Night Time
		(2300 -0700)
		L _{Aeq} , 1 hour 29 dB
2)	Acoustic feature correction	0
	Justification	Well below ambient L _{Aeq} ,T and considered 'low level'
3)	Rating Level	L _{Aeq} , 15min 29 dB

10.15 o) Excess of Rating over Background Level

1)	Assessment	Night Time
		(2300 -0700)
		-3 dB
2)	Estimate of Impact	Below low Adverse Impact / No Observed Effect Level

10.16 p) Conclusions

1)	Conclusion	Night Time
		(2300 -0700)
		The British Standard 4142:2014 assessments indicate that the new plant is unlikely to have the potential for impact on the local receptors post mitigation

11 APPENDIX C – CHARACTER CORRECTION

11.1 Subjective Method

The subjective method establishes a rating penalty that is added to the specific noise level if any of the following is present at the assessment position.

If a tone is expected to be present a character correction of 0 dB to 6 dB is added depending on how perceptible it is at noise sensitive locations.

BS4142:2014 – Section 9.2 Subjective Method	Perceptibility to noise sensitive facades	Correction
Tonality Ranging from not tonal to prominently tonal	Not tonal	+0
	Just perceptible	+2
	Clearly perceptible	+4
	Highly perceptible	+6

If the source is expected to be impulsive a character correction of 0 dB to 9 dB is added depending on how perceptible it is at noise sensitive locations.

BS4142:2014 – Section 9.2 Subjective Method	Perceptibility to noise sensitive facades	Correction
Impulsivity Considering both the rapidity and any overall change in sound levels	Not impulsive	+0
	Just perceptible	+3
	Clearly perceptible	+6
	Highly perceptible	+9

When the sound features are neither tonal nor impulsive, a character correction of +3 is added for the readily distinctive quality against the acoustic environment or for the intermittency of the source.

BS4142:2014 – Section 9.2 Subjective Method	Perceptibility to noise sensitive facades	Correction
Readily Distinctive	Is not present	+0
	Is present	+3
Intermittency	Is not present	+0
	Is present	+3

11.2 Objective Method

The objective method is used if the subjective method is not sufficient. This identifies tones from the one-third octave bands and adds a character correction of 6 dB if the tone is present.

According to BS4142:2014 (Annex C):

“For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third octave bands by some constant level difference.”

BS4142:2014 – Section 9.3 Objective Method	One – Third Octave Band	Difference
The level differences between adjacent one-third octave bands that identify a tone	25 Hz to 125 Hz	15 dB
	160 Hz to 400 Hz	8 dB
	500 Hz to 10,000 Hz	5 dB

11.3 Reference Method

The reference method is used if using one-third octave bands is not sufficient. This provides a method for assessing how audible a tone will be or how prominent the impulsive sounds will be and produces a penalty of up to 6 dB.

For full details of how to utilise the reference method see British Standard 4142:2014 Annexes D and E.

12 APPENDIX D – UNCERTAINTY BUDGET

Sources of Uncertainty	Uncertainty Notes	Commentary	Value (half Width)	Convert to Same Units (dB)	Distribution Divisor			Standard Uncertainty (u) dB
					Normal	Rectangular	Other	
Source								
Source Sound Power	Variation	Estimated From Plant to SLM	0.1		Normal			0.10
Position of Source	Height above ground	Estimated from 1.2m to 1.5m	0.3			rect($\sqrt{3}$)		0.14
	Run Condition	Normal Estimate Continuous (multiple source)	2.0			rect($\sqrt{3}$)		1.15
	Operators set up							
Type of Propagation	Spherical / hemi	Point Source at Distance						
Environmental Effects	wind	Small Effect	0.5			rect($\sqrt{3}$)		0.29
Transmission Path								
Weather	Propagation of source	150m downwind	0.5			rect($\sqrt{3}$)		0.29
	wind direction							
	temperature gradient							
Ground Reflection	Magnitude of ground dip,	Flat Ground Reflections applied						
	variability of surface							
Receiver								
Measurement Position	Choice of position, ,	5m in 150m		0.2		rect($\sqrt{3}$)		0.13
	microphone orientation	Type 1 0 - 30deg	0.4		Normal			0.50
Instrumentation	Calibration	Calibration Drift	0.1		Normal			0.10
	Accuracy and precision (type 1)	Type 1 practical	1.9			rect($\sqrt{3}$)		0.50
	Windshield							
	Environmental influence							
Background Noise Level	Timing of Measurement							
	Modal Analysis Day	Calculated Standard Deviation	3.7				s/ $\sqrt{n}$	0.39
	Modal Analysis Night	Calculated Standard Deviation	2.2				s/ $\sqrt{n}$	0.16
	Choice of Measurement Position	NSP First Floor Window						
Combined Uncertainty (root sum of squares)								1.49
Expanded Uncertainty U = Kuc (95% Confidence K =2)								2.99
Final Answer Expressed as Value +/- U dB with a confidence Level of 95%								
REFERENCE: Uncertainty Budget Calculated in line with M3003: The Expression of Uncertainty and Confidence in Measurement Edition 3, November 2012 and A Good Practice Guide on the Sources and Magnitude of Uncertainty Arising in the Practical Measurement of Environmental Noise N J Craven, G Kerry Edition 1a – May 2007.								

13 GLOSSARY

Ambient Noise: Totally encompassing sound in a given situation at a given time usually composed of sounds from many sources near and far. [BS 4142]

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).

Free Field: 1. A free sound field is a field in a homogeneous, isotropic medium free from boundaries. In practice it is a field in which the effects of the boundaries are negligible over the region of interest. The actual pressure impinging on an object (e.g., a microphone) placed in an otherwise free sound field will differ from the pressure which would exist at the point with the object removed, unless the acoustic impedance of the object matches the acoustic impedance of the medium.

2. An environment in which there are no reflective surfaces within the frequency region of interest.

3. A region in which no significant reflections of sound occur.

4. [BS4142] suggests that free-field environmental noise measurements need to be made at least 3.5m from any reflecting structure.

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

$L_{A90,T}$: the A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1997 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.

Steady Noise: Noise that gives fluctuations over a range of not more than 5 dB on a sound level meter set to frequency weighting A and time weighting S. [BS 4142]

14 **DISCLAIMER**

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#END OF REPORT#