



REPORT REFERENCE:

IMP7311 v2.0

## **INDUSTRIAL NOISE IMPACT ASSESSMENT INSTALLATION OF NEW INDUSTRIAL PLANT**

British Standard 4142:2019

CLIENT:

Annette Mead  
Waters Edge  
Lands End Road  
Old Bursledon  
Southampton  
Hampshire SO31 8DN

SITE:

Waters Edge  
Lands End Road  
Old Bursledon  
Southampton  
Hampshire SO31 8DN

SURVEY DATE:

12<sup>th</sup> – 18<sup>th</sup> January 2023

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## 1 EXECUTIVE SUMMARY

### 1.1 Instruction

Impact Acoustics Ltd have been instructed by Annete Mead to undertake a background noise survey at the existing premises at Waters Edge, Lands End Road, Old Bursledon, Southampton, Hampshire SO31 8DN to understand the level of impact in relation to the new external 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: 2019.

### 1.2 Scope of Report

The measurements have been undertaken in accordance with British Standard 4142:2019 and ISO 1996 – Part 2: 2017 to establish if the 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 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 12<sup>th</sup> – 18<sup>th</sup> January 2023 at Assessment Position 1. The representative daytime background noise levels (0700 - 2300) was found to be  $L_{A90,1hour}$  47 dB This been evaluated from the recorded data.

|                                                                              |                                          |                    |
|------------------------------------------------------------------------------|------------------------------------------|--------------------|
| Daytime Equivalent Existing<br>Background Noise Levels<br>7 days (0700-2300) | Measured Levels at Assessment Position 1 | $L_{A90, t}$ 47 dB |
|------------------------------------------------------------------------------|------------------------------------------|--------------------|

| Representative Background Position 1 |            | LAeq          |               |
|--------------------------------------|------------|---------------|---------------|
|                                      |            | Day           | Night         |
|                                      |            | (0700 - 2300) | (2300 - 0700) |
| 1                                    | 12/01/2023 | 48.4          | 41.7          |
| 1                                    | 13/01/2023 | 51.7          | 50.0          |
| 1                                    | 14/01/2023 | 51.3          | 39.0          |
| 1                                    | 15/01/2023 | 46.2          | 59.7          |
| 1                                    | 16/01/2023 | 57.1          | 47.5          |
| 1                                    | 17/01/2023 | 51.8          | 38.3          |
| 1                                    | 18/01/2023 | 47.2          | 0.0           |

### 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 installed. From assessment and attendance at site; the site is considered urban and whilst there is a busy road that has a constant steady state flow of traffic; the levels late evening and night time are very low which forms the dominant residual noise climate during this period (Average Night time LAeq,8 hour circa 51dB(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 (-10 at representative measured LA90 with a maximum of 30dB LA90 where measured background levels are considered “very low” and outside the scope of BS4142:2019):

#### 1.3.3 Daytime (0700 – 2300)

| Operating Hours       | Criterion                  | Maximum Rating Level (LAeq,1 hour) | Colour Code |
|-----------------------|----------------------------|------------------------------------|-------------|
| Daytime (0700 – 2300) | No Observed Affect Level   | 30                                 |             |
|                       | <b>Low Impact</b>          | 37                                 |             |
|                       | Adverse Effect             | 42                                 |             |
|                       | Significant Adverse Effect | 47                                 |             |

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

## 1.4 Proposed Plant

### 1.4.1 Plant Source Levels

| Items of Equipment                                                             | Operating Hours | Sound Pressure @ 1m (dB(A)) | Maximum Sound Power Level |
|--------------------------------------------------------------------------------|-----------------|-----------------------------|---------------------------|
| BPN08                                                                          | Daytime         | 51dB(A)                     | L <sub>w</sub> (A) 62 dBA |
| Sound Power Level – British Standard 3744: 2010 (Engineering Grade 2 Accuracy) |                 |                             |                           |

### 1.4.2 Proposed Operations

Hours operation are daytime only therefore no night time assessment has been undertaken.

## 1.5 Assessment

### 1.5.1 Daytime (0700 – 2300)

| Rating Level                                    | 36 dB                                                                                  | 9.1 | The acoustic feature correction is added to the specific noise level |
|-------------------------------------------------|----------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------|
| Background Noise Level $L_{A90,1 \text{ hour}}$ | 47 dB                                                                                  | 8.1 | Modal Background Noise Level (0700 - 2300)                           |
| Assessment Level                                | -11 dB                                                                                 | 11  | The background level is subtracted from the rating level.            |
| Conclusion BS 4142:2019 <sup>[1]</sup>          | +10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact            |     |                                                                      |
| <b>Assessment</b>                               | <b>-11 dB</b>                                                                          |     |                                                                      |
| <b>Conclusion</b>                               | <b>The assessment level is 'Low Impact'</b>                                            |     |                                                                      |
|                                                 | <b>(additional) Meets internal absolute noise criterion with partially open window</b> |     |                                                                      |

## 1.6 Conclusions

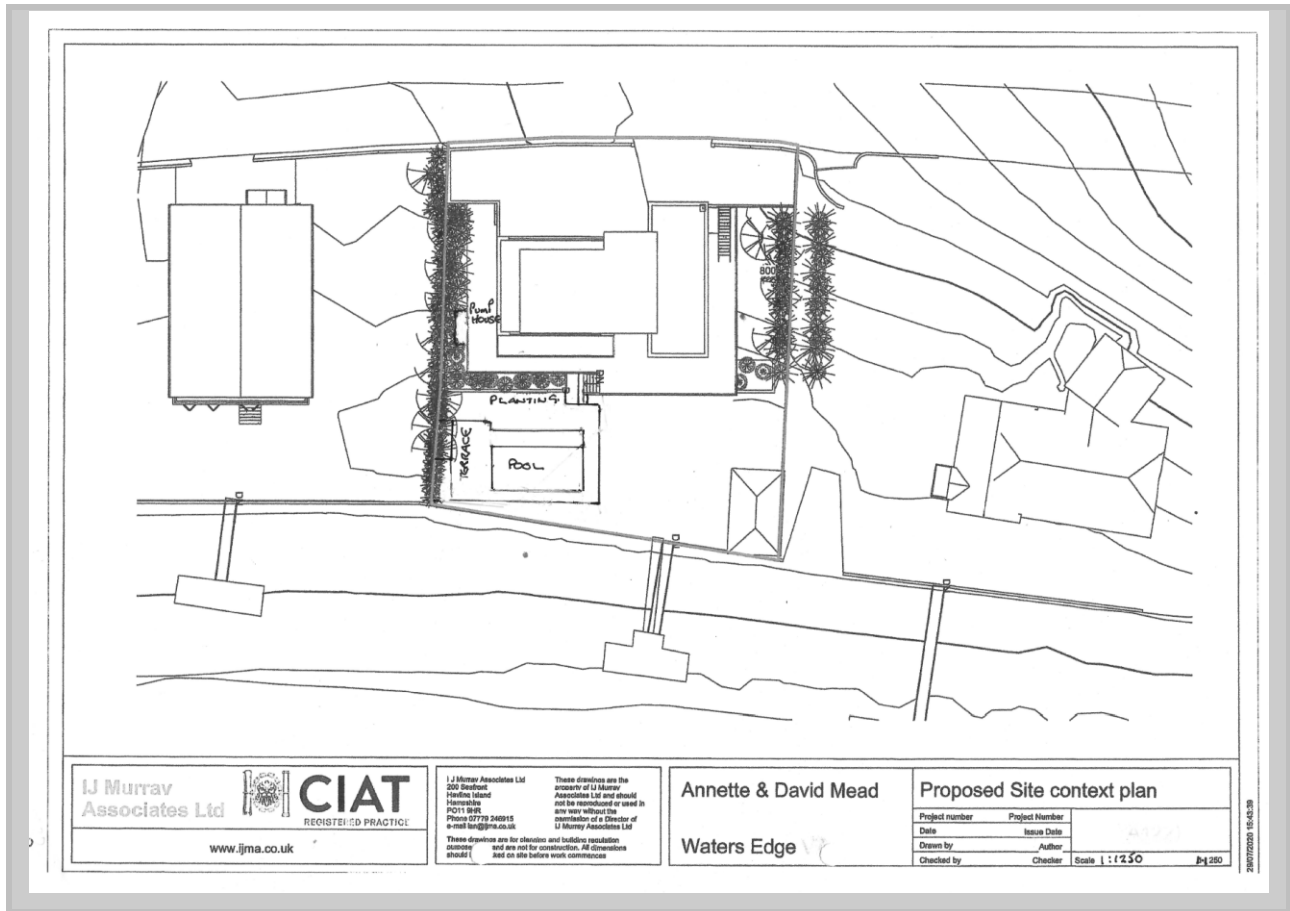
The operation of the plant has been assessed to establish if the development will have a demonstrable adverse effect in terms of noise that outweigh the benefits of the development. Measurements have been undertaken in accordance with British Standard 4142:2019 and ISO 1996 – Part 2: 2017. This report has established the existing background noise levels at the closest residential façade to the 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 'low impact' criteria during operational hours. This is further enforced as the plant will have a wooden louvre casing around this (not included within calculations or modelling) which once installed will reduce the level of impact further.

## 1.7 NPPF 2019

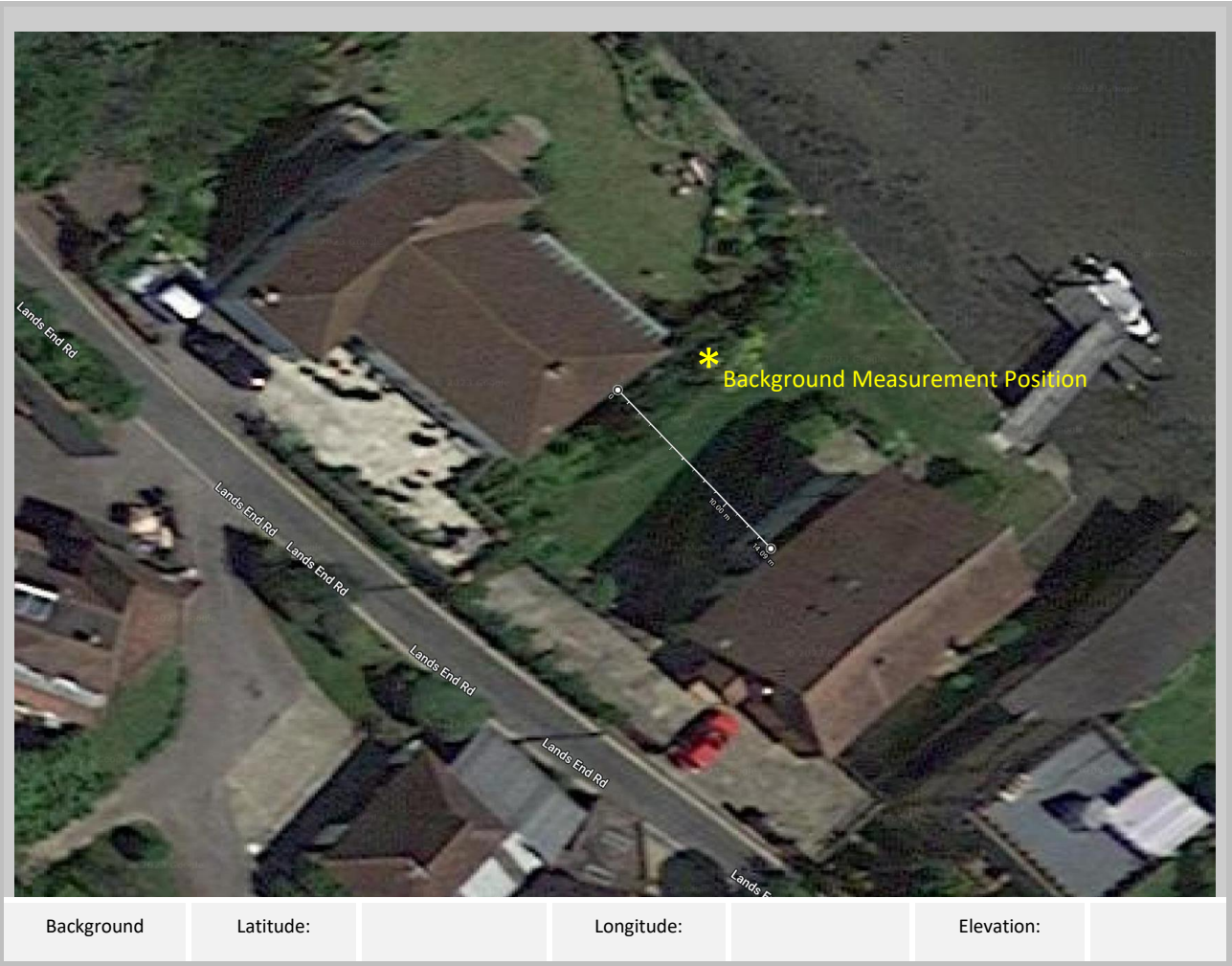
National Planning Policy Framework 2019 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate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

## 2 SITE

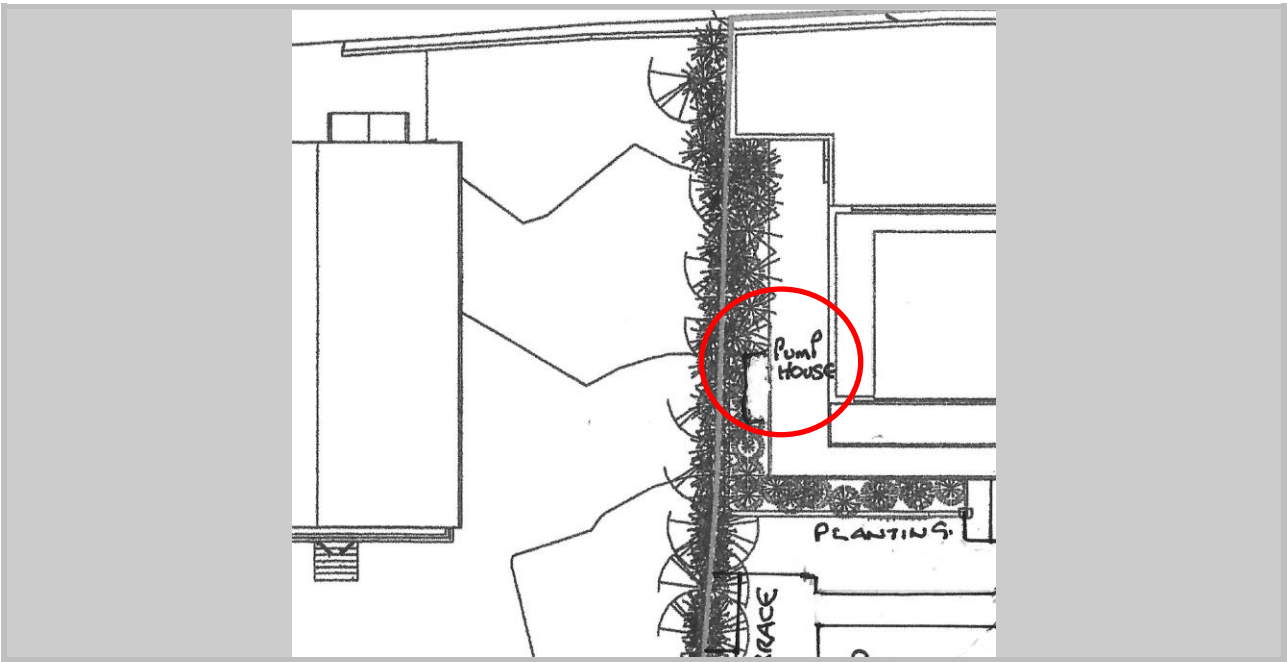
### 2.1 Site Location



2.2 Assessment Positions and Background Position



2.3 Proposed Plant Locations



&lt;&lt; Back



COMFORTLINE INVERTER Swimming Pool Heat Pump

| Description                                                   | More details |                              |             |             |             |             |
|---------------------------------------------------------------|--------------|------------------------------|-------------|-------------|-------------|-------------|
| MODEL                                                         |              | BPN06                        | BPN08       | BPN09       | BPN13       | BPN17       |
| Recommended pool volume (m³)                                  |              | 15 - 30                      | 20 - 40     | 25 - 45     | 30 - 60     | 40 - 75     |
| Performance Condition: Air 26 °C / Water 26 °C / Humidity 80% |              |                              |             |             |             |             |
| Heating capacity (kW)                                         |              | 6.5                          | 8.0         | 9.2         | 12.5        | 16.5        |
| COP                                                           |              | 10.0 - 5.8                   | 9.5 - 5.6   | 10.0 - 5.7  | 11.0 - 5.9  | 10.5 - 5.7  |
| COP at 50% capacity                                           |              | 8,8                          | 8,2         | 8,6         | 9,5         | 9,1         |
| Performance Condition: Air 15 °C / Water 26 °C / Humidity 70% |              |                              |             |             |             |             |
| Heating capacity (kW)                                         |              | 4.5                          | 6.0         | 7.0         | 9.0         | 11.5        |
| COP                                                           |              | 6.1 - 4.25                   | 6.1 - 4.1   | 6.2 - 4.3   | 6.1 - 4.2   | 6.2 - 4.2   |
| COP at 50% capacity                                           |              | 6.0                          | 6.1         | 5.8         | 6.0         | 6.2         |
| Sound pressure at 1m dB(A)                                    |              | 39.8 - 51.2                  | 40.8 - 51.1 | 40.6 - 52.5 | 42.9 - 53.0 | 45.2 - 56.3 |
| Sound pressure of 50% capacity at 1m dB(A)                    |              | 43.8                         | 43.9        | 45.8        | 48.5        | 48.7        |
| Sound pressure at 10m dB(A)                                   |              | 19.8 - 31.2                  | 20.8 - 31.1 | 20.6 - 32.5 | 22.9 - 33.0 | 25.2 - 36.3 |
| Rated input power at air 15 °C (kW)                           |              | 0.35 - 1.0                   | 0.34 - 1.4  | 0.34 - 1.6  | 0.36 - 2.0  | 0.56 - 2.7  |
| Rated input current at air 15 °C (A)                          |              | 1.52 - 4.4                   | 1.48 - 6.0  | 1.48 - 7.0  | 1.57 - 8.7  | 2.43 - 11.7 |
| Max input current (A)                                         |              | 6.5                          | 8.0         | 9.5         | 12.5        | 15          |
| Circuit breaker (A)                                           |              | 16                           | 16          | 16          | 16          | 20          |
| Power cord (mm²)                                              |              | 3x1.5                        | 3x1.5       | 3x1.5       | 3x2.5       | 3x4         |
| Power supply                                                  |              | 230 V / Single-Phase / 50 Hz |             |             |             |             |
| Advised water flux (m³/h)                                     |              | 2 - 4                        | 2 - 4       | 3 - 4       | 4 - 6       | 6 - 8       |
| Water inlet/outlet connections (mm)                           |              |                              |             | 50 / 50     |             |             |
| Net dimensions LxWxH (mm)                                     |              | 744x349x648                  | 864x349x648 | 864x349x648 | 864x349x648 | 954x349x648 |
| Net weight (kg)                                               |              | 42                           | 46          | 47          | 49          | 60          |

The specified pool volumes are only valid for heating from April to October and the swimming pool should be covered during the night. If these conditions are not met, please choose a larger model.

| Items of Equipment                                                             | Operating Hours | Sound Pressure @ 1m (dB(A)) | Maximum Sound Power Level |
|--------------------------------------------------------------------------------|-----------------|-----------------------------|---------------------------|
| BPN08                                                                          | Daytime         | 51dB(A)                     | L <sub>w</sub> (A) 62 dBA |
| Sound Power Level – British Standard 3744: 2010 (Engineering Grade 2 Accuracy) |                 |                             |                           |

Industry

Source name

Day  
dB(A)

ASHP

62.0

Data Input into 3D Modelling software

### 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               | 08.08.2021      | 08.08.2023           |
| 12.5mm Microphone (with windshield) | Norsonic | 1220 | 41075      | 2 YEARS               | 08.08.2021      | 08.08.2023           |
| Microphone Pre – Amplifier          | Norsonic | 1201 | 30327      | 2 YEARS               | 08.08.2021      | 08.08.2023           |

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

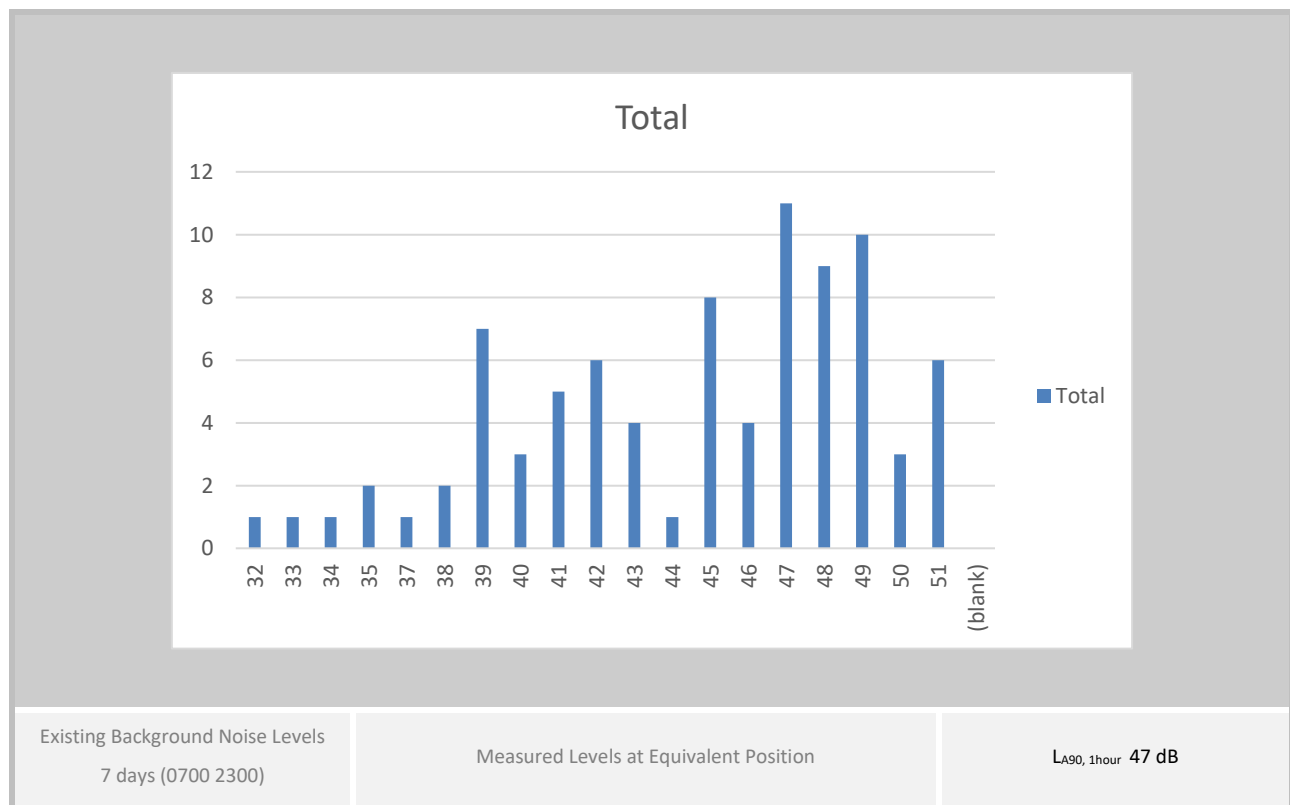
Continuous background noise measurements were undertaken between 12<sup>th</sup> – 18<sup>th</sup> January 2023 at Assessment Position 1. The representative daytime background noise levels (0700 - 2300) was found to be  $L_{A90,1\text{hour}}$  47 dB This been evaluated from the recorded data.

|                                                                              |                                          |                    |
|------------------------------------------------------------------------------|------------------------------------------|--------------------|
| Daytime Equivalent Existing<br>Background Noise Levels<br>7 days (0700-2300) | Measured Levels at Assessment Position 1 | $L_{A90, t}$ 47 dB |
|------------------------------------------------------------------------------|------------------------------------------|--------------------|

| Representative Background Position 1 |            | LAeq          |               |
|--------------------------------------|------------|---------------|---------------|
|                                      |            | Day           | Night         |
|                                      |            | (0700 - 2300) | (2300 - 0700) |
| 1                                    | 12/01/2023 | 48.4          | 41.7          |
| 1                                    | 13/01/2023 | 51.7          | 50.0          |
| 1                                    | 14/01/2023 | 51.3          | 39.0          |
| 1                                    | 15/01/2023 | 46.2          | 59.7          |
| 1                                    | 16/01/2023 | 57.1          | 47.5          |
| 1                                    | 17/01/2023 | 51.8          | 38.3          |
| 1                                    | 18/01/2023 | 47.2          |               |

## 4.2 Modal Background Analysis during Operating Times

### 4.2.1 Day Time (0700 2300 Monday to Sunday)



## 5 CRITERION

### 5.1 National Planning Policy Framework (“NPPF”)

#### 5.1.1 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.

#### 5.1.2 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.*

#### 5.1.3 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...”*

## 5.2 British Standard 4142:2019 ("BS4142")

### 5.2.1 Scope of BS 4142:2019

In the assessment of the site, consideration has been given to the scope of British Standard 4142:2019, 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 4142:2019 by using outdoor sound levels to assess the effect of sound on local residents.

### 5.2.2 Assessment Position

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

### 5.2.3 Sound Power Levels

Sound power levels have been provided by the manufacturer in the form of data sheets

### 5.2.4 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.

### 5.2.5 Assessment Position

In line with the requirements of British Standard 4142:2019 the background noise levels should be measured at a position representative of the assessment position.

#### 5.2.6 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 BS4142:2019. 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.

### 5.3 ISO 1996 – Part 2:2007

#### 5.3.1 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.

#### 5.3.2 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.

#### 5.3.3 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.

#### 5.3.4 Calculation Methods

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

### 5.4 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.....”*

#### 5.4.1 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 <sub>Amax,inside</sub> | 35 dB             |
|                    | Motility, onset of motility                                                                   | L <sub>Amax,inside</sub> | 32 dB             |
|                    | Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep | L <sub>Amax,inside</sub> | 35 dB             |
| Sleep Quality      | Waking up in the night and / or too early in the morning                                      | L <sub>Amax,inside</sub> | 42 dB             |

#### 5.4.2 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.

#### 5.4.3 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.

## 5.5 Proposed Criterion

### 5.5.1 Relative to Background

Having regard to the guidance within BS4142:2019 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 BS4142:2019. 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.

### 5.5.2 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 installed. From assessment and attendance at site; the site is considered urban and whilst there is a busy road that has a constant steady state flow of traffic; the levels late evening and night time are very low which forms the dominant residual noise climate during this period (Average Night time LAeq,8 hour circa 51dB(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 (-10dB at representative measured LA90 with a maximum of 30dB LA90 where measured background levels are considered “very low” and outside the scope of BS4142:2019):

### 5.5.3 Daytime (0700 – 2300)

| Operating Hours       | Criterion                  | Maximum Rating Level<br>(LAeq,1 hour) | Colour Code |
|-----------------------|----------------------------|---------------------------------------|-------------|
| Daytime (0700 – 2300) | No Observed Affect Level   | 30                                    |             |
|                       | <b>Low Impact</b>          | 37                                    |             |
|                       | Adverse Effect             | 42                                    |             |
|                       | Significant Adverse Effect | 47                                    |             |

NOTE 1: the above is permissible rating level (specific noise level + source characteristic) which accounts for audible characteristics associated with 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)<br>$d$ = Distance from source to receiver (m)<br>$d_0$ = 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $A_{bar} = 10 \cdot \log_{10} [3 + (40 \cdot \delta / \lambda) - A_g]$<br>*Note1<br>where $\delta = a + b - r$<br>and $\lambda = c / f$ | $A_{bar}$ = Effective barrier attenuation (dB)<br>$A_g$ = Total Ground Absorption (dB)<br>*Note 1: Only apply the $A_g$ correction if $A_g > 0$<br>$\delta$ = Path difference (m)<br>$a$ = Distance from source to barrier head (m)<br>$b$ = Distance from barrier head to assessment position (m)<br>$r$ = Distance from source to assessment position (m)<br>$\lambda$ = Wavelength of sound (m)<br>$c$ = Speed of sound – Assumed to be $342 \text{ ms}^{-1}$<br>$f$ = 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.

## 7 CALCULATIONS AND ASSESSMENTS

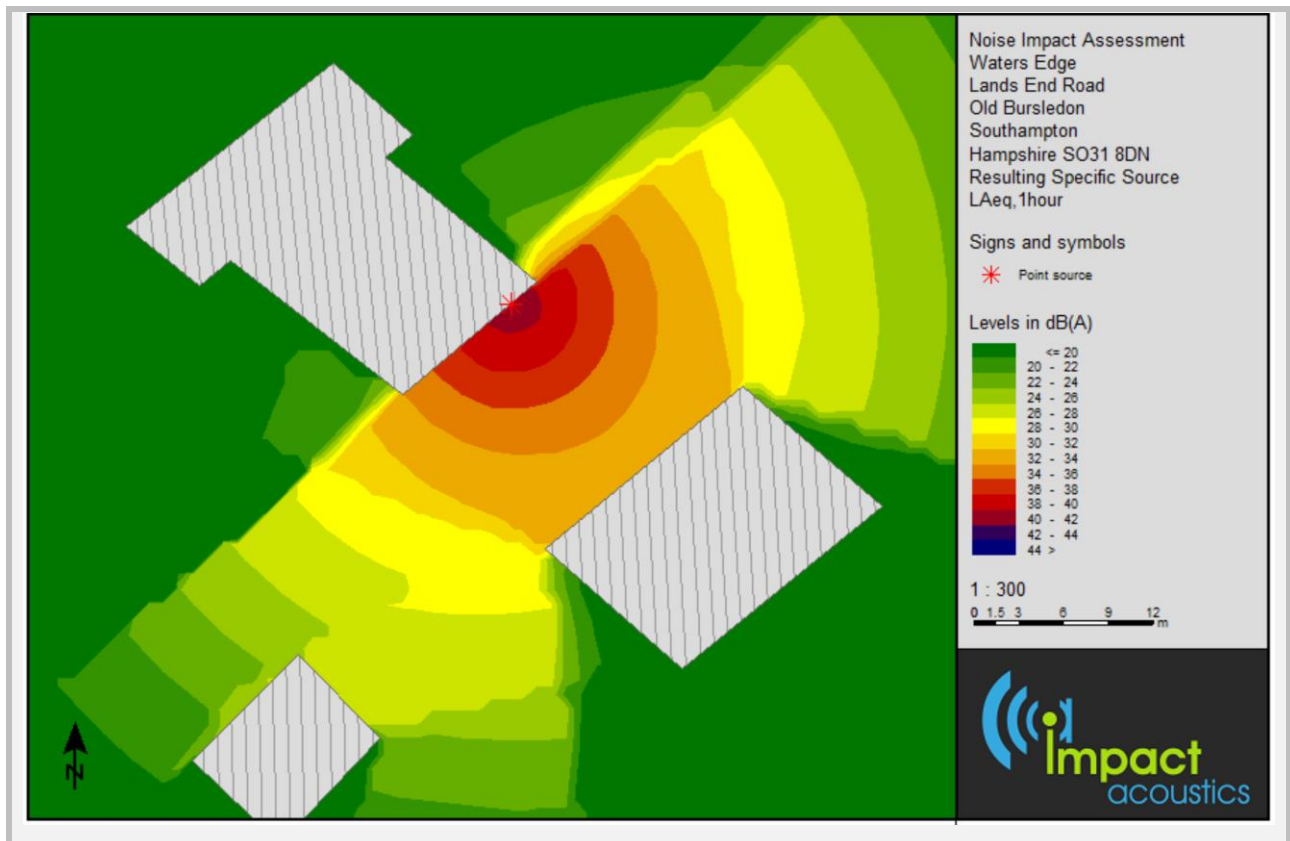
### 7.1 Summary of Calculations

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.

| No. | Building   | Floor | Level w/o. NP |
|-----|------------|-------|---------------|
|     | side       |       | Day           |
|     |            |       | dB(A)         |
| 1   | North east | GF    | 15.6          |
| 1   | North east | 1.FI  | 17.6          |
| 2   | North west | GF    | 30.3          |
| 2   | North west | 1.FI  | 30            |
| 3   | North west | GF    | 31.1          |
| 3   | North west | 1.FI  | 30.7          |
| 4   | South west | GF    | 17.7          |
| 4   | South west | 1.FI  | 19.3          |

#### 7.1.1 3D Noise Map (ISO9613-2 predicted with SoundPLAN )





## 7.2 Modelling Calculation Confirmation Check

|   | Unit (dBA) | Commentary                                               |
|---|------------|----------------------------------------------------------|
| A | 62.0       | Sound Power Unit                                         |
| B | 33.9       | Distance correction for 14m ( $20 \cdot \log(14) + 11$ ) |
| C | 3.0        | Reflections                                              |
|   | 31.1       | A-B+C                                                    |

## 7.4 Assessments

### 7.4.1 Daytime (0700 -2300)

| Rating Industrial Noise affecting<br>Mixed Industrial and Residential Areas |                                                                                 |           |  |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------|
| British Standard 4142:2019 Day Time (0700 – 2300 )                          |                                                                                 |           |                                                                                     |
| Source                                                                      | Operating Times                                                                 |           | Source Position                                                                     |
|                                                                             | Day Time (0700 – 2300 )                                                         | See Plans |                                                                                     |
|                                                                             | 7 days per week                                                                 |           |                                                                                     |
|                                                                             | Worst case scenario                                                             |           |                                                                                     |
| Assessment Position                                                         | As Report                                                                       |           |                                                                                     |
| Background Position                                                         | At a position representative to the assessment position                         |           |                                                                                     |
| Item                                                                        | Calculation                                                                     | Clause    | Commentary                                                                          |
| Specific Noise Level $L_{Aeq,1\text{ hour}}$                                | 31dB                                                                            | 7         | Calculated using ISO 9613:1996 <sub>[3]</sub> .                                     |
| Tonality                                                                    | +2 dB                                                                           | 8.1       | Tonality Characteristic                                                             |
| Intermittency                                                               | +3 dB                                                                           | 8.1       | Intermittency Characteristic                                                        |
| Rating Level                                                                | 36 dB                                                                           | 9.1       | The acoustic feature correction is added to the specific noise level                |
| Background Noise Level $L_{A90,1\text{ hour}}$                              | 47 dB                                                                           | 8.1       | Modal Background Noise Level Day Time (0700 – 2300 )                                |
| Assessment Level                                                            | -11 dB                                                                          | 11        | The background level is subtracted from the rating level.                           |
| Conclusion BS 4142:2019 <sub>[1]</sub>                                      | +10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact     |           |                                                                                     |
| Assessment                                                                  | -11 dB                                                                          |           |                                                                                     |
| Conclusion                                                                  | The assessment level is ‘Low Impact Level’                                      |           |                                                                                     |
|                                                                             | (additional) Meets internal absolute noise criterion with partially open window |           |                                                                                     |

### 7.4.2 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 plant.

### 7.4.3 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 plant.

## 8 CONCLUSIONS

### 8.1 Summary of Report

#### 8.1.1 Measured Background Noise Levels

Continuous background noise measurements were undertaken between 12<sup>th</sup> – 18<sup>th</sup> January 2023 at Assessment Position 1. The representative daytime background noise levels (0700 - 2300) was found to be  $L_{A90,1\text{hour}}$  47 dB This been evaluated from the recorded data.

|                                                                              |                                          |                    |
|------------------------------------------------------------------------------|------------------------------------------|--------------------|
| Daytime Equivalent Existing<br>Background Noise Levels<br>7 days (0700-2300) | Measured Levels at Assessment Position 1 | $L_{A90, t}$ 47 dB |
|------------------------------------------------------------------------------|------------------------------------------|--------------------|

| Representative Background Position 1 |            | LAeq                 |                        |
|--------------------------------------|------------|----------------------|------------------------|
|                                      |            | Day<br>(0700 - 2300) | Night<br>(2300 - 0700) |
| 1                                    | 12/01/2023 | 48.4                 | 41.7                   |
| 1                                    | 13/01/2023 | 51.7                 | 50.0                   |
| 1                                    | 14/01/2023 | 51.3                 | 39.0                   |
| 1                                    | 15/01/2023 | 46.2                 | 59.7                   |
| 1                                    | 16/01/2023 | 57.1                 | 47.5                   |
| 1                                    | 17/01/2023 | 51.8                 | 38.3                   |
| 1                                    | 18/01/2023 | 47.2                 | 0.0                    |

#### 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 installed. From assessment and attendance at site; the site is considered urban and whilst there is a busy road that has a constant steady state flow of traffic; the levels late evening and night time are very low which forms the dominant residual noise climate during this period (Average Night time  $LA_{eq,8\text{ hour}}$  circa 51dB(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 (-10 at representative measured  $LA_{90}$  with a maximum of 30dB  $LA_{90}$  where measured background levels are considered “very low” and outside the scope of BS4142:2019):

#### 8.1.3 Daytime (0700 – 2300)

| Operating Hours       | Criterion                  | Maximum Rating Level<br>( $LA_{eq,1\text{ hour}}$ ) | Colour Code |
|-----------------------|----------------------------|-----------------------------------------------------|-------------|
| Daytime (0700 – 2300) | No Observed Affect Level   | 30                                                  |             |
|                       | Low Impact                 | 37                                                  |             |
|                       | Adverse Effect             | 42                                                  |             |
|                       | Significant Adverse Effect | 47                                                  |             |

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

## 8.2 Proposed Plant

### 8.2.1 Plant Source Levels

| Items of Equipment                                                             | Operating Hours | Sound Pressure @ 1m (dB(A)) | Maximum Sound Power Level |
|--------------------------------------------------------------------------------|-----------------|-----------------------------|---------------------------|
| BPN08                                                                          | Daytime         | 51dB(A)                     | L <sub>w</sub> (A) 62 dBA |
| Sound Power Level – British Standard 3744: 2010 (Engineering Grade 2 Accuracy) |                 |                             |                           |

### 8.2.2 Proposed Operations

Hours operation are daytime only therefore no night time assessment has been undertaken.

## 8.3 Assessment

### 8.3.1 Daytime (0700 – 2300)

| Rating Level                           | 36 dB                                                                                  | 9.1 | The acoustic feature correction is added to the specific noise level |
|----------------------------------------|----------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------|
| Background Noise Level LA90,1 hour     | 47 dB                                                                                  | 8.1 | Modal Background Noise Level (0700 - 2300)                           |
| Assessment Level                       | -11 dB                                                                                 | 11  | The background level is subtracted from the rating level.            |
| Conclusion BS 4142:2019 <sup>[1]</sup> | +10 dB Significant Adverse Effects, +5 dB Adverse Effects, +0 dB Low Impact            |     |                                                                      |
| <b>Assessment</b>                      | <b>-11 dB</b>                                                                          |     |                                                                      |
| <b>Conclusion</b>                      | <b>The assessment level is 'Low Impact'</b>                                            |     |                                                                      |
|                                        | <b>(additional) Meets internal absolute noise criterion with partially open window</b> |     |                                                                      |

## 8.4 Conclusions

The operation of the 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 4142:2019 and ISO 1996 – Part 2: 2017. This report has established the existing background noise levels at the closest residential façade to the 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 'low impact' criteria during operational hours. This is further enforced as the plant will have a wooden louvre casing around this (not included within calculations or modelling) which once installed will reduce the level of impact further.

## **8.5 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.

### **8.5.1 Uncertainty**

In line with the requirements of section 10 of British Standard 4142: 2019 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 – INFORMATION TO BE REPORTED

### 9.1 a) Competency

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

### 9.2 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        | Daytime            | continuous        |
|    | Description of Premises |                 |                    |                   |

### 9.3 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                                                  |

### 9.4 d) Existing Contexts

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

## 9.5 e) Relative Positions

|    |                           |                                                                                            |                                    |                              |
|----|---------------------------|--------------------------------------------------------------------------------------------|------------------------------------|------------------------------|
| 1) | Assessment Position       |                                                                                            |                                    |                              |
|    |                           | BS 4142:2019 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 existing                                                                           |                                    |                              |
| 3) | Background Measurement    | At assessment positions in report                                                          |                                    |                              |
|    | Justification             | BS 4142:2019 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 <sup>st</sup> floor 1m to facade | Does comply with Criteria    |
|    |                           | Section 6.2                                                                                | Measurement Height                 | 10                           |
|    |                           |                                                                                            | Distance to Reflecting Surface     | 3.5                          |
| 4) | Topography, surfaces etc. | Hard                                                                                       |                                    |                              |
| 5) | Relative Distances        | See Report                                                                                 |                                    |                              |

## 9.6 f) Noise Measurement Equipment Calibration

### 9.6.1 Continuous Measurement

| Description                         | Make     | Type | Serial No. | Calibration Intervals | Last Calibrated | Next Due Calibration |
|-------------------------------------|----------|------|------------|-----------------------|-----------------|----------------------|
| Integrated Sound Level Meter        | Norsonic | 118  | 31471      | 2 YEARS               | 08.08.2021      | 08.08.2023           |
| 12.5mm Microphone (with windshield) | Norsonic | 1220 | 41075      | 2 YEARS               | 08.08.2021      | 08.08.2023           |
| Microphone Pre – Amplifier          | Norsonic | 1201 | 30327      | 2 YEARS               | 08.08.2021      | 08.08.2023           |

## 9.7 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. |

## 9.8 h) Weather Conditions

|    |                    |     |
|----|--------------------|-----|
| 1) | Weather Conditions | Dry |
|----|--------------------|-----|

## 9.9 i) Date and Time of Measurements

|    |                         |                                                  |
|----|-------------------------|--------------------------------------------------|
| 1) | Background Measurements | 12 <sup>th</sup> – 18 <sup>th</sup> January 2023 |
|----|-------------------------|--------------------------------------------------|

## 9.10 j) Measurement Time Interval

|    |                         |                           |
|----|-------------------------|---------------------------|
| 1) | Source Measurements     | N/a                       |
|    | Background Measurements | Daytime                   |
|    |                         | 0700 - 2300               |
|    |                         | T <sub>m</sub> = 16 hours |

## 9.11 k) Reference Time Interval

|    |                         |                              |
|----|-------------------------|------------------------------|
| 1) | Reference Time Interval | Daytime                      |
|    |                         | 0700 - 2300                  |
|    |                         | T <sub>r</sub> = LAeq, 1hour |

## 9.12 l) Specific Noise Levels

|    |                                |                                                                                                            |
|----|--------------------------------|------------------------------------------------------------------------------------------------------------|
| 1) | Measured Sound Levels          | Daytime                                                                                                    |
|    |                                | 0700 - 2300                                                                                                |
|    |                                | 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 <sub>Aeq, 1 hour</sub> 31 dB                                                                             |
|    | Method of Determination        | Calculated using the measured sound power levels and noise modelling software in accordance with ISO9613-2 |
| 4) | Justification                  |                                                                                                            |
| 5) | Correction Applied             | Not Applicable                                                                                             |

### 9.13 m) Background Noise Levels

|    |                         |                                           |
|----|-------------------------|-------------------------------------------|
| 1) | Background Noise Levels | Daytime                                   |
|    |                         | 0700 - 2300                               |
|    |                         | L <sub>A90,15min</sub> 47 dB              |
|    | Background Position     | Representative to the Assessment Position |

### 9.14 n) Rating Levels

|    |                             |                                |
|----|-----------------------------|--------------------------------|
| 1) | Specific Noise Level        | Daytime                        |
|    |                             | 0700 - 2300                    |
|    |                             | L <sub>Aeq, 1 hour</sub> 31 dB |
| 2) | Acoustic feature correction | +5                             |
|    | Justification               | Tonality / Intermittency       |
| 3) | Rating Level                | L <sub>Aeq, 15min</sub> 36 dB  |

### 9.15 o) Excess of Rating over Background Level

|    |                    |             |
|----|--------------------|-------------|
| 1) | Assessment         | Daytime     |
|    |                    | 0700 - 2300 |
|    |                    | -11 dB      |
| 2) | Estimate of Impact | Low Impact  |

### 9.16 p) Conclusions

|    |            |                                                                                  |
|----|------------|----------------------------------------------------------------------------------|
| 1) | Conclusion | Daytime                                                                          |
|    |            | 0700 - 2300                                                                      |
|    |            | The British Standard 4142:2019 assessments indicate that the plant is Low impact |

## 10 APPENDIX C – CHARACTER CORECTION

### 10.1 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.

| BS4142:2019 – Section 9.2<br>Subjective Method          | Perceptibility to noise sensitive facades | Correction |
|---------------------------------------------------------|-------------------------------------------|------------|
| Tonality<br>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.

| BS4142:2019 – Section 9.2<br>Subjective Method                                      | Perceptibility to noise sensitive facades | Correction |
|-------------------------------------------------------------------------------------|-------------------------------------------|------------|
| Impulsivity<br>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.

| BS4142:2019 – Section 9.2<br>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         |

## 10.2 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 BS4142:2019 (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.”*

| BS4142:2019 – Section 9.3<br>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       |

## 10.3 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 4142:2019 Annexes D and E.

## 11 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         |                             |
| <b>Source</b>                                                                                                                                                                                                                                                                                                                  |                                 |                                              |                    |                            |                      |                    |               |                             |
| 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                        |
| <b>Transmission Path</b>                                                                                                                                                                                                                                                                                                       |                                 |                                              |                    |                            |                      |                    |               |                             |
| 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          |                                              |                    |                            |                      |                    |               |                             |
| <b>Receiver</b>                                                                                                                                                                                                                                                                                                                |                                 |                                              |                    |                            |                      |                    |               |                             |
| 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. |                                 |                                              |                    |                            |                      |                    |               |                             |

## 12 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]

## 13 **DISCLAIMER**

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#END OF REPORT#