

Hot Food Takeaway, Havant

# Environmental Assessment Report

Report 18/0455/R1

Hot Food Takeaway, Havant

# Environmental Assessment Report

Report 18/0455/R1

## Pegasus Group

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## Environmental Assessment Report

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### Attachments

#### **Glossary of Acoustic Terms**

##### **18/0455/SP1**

Site plan detailing the measurement and assessment positions on site

##### **18/0455/SCH1**

Schedule of results from attended survey



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### **18/0455/PNS1**

Plant noise schedule

### **18/0455/CS1-8**

Calculation sheets



End of Section



# Environmental Assessment Report

## 1 Introduction

- 1.1 It is proposed that the existing retail unit at 39 West Street, Havant be converted from a class A2 (Bank) use to a class A5 (Hot Food Takeaway) use.
- 1.2 Cole Jarman have been instructed to undertake an environmental noise survey in order to quantify the existing noise climate and to conduct an assessment of plant and delivery vehicle noise.
- 1.3 This report contains full details of the environmental noise survey, assessment methodology and required mitigation measures in order to meet the noise limits at the nearest noise sensitive receivers.

## 2 Site Description

- 2.1 The site is located at 39 West Street, Havant. The unit is currently a single storey vacant unit having been previously used as a HSBC bank. The upper floor is in use as an office space and not within the proposed demise of the takeaway outlet.
- 2.2 The site is located on the corner of West Street and Park Road South (B2149), a busy road running through the middle of Havant. The neighbouring units comprise mixed use office and retail use.
- 2.3 Opposite the unit, to the north, on west street are offices, a café and residences. To the west on Brockhampton Lane are further residences. To the south west, also on Brockhampton Lane, is a tyre and servicing garage, an ex-servicemen's club and the delivery entrance for a large retail park. To the east of the unit, over Park Road South is a high street comprising retail units, banks, a large public house and a fast food restaurant.

## 3 Local Authority Discussion

- 3.1 Mark Moss, Regulatory Officer in the Environmental Health department at Havant Borough Council gave the following guidance during a discussion of the noise survey results and the proposed plant to be installed on site:

*"We would expect BS 4142:2014 to be employed to ensure no adverse impact on nearby residential occupants of new & existing flats. In this instance we would expect to see NOAEL achieved or not exceeding existing background levels."*

- 3.2 It is therefore considered that the plant noise limits set as equal to the existing background noise levels in line with BS4142:2014 will meet the council's requirements.



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### 4 Attended Noise Survey

#### 4.1 Methodology and Instrumentation

- 4.1.1 An attended noise survey was undertaken at the site between 19h00 on 24<sup>th</sup> August and 02h15 on 25<sup>th</sup> August 2018.
- 4.1.2 Measurements of the background noise levels were taken in a free-field position in the rear car park/yard area of the property and in front of the nearest noise sensitive receiver on West Street. Both positions were approximately 1.5m above the local ground floor level these positions can be seen on the attached site plan 18/0455/SP1 marked as MP1 and MP2 respectively.
- 4.1.3 These positions were selected to quantify the background noise levels representative of those at the nearest noise sensitive receptors to the proposed items of mechanical services plant.
- 4.1.4 Measurements of the  $L_{Aeq}$ ,  $L_{Amax}$ , and  $L_{A90}$  indices were recorded over consecutive 15 minute periods for the duration of the survey using the equipment listed within T1 below (see attached Glossary of Acoustic Terms for an explanation of the noise units used).

| Item                    | Manufacturer | Type |
|-------------------------|--------------|------|
| Sound Level Analyser    | Norsonic     | 140  |
| Acoustic Calibrator     | Norsonic     | 1251 |
| Weatherproof windshield | Norsonic     | 1212 |

T1 Equipment used during attended noise survey.

- 4.1.5 The microphone was fitted within a weatherproof enclosure, and the sound level meter was calibrated before and after the survey period in order to confirm an acceptable level of accuracy. No significant drift was noted to have occurred.
- 4.1.6 The weather conditions during the course of the attended survey were overcast, cool and dry with a light breeze. These conditions are deemed acceptable and are not considered to have affected measurement results.

#### 4.2 Results

- 4.2.1 The results of the noise measurements are presented in the attached survey schedule 18/0455/SCH1.
- 4.2.2 The noise climate to the rear of the building was observed to consist of mechanical services noise from services located to the south of the site, on the ex-serviceman's club and the large retail park during the quieter late night periods. During the earlier hours of the survey the noise



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levels were dominated by the traffic activity on Park Road South. Infrequent aircraft flyovers were also noted.

4.2.3 For the purposed of our assessment we have taken the lowest measured background levels over the given time periods to allow for a worst case assessment when assessing the plant noise to the nearest noise sensitive receptor.

4.2.4 The minimum measured background noise levels can be seen in T2 below.

| Location                              | Minimum Background Noise Level, dB(A) |                                  |
|---------------------------------------|---------------------------------------|----------------------------------|
|                                       | Open Hours<br>(1100-0100 only)        | Closed Hours<br>(0100-1100 only) |
| MP1 – Residences behind rear car park | 37                                    | 36                               |
| MP2 – Residences on West Street       | 40                                    | 39                               |

T2 Measured minimum background noise levels,  $L_{A90,15min}$

## 5 Plant Noise Limits

5.1 Guidance outlined in section 3 above in conjunction with the results of the noise survey determined the following noise emission limits:

| Location                             | Noise Emission Limit, dB       |                                  |
|--------------------------------------|--------------------------------|----------------------------------|
|                                      | Open Hours<br>(1100-0100 only) | Closed Hours<br>(0100-1100 only) |
| AP1 – Residents on Brockhampton Lane | 37                             | 36                               |
| AP2 – Residents on West Street       | 40                             | 39                               |

T3 Plant noise emission limits at the sensitive receptors

5.2 These noise limits are to apply 1m from the windows of the receiver locations. Any plant with tonal or impulsive components would be subject to a further penalty in line with BS4142:2014.

5.3 It is noted from a discussion with Mark Moss that he would expect there to be an intermittent element to the cold store condenser. However, due to the correction necessary to be undertaken for an estimated 50/50 on off time (of 3dB) the 3dB correction necessary for



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intermittency would be cancelled out by the on time correction and so neither correction has been applied in this instance.

### 6 Plant Noise Assessment

#### 6.1 Proposed Installation

6.1.1 The proposed plant items to be installed with external noise emissions are as follows:

- |                        |                                          |
|------------------------|------------------------------------------|
| • Cold Store Condenser | Silensys CIL 4519Z                       |
| • A/C Condenser        | Mitsubishi Heavy Industries FDC224KXZPE1 |
| • Extract Fan          | Flaktwoods 50JM                          |
| • Fresh Air Fan        | Air Vent Tech Model 5                    |

6.1.2 The cold store and A/C condensers are proposed to be mounted at low level to the rear of the unit within the bin store. The extract flue is to terminate 1m above the eaves to the rear of the unit. The fresh air intake grille is to terminate at high level on the ground floor.

6.1.3 Noise from the proposed plant has been assessed to the two most noise sensitive positions detailed below and shown on site plan 18/0455/SP1:

- AP1 – Nearest residential window to the South on Brockhampton Lane
- AP2 – Nearest residential window to the North on West Street

6.1.4 The noise data from the proposed plant items has been provided by the manufacturer and is shown in the attached plant noise schedule 18/0455/PNS1.

#### 6.2 Mitigation Measures

6.2.1 It is required that mitigation measures be installed to determine compliance with the noise emission limits set out in table T3 above. This can be achieved using an atmospheric side silencer servicing the fresh air fan. The silencer is required to meet the insertion losses in each octave band as defined in table T4.

| Silencer      | Insertion Loss (dB) at             |     |     |     |    |    |    |    |
|---------------|------------------------------------|-----|-----|-----|----|----|----|----|
|               | Octave Band Centred Frequency (Hz) |     |     |     |    |    |    |    |
|               | 63                                 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Fresh Air Fan | 3                                  | 4   | 8   | 19  | 18 | 14 | 11 | 10 |

T4 Attenuator insertion losses (Atmospheric Side)



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- 6.2.2 We would expect the insertion losses required for the fresh air fan to be achievable with a circular unpodded silencer of 500mm diameter and 1000mm length. Any pressure drops from the attenuator or the atmospheric duct termination grilles will be limited to 40Pa.
- 6.2.3 The silencer will be located within the hot food takeaway demise, close to the fan so that noise breakout from the duct is also attenuated.
- 6.2.4 The fan will be mounted on anti-vibration mounts and will have flexible ductwork connections to control structure-borne sound transmission. The fresh air intake and extract air discharge louvres will be sized at a face velocity of not more than 2m/s.

### 6.3 Assessment Results

- 6.3.1 All plant items are required to be operational during opening hours, while only the cold room condenser is required when the store is closed. Therefore, both the day time (opening hours) and night time (closed hours) have been taken into consideration.
- 6.3.2 With the provided mitigation measures in place, we have assessed the following noise levels at each respective assessment position:

| Location                                                           | Rating Noise Level, dB(A) <i>(Limit)</i> |                                  |
|--------------------------------------------------------------------|------------------------------------------|----------------------------------|
|                                                                    | Open Hours<br>(1100-0100 only)           | Closed Hours<br>(0100-1100 only) |
| AP1 – Nearest residential window to the South on Brockhampton Lane | 37 (37)                                  | 33 (36)                          |
| AP2 – Nearest residential window to the North on West Street       | 38 (40)                                  | 11 (39)                          |

T5 Plant Noise Emission Levels at the Nearest Residential Properties

- 6.3.3 The results of these calculations can be found in the attached calculation sheets 18/0455/CS1-8.

## 7 Delivery Noise Assessment

### 7.1 Delivery Method and Description

- 7.1.1 It is understood that delivery activity will occur from the rear of the site utilising the associated parking spaces, it is expected that the delivery drivers will use the yard entrance from Park Road South and leave in the same direction. Collections will be from the front of the unit with cars utilising the available parking spaces on West Street.



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7.1.2 There are two assessment positions required in order to determine the impact on the existing noise climate. These positions are illustrated on the attached site plan and described below:

- AP1 – Nearest residential window to the South on Brockhampton Lane
- AP2 – Nearest residential window to the North on West Street

7.1.3 Deliveries are to be made by cars. These operate individually and therefore communication between drivers is non-existent. Drivers are instructed to avoid interaction which could cause noise. Because of the above the calculated noise is limited to arrival and departure of individual customer collections and delivery vehicles.

7.1.4 The noise impact resulting from delivery and collection operations at the rear of the building have been calculated between 19h00 - 01h00 when the unit is proposed to close. Evenings are expected to present the worst case scenario with respect to the potential noise impact as delivery numbers are at their greatest, whilst background noise levels are falling.

7.1.5 Typical numbers of delivery arrivals and departures have been provided for the busiest evening period as recorded at a similar sized local unit set out in table T6 below. This is thought to be an extreme worst case and therefore is a robust assessment point.

| Time Period | Deliveries | Collections |
|-------------|------------|-------------|
|             | Car        | Car         |
| 19h00-20h00 | 70         | 30          |
| 20h00-21h00 | 40         | 12          |
| 21h00-22h00 | 34         | 16          |
| 22h00-23h00 | 8          | 6           |
| 23h00-00h00 | 4          | 4           |
| 00h00-01h00 | 4          | 6           |

T6 Predicted delivery operation movement

7.1.6 In order to quantify the impact that delivery operations make on the existing noise climate the existing levels are compared to the future levels, including the calculated delivery noise. The difference between these values is referred to as the impact.

## 7.2 Assessment Guidance

BS 4142

7.2.1 BS 4142:204 states the following with regards to the scope of the document:

*“1.1 This British Standard describes methods of rating and assessing sound of an industrial and/or commercial nature, which includes:*



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*a) Sound from industrial and manufacturing processes;*

*b) Sound from fixed installations which comprise mechanical and electrical plant and equipment;*

*c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and*

*d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from trains or ship movements on or around industrial and/or commercial site."*

7.2.2 The quote above makes it clear that BS 4142:2014 is appropriate for the assessment of noise associated with delivery vehicles and operations within the development site.

7.2.3 The scope then discusses in section 1.3 of the document the limitations of the document, within which the following is stated:

*"Sound of an industrial or commercial nature does not include sound from the passage of vehicles on public roads and railway systems."*

7.2.4 The limitations above makes it clear that it is not appropriate to assess noise from vehicles on the public highway using the guidance detailed within the standard.

7.2.5 Based on the information above noise associated with delivery activities within the rear car park area will be assessed against BS 4142:2014.

7.2.6 BS 4142:2014 provides the following guidance on the Assessment of the impacts within section 11:

*"A Difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context."*

*"A difference of around +5 dB is likely to be an indication of an adverse Impact, depending on the context."*

*"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

7.2.7 As can be seen BS4142:2014 assessments generally compare the rated noise level to the existing background noise levels. However, the context of the noise as well as the numerical calculated impact value must be taken into consideration. This is important as the character of the specific noise source greatly affects the ability of a listener to identify the specific sound within an existing ambient noise climate.



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### DMRB Guidance

- 7.2.8 As detailed above BS 4142:2014 is not appropriate for the assessment of noise from vehicles on public roads. Due to this it is necessary to consider other guidance documents when assessing noise generated by people collecting from the store as this will occur on the public road/parking areas.
- 7.2.9 The assessment criteria proposed is based upon guidance contained within DMRB<sup>1</sup>, *Guidelines for Environmental Noise Impact Assessment* (2014).
- 7.2.10 Vehicle movements are likely to vary significantly over the course of a day and night time, for example during rush hour. It is therefore not appropriate to only consider noise levels in terms of  $L_{Aeq,16 \text{ hour}}$  and  $L_{Aeq,8 \text{ hour}}$  for full day and night time periods respectively, as these indices have the potential to not properly reflect the variable nature of road traffic on such low flow roads. Instead, changes in noise level are assessed in terms of  $L_{Aeq,1 \text{ hour}}$  for each hour. The significance of the change in a given period can then be determined.
- 7.2.11 Based on the information above, Table T7 shows proposed criteria by which noise impact from the proposed hot food takeaway will be assessed in relation to the nearby noise sensitive receptors. As noted above, the change in  $L_{Aeq,1 \text{ hour}}$  for each period within a 24 hour should be considered.

| Noise Change<br>dB(A) | Perceived impact |
|-----------------------|------------------|
| 0                     | No change        |
| 0.1 to 0.9            | Negligible       |
| 1.0 to 2.9            | Minor            |
| 3.0 to 4.9            | Moderate         |
| 5.0 to 9.9            | Major            |
| 10+                   | Major            |

T7 Short term noise impact descriptors

‘Negligible’ and ‘Minor’ levels of noise impact are considered acceptable, however the context of the noise in the environment should always be considered and not purely the numerical impact.

<sup>1</sup> Design Manual for Roads and Bridges, Volume 11, Section 3, 2011



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## Summary

- 7.2.12 Assessment Position 1 (AP1) is found backing on to the private rear yard. This is a private road and is therefore within the scope of a BS 4142 assessment. The details of this can be seen in section
- 7.2.13 Assessment Position 2 (AP2) is found at the nearest residential receiver on West Street. This is a public road and is therefore outside the scope of BS 4142 and is assessed in line with DMRB. The details of this can be seen in section 7.2 above.

## 7.3 Assessment Methodology

- 7.3.1 Noise data used in the calculations has been measured by Cole Jarman at other similar operations at façade incident locations. These noise levels are shown in the table below:

| Activity            | Distance | Measured Sound Level,<br>$L_{AE}$ |
|---------------------|----------|-----------------------------------|
| Car pass            | 5        | 72                                |
| Car start up        | 5        | 70                                |
| Car door open/close | 5        | 65                                |
| Moped pass          | 5        | 70                                |
| Moped start up      | 5        | 73                                |

T8 Noise data, dB  $L_{AE}$  used in assessment calculations

- 7.3.2 In order to calculate the noise levels, from the delivery and collection activities, at the assessment positions, the noise levels detailed above have been corrected to take account of the quantity of deliveries, location of loading, and exit and return routes. The corrections have taken account of distance losses, as well as angle of view and screening where appropriate.

## 7.4 Noise Impact Assessments

BS 4142:2014

- 7.4.1 The specific noise levels from delivery activities within the rear yard has been calculated at AP1. Corrections for intermittency (3dB) of the noise sources have been applied to the specific noise level in order to calculate the rating level in line with guidance within BS 4142:2014. The resultant noise impacts are shown below:



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| Time Period | Existing Background<br>(dB $L_{A90,15min}$ ) | AP1                                |                       |
|-------------|----------------------------------------------|------------------------------------|-----------------------|
|             |                                              | Rating Level<br>(dB $L_{Ar,T}^2$ ) | Level Difference (dB) |
| 19h00-20h00 | 47.4                                         | 43.1                               | -4.3                  |
| 20h00-21h00 | 46.0                                         | 40.7                               | -5.3                  |
| 21h00-22h00 | 45.7                                         | 40.0                               | -5.7                  |
| 22h00-23h00 | 44.2                                         | 33.7                               | -10.5                 |
| 23h00-00h00 | 39.9                                         | 30.7                               | -9.2                  |
| 00h00-01h00 | 36.8                                         | 30.7                               | -6.1                  |

T9 BS4142:2014 Calculations for delivery noise to AP1

- 7.4.2 As can be seen in table T9 above the assessed noise levels do not exceed the background sound level, this is an indication of the specific sound source having a low impact, as discussed in section 7.2 above.

### DMRB Impact Assessment

- 7.4.3 The noise levels from collection activities from the front of the store has been calculated at AP2. The resultant noise impacts are shown below:

| Time Period | Measured Ambient Noise<br>(dB $L_{Aeq,15min}$ ) | Calculated Delivery Noise<br>(dB $L_{Aeq,1h}$ ) | AP2                       |                                  | Impact     |
|-------------|-------------------------------------------------|-------------------------------------------------|---------------------------|----------------------------------|------------|
|             |                                                 |                                                 | Sum<br>(dB $L_{Aeq,1h}$ ) | Increase in noise levels<br>(dB) |            |
| 19h00-20h00 | 67.3                                            | 57.1                                            | 67.7                      | 0.4                              | Negligible |
| 20h00-21h00 | 60.7                                            | 53.1                                            | 61.4                      | 0.7                              | Negligible |
| 21h00-22h00 | 62.4                                            | 54.4                                            | 63.0                      | 0.6                              | Negligible |
| 22h00-23h00 | 57.6                                            | 50.1                                            | 58.3                      | 0.7                              | Negligible |
| 23h00-00h00 | 55.3                                            | 48.4                                            | 56.1                      | 0.8                              | Negligible |
| 00h00-01h00 | 53.2                                            | 50.1                                            | 54.9                      | 1.7                              | Minor      |

T10 Predicted noise impact associated with delivery operations at AP2

- 7.4.4 The results of the calculations above show that noise impact on nearby residences would be 'negligible' in the main and 'minor' in the last hour of operation. This shows an acceptable level of impact on dwellings and amenity will be maintained for all residents.

<sup>2</sup> T = 1 hour between 19h00-23h00 and 15 minutes between 23h00-01h00 in line with BS 4142



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- 7.4.5 For residences further away, any impact would be less than that assessed at the most exposed positions considered above.

## 8 Conclusion

- 8.1 Planning permission is being sought for the development of 39 West Street, Havant. It is proposed that the premises be used as a hot food takeaway outlet.
- 8.2 Details of the attended survey completed at site have been set out within this report, quantifying existing noise levels.
- 8.3 An environmental impact assessment has been made assessing the impact of the proposed plant to be installed on site and of noise from the delivery operations at the closest residences.
- 8.4 With all the proposed mitigation measures in place, the proposed plant will meet the noise limits as set by the local authority.
- 8.5 It has been found that the impact from the delivery and collection operations would not be expected to cause a negative impact on the amenity of local residences.

 End of Section



## Environmental Assessment Report

### Glossary of Acoustic Terms

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#### $L_{Aeq}$ :

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A)  $L_{eq}$ .

#### $L_{Amax}$ :

The maximum A-weighted sound pressure level recorded over the period stated.  $L_{Amax}$  is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the  $L_{Aeq}$  noise level. Unless described otherwise,  $L_{Amax}$  is measured using the “fast” sound level meter response.

#### $L_{A10}$ & $L_{A90}$ :

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The  $L_{An}$  indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified.  $L_{A10}$  is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly  $L_{A90}$  gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

$L_{A10}$  is commonly used to describe traffic noise. Values of dB  $L_{An}$  are sometimes written using the alternative expression dB(A)  $L_n$ .

#### $L_{AX}$ , $L_{AE}$ or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event.  $L_{AX}$  values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of  $L_{Aeq}$  for the total noise. The  $L_{AX}$  term can sometimes be referred to as Exposure Level ( $L_{AE}$ ) or Single Event Level (SEL).

■ End of Section

Figure 18/0455/SP1

Title:

Site plan illustrating the measurement and assessment positions on site

 Measurement Position  
 Assessment Position



Project:

Hot Food Takeaway, Havant

Date:

September, 2018

Revision:

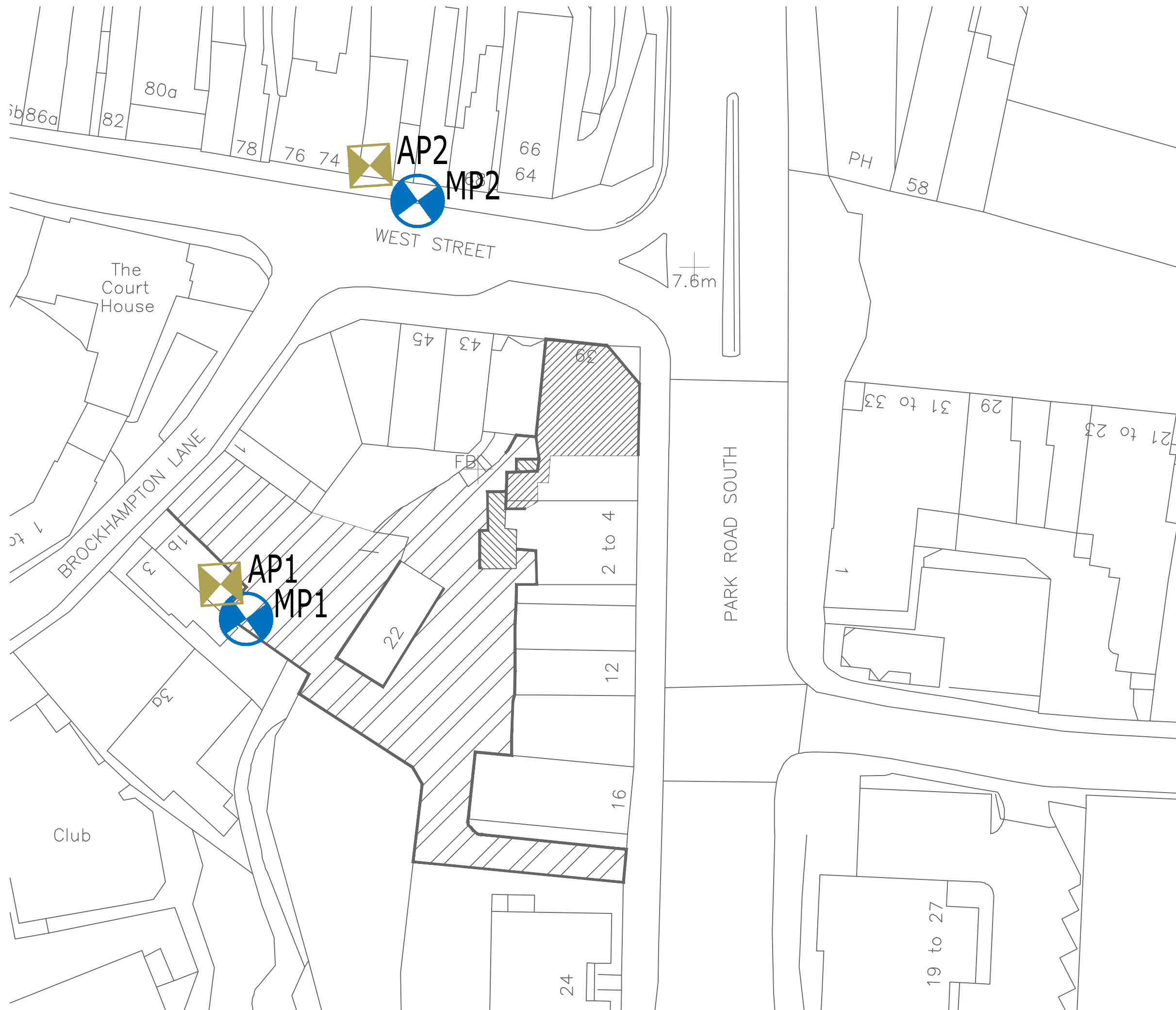
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Scale:

Not to scale

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## Schedule of Plant and Air Handling Equipment Sound Levels, dB

| Reference  | Description                                 | Data <sup>1</sup><br>Source | Noise Level Type | Noise Levels (dB) |     |     |     |    |    |      |    |
|------------|---------------------------------------------|-----------------------------|------------------|-------------------|-----|-----|-----|----|----|------|----|
|            |                                             |                             |                  | 63                | 125 | 250 | 500 | 1k | 2k | 4k   | 8k |
| Fresh Air  | Air Vent Tech Model 5                       | Man                         | Sound Power, Lw  | 77                | 79  | 73  | 74  | 77 | 77 | 74   | 69 |
| AC Unit    | Mitsubishi Heavy Industries AC FDC224KXZPE1 | Man                         | Sound Power, Lw  | 81                | 77  | 71  | 69  | 70 | 64 | 58.5 | 56 |
| Extract    | Flaktwoods 50JM                             | Man                         | Sound Power, Lw  | 78                | 79  | 76  | 74  | 73 | 70 | 67   | 62 |
| Cold Store | Silensys CIL 4519Z                          | Man                         | Sound Power, Lw  | 72                | 75  | 66  | 65  | 60 | 54 | 52   | 51 |

## Notes

1 - Man refers to data supplied by the equipment manufacturer or supplier, Emp refers to data calculated using empirical formulae, and Meas refers to data measured by Cole Jarman



## Noise Survey Results

## Measurement Position 1 – Rear Yard

| Period      | $L_{Aeq}$ | $L_{Amax}$ | $L_{A90}$ |
|-------------|-----------|------------|-----------|
| 19h42-19h57 | 51.8      | 66.1       | 47.4      |
| 20h46-21h01 | 48.6      | 65.6       | 46.0      |
| 21h39-21h54 | 47.9      | 60.0       | 45.7      |
| 22h36-22h51 | 47.0      | 60.0       | 44.2      |
| 23h34-23h49 | 43.0      | 55.9       | 39.9      |
| 00h33-00h48 | 42.4      | 62.6       | 36.8      |
| 01h34-01h49 | 40.2      | 54.0       | 36.4      |
| 02h00-02h15 | 39.8      | 52.5       | 36.0      |

## Measurement Position 2 – West Street

| Period      | $L_{Aeq}$ | $L_{Amax}$ | $L_{A90}$ |
|-------------|-----------|------------|-----------|
| 19h23-19h38 | 67.3      | 90.4       | 53.5      |
| 20h29-21h44 | 60.7      | 79.5       | 53.1      |
| 21h21-21h36 | 62.4      | 82.6       | 50.9      |
| 22h19-22h34 | 57.6      | 73.2       | 48.1      |
| 23h17-23h32 | 55.3      | 71.7       | 44.7      |
| 00h16-00h31 | 53.2      | 70.4       | 39.7      |
| 01h17-01h32 | 50.3      | 67.4       | 38.9      |





## Calculation Sheet

18/0455/CS2

Cold Store to AP1 - Day

| Octave Band Centre Frequency (Hz)  |             |             |             |             |             |             |             |             |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                    | 63          | 125         | 250         | 500         | 1k          | 2k          | 4k          | 8k          |
| <b>Noise Source</b>                |             |             |             |             |             |             |             |             |
| Noise Source - Cold Store          |             |             |             |             |             |             |             |             |
| <b>Sound Power Levels</b>          | <b>72.0</b> | <b>75.0</b> | <b>66.0</b> | <b>65.0</b> | <b>60.0</b> | <b>54.0</b> | <b>52.0</b> | <b>51.0</b> |
| <b>Point Source Radiation Loss</b> |             |             |             |             |             |             |             |             |
| Radiation - Quarterspherical       |             |             |             |             |             |             |             |             |
|                                    | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        |
| <b>Point Source Distance Loss</b>  |             |             |             |             |             |             |             |             |
| End Distance (m)                   | 40.0        |             |             |             |             |             |             |             |
|                                    | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       |
| <b>Facade Reflection</b>           |             |             |             |             |             |             |             |             |
| Reflection (dB)                    | 3.0         |             |             |             |             |             |             |             |
|                                    | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         |
| <b>External Receiver</b>           |             |             |             |             |             |             |             |             |
| External Receiver - AP1 - Day      |             |             |             |             |             |             |             |             |
| <b>Sound Pressure, Lp</b>          | <b>38.0</b> | <b>41.0</b> | <b>32.0</b> | <b>31.0</b> | <b>26.0</b> | <b>20.0</b> | <b>18.0</b> | <b>17.0</b> |



## Calculation Sheet

18/0455/CS3

Extract to AP1 - Day

|                                         |       | Octave Band Centre Frequency (Hz) |             |             |             |             |             |             |             |
|-----------------------------------------|-------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                         |       | 63                                | 125         | 250         | 500         | 1k          | 2k          | 4k          | 8k          |
| <b>Noise Source</b>                     |       |                                   |             |             |             |             |             |             |             |
| Noise Source - Extract                  |       |                                   |             |             |             |             |             |             |             |
| <b>Sound Power Levels</b>               |       | <b>78.0</b>                       | <b>79.0</b> | <b>76.0</b> | <b>74.0</b> | <b>73.0</b> | <b>70.0</b> | <b>67.0</b> | <b>62.0</b> |
| <b>Bend Loss CJ</b>                     |       |                                   |             |             |             |             |             |             |             |
| Dimension (mm)                          | 500.0 |                                   |             |             |             |             |             |             |             |
| No. of Bends (no.)                      | 6.0   |                                   |             |             |             |             |             |             |             |
| Type - Unlined Square Bend - With Vanes |       |                                   |             |             |             |             |             |             |             |
|                                         |       | 0.0                               | 0.0         | -6.0        | -12.0       | -18.0       | -18.0       | -18.0       | -18.0       |
| <b>Rect Unlined Duct Losses CJ</b>      |       |                                   |             |             |             |             |             |             |             |
| Width (mm)                              | 500.0 |                                   |             |             |             |             |             |             |             |
| Height (mm)                             | 500.0 |                                   |             |             |             |             |             |             |             |
| Length (m)                              | 20.0  |                                   |             |             |             |             |             |             |             |
|                                         |       | -15.0                             | -12.0       | -6.0        | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        |
| <b>End Reflection</b>                   |       |                                   |             |             |             |             |             |             |             |
| Width/Diameter                          | 0.5   |                                   |             |             |             |             |             |             |             |
| Length                                  | 0.5   |                                   |             |             |             |             |             |             |             |
| Rec or Circ - Circular                  |       |                                   |             |             |             |             |             |             |             |
| Free or Flush - Free Space              |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -11.9                             | -6.5        | -1.1        | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Point Source Radiation Loss</b>      |       |                                   |             |             |             |             |             |             |             |
| Radiation - Spherical                   |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -11.0                             | -11.0       | -11.0       | -11.0       | -11.0       | -11.0       | -11.0       | -11.0       |
| <b>Point Source Distance Loss</b>       |       |                                   |             |             |             |             |             |             |             |
| End Distance (m)                        | 40.0  |                                   |             |             |             |             |             |             |             |
|                                         |       | -32.0                             | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       |



18/0455/CS3

| Octave Band Centre Frequency (Hz) |      |      |      |      |      |     |     |     |
|-----------------------------------|------|------|------|------|------|-----|-----|-----|
|                                   | 63   | 125  | 250  | 500  | 1k   | 2k  | 4k  | 8k  |
| <b>Facade Reflection</b>          |      |      |      |      |      |     |     |     |
| Reflection (dB)                   | 3.0  |      |      |      |      |     |     |     |
|                                   | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  | 3.0 | 3.0 | 3.0 |
| <b>External Receiver</b>          |      |      |      |      |      |     |     |     |
| External Receiver - AP1 - Day     |      |      |      |      |      |     |     |     |
| Sound Pressure, Lp                | 11.1 | 20.5 | 22.9 | 19.0 | 12.0 | 9.0 | 6.0 | 1.0 |



## Calculation Sheet

18/0455/CS4

Fresh Air to AP1 - Day

|                                         |       | Octave Band Centre Frequency (Hz) |             |             |             |             |             |             |             |
|-----------------------------------------|-------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                         |       | 63                                | 125         | 250         | 500         | 1k          | 2k          | 4k          | 8k          |
| <b>Noise Source</b>                     |       |                                   |             |             |             |             |             |             |             |
| Noise Source - Fresh Air                |       |                                   |             |             |             |             |             |             |             |
| <b>Sound Power Levels</b>               |       | <b>77.0</b>                       | <b>79.0</b> | <b>73.0</b> | <b>74.0</b> | <b>77.0</b> | <b>77.0</b> | <b>74.0</b> | <b>69.0</b> |
| <b>Coil and Filter Losses</b>           |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -3.0                              | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        |
| <b>Bend Loss CJ</b>                     |       |                                   |             |             |             |             |             |             |             |
| Dimension (mm)                          | 400.0 |                                   |             |             |             |             |             |             |             |
| No. of Bends (no.)                      | 0.0   |                                   |             |             |             |             |             |             |             |
| Type - Unlined Square Bend - With Vanes |       |                                   |             |             |             |             |             |             |             |
|                                         |       | 0.0                               | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Rect Unlined Duct Losses CJ</b>      |       |                                   |             |             |             |             |             |             |             |
| Width (mm)                              | 400.0 |                                   |             |             |             |             |             |             |             |
| Height (mm)                             | 400.0 |                                   |             |             |             |             |             |             |             |
| Length (m)                              | 1.5   |                                   |             |             |             |             |             |             |             |
|                                         |       | -0.7                              | -0.9        | -0.7        | -0.5        | -0.3        | -0.3        | -0.3        | -0.2        |
| <b>End Reflection</b>                   |       |                                   |             |             |             |             |             |             |             |
| Width/Diameter                          | 0.8   |                                   |             |             |             |             |             |             |             |
| Length                                  | 0.5   |                                   |             |             |             |             |             |             |             |
| Rec or Circ - Rectangular               |       |                                   |             |             |             |             |             |             |             |
| Free or Flush - Flush                   |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -7.2                              | -2.7        | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Point Source Radiation Loss</b>      |       |                                   |             |             |             |             |             |             |             |
| Radiation - Hemispherical               |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -8.0                              | -8.0        | -8.0        | -8.0        | -8.0        | -8.0        | -8.0        | -8.0        |



18/0455/CS4

|                                   |      | Octave Band Centre Frequency (Hz) |       |       |       |       |       |       |       |
|-----------------------------------|------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                                   |      | 63                                | 125   | 250   | 500   | 1k    | 2k    | 4k    | 8k    |
| <b>Point Source Distance Loss</b> |      |                                   |       |       |       |       |       |       |       |
| End Distance (m)                  | 50.0 |                                   |       |       |       |       |       |       |       |
|                                   |      | -34.0                             | -34.0 | -34.0 | -34.0 | -34.0 | -34.0 | -34.0 | -34.0 |
| <b>Maekawa Screening Loss</b>     |      |                                   |       |       |       |       |       |       |       |
| Path Difference (m)               | 2.0  |                                   |       |       |       |       |       |       |       |
|                                   |      | -12.5                             | -15.1 | -17.9 | -20.8 | -23.7 | -26.7 | -29.7 | -32.7 |
| <b>Silencer</b>                   |      |                                   |       |       |       |       |       |       |       |
| Silencer - FA Silencer            |      |                                   |       |       |       |       |       |       |       |
|                                   |      | -3.0                              | -4.0  | -8.0  | -19.0 | -18.0 | -14.0 | -11.0 | -10.0 |
| <b>Facade Reflection</b>          |      |                                   |       |       |       |       |       |       |       |
| Reflection (dB)                   | 3.0  |                                   |       |       |       |       |       |       |       |
|                                   |      | 3.0                               | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   |
| <b>External Receiver</b>          |      |                                   |       |       |       |       |       |       |       |
| External Receiver - AP1 - Day     |      |                                   |       |       |       |       |       |       |       |
| Sound Pressure, Lp                |      | 11.7                              | 14.3  | 4.5   | -8.2  | -7.0  | -6.0  | -9.0  | -15.9 |



## Calculation Sheet

18/0455/CS5

Cold Store to AP1 - Night

| Octave Band Centre Frequency (Hz)  |             |             |             |             |             |             |             |             |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                    | 63          | 125         | 250         | 500         | 1k          | 2k          | 4k          | 8k          |
| <b>Noise Source</b>                |             |             |             |             |             |             |             |             |
| Noise Source - Cold Store          |             |             |             |             |             |             |             |             |
| <b>Sound Power Levels</b>          | <b>72.0</b> | <b>75.0</b> | <b>66.0</b> | <b>65.0</b> | <b>60.0</b> | <b>54.0</b> | <b>52.0</b> | <b>51.0</b> |
| <b>Point Source Radiation Loss</b> |             |             |             |             |             |             |             |             |
| Radiation - Quarterspherical       |             |             |             |             |             |             |             |             |
|                                    | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        |
| <b>Point Source Distance Loss</b>  |             |             |             |             |             |             |             |             |
| End Distance (m)                   | 40.0        |             |             |             |             |             |             |             |
|                                    | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       | -32.0       |
| <b>Facade Reflection</b>           |             |             |             |             |             |             |             |             |
| Reflection (dB)                    | 3.0         |             |             |             |             |             |             |             |
|                                    | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         |
| <b>External Receiver</b>           |             |             |             |             |             |             |             |             |
| External Receiver - AP1 - Night    |             |             |             |             |             |             |             |             |
| <b>Sound Pressure, Lp</b>          | <b>38.0</b> | <b>41.0</b> | <b>32.0</b> | <b>31.0</b> | <b>26.0</b> | <b>20.0</b> | <b>18.0</b> | <b>17.0</b> |



## Calculation Sheet

18/0455/CS6

AC Unit to AP2 - Day

|                                    |  | Octave Band Centre Frequency (Hz) |             |             |             |             |             |              |              |
|------------------------------------|--|-----------------------------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|
|                                    |  | 63                                | 125         | 250         | 500         | 1k          | 2k          | 4k           | 8k           |
| <b>Noise Source</b>                |  |                                   |             |             |             |             |             |              |              |
| Noise Source - AC Unit             |  |                                   |             |             |             |             |             |              |              |
| <b>Sound Power Levels</b>          |  | <b>81.0</b>                       | <b>77.0</b> | <b>71.0</b> | <b>69.0</b> | <b>70.0</b> | <b>64.0</b> | <b>58.5</b>  | <b>56.0</b>  |
| <b>Point Source Radiation Loss</b> |  |                                   |             |             |             |             |             |              |              |
| Radiation - Quarterspherical       |  |                                   |             |             |             |             |             |              |              |
|                                    |  | -5.0                              | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0         | -5.0         |
| <b>Point Source Distance Loss</b>  |  |                                   |             |             |             |             |             |              |              |
| End Distance (m)                   |  | 55.0                              |             |             |             |             |             |              |              |
|                                    |  | -34.8                             | -34.8       | -34.8       | -34.8       | -34.8       | -34.8       | -34.8        | -34.8        |
| <b>Maekawa Screening Loss</b>      |  |                                   |             |             |             |             |             |              |              |
| Path Difference (m)                |  | 2.0                               |             |             |             |             |             |              |              |
|                                    |  | -12.5                             | -15.1       | -17.9       | -20.8       | -23.7       | -26.7       | -29.7        | -32.7        |
| <b>Facade Reflection</b>           |  |                                   |             |             |             |             |             |              |              |
| Reflection (dB)                    |  | 1.0                               |             |             |             |             |             |              |              |
|                                    |  | 1.0                               | 1.0         | 1.0         | 1.0         | 1.0         | 1.0         | 1.0          | 1.0          |
| <b>External Receiver</b>           |  |                                   |             |             |             |             |             |              |              |
| External Receiver - AP2 - Day      |  |                                   |             |             |             |             |             |              |              |
| <b>Sound Pressure, Lp</b>          |  | <b>29.7</b>                       | <b>23.1</b> | <b>14.3</b> | <b>9.4</b>  | <b>7.5</b>  | <b>-1.5</b> | <b>-10.0</b> | <b>-15.5</b> |



## Calculation Sheet

18/0455/CS7

Cold Store to AP2 - Day

| Octave Band Centre Frequency (Hz)  |             |             |             |             |             |             |              |              |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|
|                                    | 63          | 125         | 250         | 500         | 1k          | 2k          | 4k           | 8k           |
| <b>Noise Source</b>                |             |             |             |             |             |             |              |              |
| Noise Source - Cold Store          |             |             |             |             |             |             |              |              |
| <b>Sound Power Levels</b>          | <b>72.0</b> | <b>75.0</b> | <b>66.0</b> | <b>65.0</b> | <b>60.0</b> | <b>54.0</b> | <b>52.0</b>  | <b>51.0</b>  |
| <b>Point Source Radiation Loss</b> |             |             |             |             |             |             |              |              |
| Radiation - Quarterspherical       |             |             |             |             |             |             |              |              |
|                                    | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0         | -5.0         |
| <b>Point Source Distance Loss</b>  |             |             |             |             |             |             |              |              |
| End Distance (m) 55.0              |             |             |             |             |             |             |              |              |
|                                    | -34.8       | -34.8       | -34.8       | -34.8       | -34.8       | -34.8       | -34.8        | -34.8        |
| <b>Maekawa Screening Loss</b>      |             |             |             |             |             |             |              |              |
| Path Difference (m) 2.0            |             |             |             |             |             |             |              |              |
|                                    | -12.5       | -15.1       | -17.9       | -20.8       | -23.7       | -26.7       | -29.7        | -32.7        |
| <b>Facade Reflection</b>           |             |             |             |             |             |             |              |              |
| Reflection (dB) 3.0                |             |             |             |             |             |             |              |              |
|                                    | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0          | 3.0          |
| <b>External Receiver</b>           |             |             |             |             |             |             |              |              |
| External Receiver - AP2 - Day      |             |             |             |             |             |             |              |              |
| <b>Sound Pressure, Lp</b>          | <b>22.7</b> | <b>23.1</b> | <b>11.3</b> | <b>7.4</b>  | <b>-0.5</b> | <b>-9.5</b> | <b>-14.5</b> | <b>-18.5</b> |



## Calculation Sheet

18/0455/CS8

Extract to AP2 - Day

|                                         |       | Octave Band Centre Frequency (Hz) |             |             |             |             |             |             |             |
|-----------------------------------------|-------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                         |       | 63                                | 125         | 250         | 500         | 1k          | 2k          | 4k          | 8k          |
| <b>Noise Source</b>                     |       |                                   |             |             |             |             |             |             |             |
| Noise Source - Extract                  |       |                                   |             |             |             |             |             |             |             |
| <b>Sound Power Levels</b>               |       | <b>78.0</b>                       | <b>79.0</b> | <b>76.0</b> | <b>74.0</b> | <b>73.0</b> | <b>70.0</b> | <b>67.0</b> | <b>62.0</b> |
| <b>Bend Loss CJ</b>                     |       |                                   |             |             |             |             |             |             |             |
| Dimension (mm)                          | 500.0 |                                   |             |             |             |             |             |             |             |
| No. of Bends (no.)                      | 6.0   |                                   |             |             |             |             |             |             |             |
| Type - Unlined Square Bend - With Vanes |       |                                   |             |             |             |             |             |             |             |
|                                         |       | 0.0                               | 0.0         | -6.0        | -12.0       | -18.0       | -18.0       | -18.0       | -18.0       |
| <b>Rect Unlined Duct Losses CJ</b>      |       |                                   |             |             |             |             |             |             |             |
| Width (mm)                              | 500.0 |                                   |             |             |             |             |             |             |             |
| Height (mm)                             | 500.0 |                                   |             |             |             |             |             |             |             |
| Length (m)                              | 20.0  |                                   |             |             |             |             |             |             |             |
|                                         |       | -15.0                             | -12.0       | -6.0        | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        |
| <b>End Reflection</b>                   |       |                                   |             |             |             |             |             |             |             |
| Width/Diameter                          | 0.5   |                                   |             |             |             |             |             |             |             |
| Length                                  | 0.5   |                                   |             |             |             |             |             |             |             |
| Rec or Circ - Circular                  |       |                                   |             |             |             |             |             |             |             |
| Free or Flush - Free Space              |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -11.9                             | -6.5        | -1.1        | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Stack Directivity</b>                |       |                                   |             |             |             |             |             |             |             |
| Angle                                   | 90.0  |                                   |             |             |             |             |             |             |             |
| Area (m2)                               | 0.2   |                                   |             |             |             |             |             |             |             |
|                                         |       | 0.0                               | 0.0         | 0.0         | -1.0        | -1.0        | -2.0        | -2.0        | -2.0        |



18/0455/CS8

| Octave Band Centre Frequency (Hz)  |       |       |       |       |       |       |       |       |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                    | 63    | 125   | 250   | 500   | 1k    | 2k    | 4k    | 8k    |
| <b>Point Source Radiation Loss</b> |       |       |       |       |       |       |       |       |
| Radiation - Spherical              | -11.0 | -11.0 | -11.0 | -11.0 | -11.0 | -11.0 | -11.0 | -11.0 |
| <b>Point Source Distance Loss</b>  |       |       |       |       |       |       |       |       |
| End Distance (m)                   | 55.0  |       |       |       |       |       |       |       |
|                                    | -34.8 | -34.8 | -34.8 | -34.8 | -34.8 | -34.8 | -34.8 | -34.8 |
| <b>Facade Reflection</b>           |       |       |       |       |       |       |       |       |
| Reflection (dB)                    | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   |
| <b>External Receiver</b>           |       |       |       |       |       |       |       |       |
| External Receiver - AP2 - Day      |       |       |       |       |       |       |       |       |
| Sound Pressure, Lp                 | 8.3   | 17.7  | 20.1  | 15.2  | 8.2   | 4.2   | 1.2   | -3.8  |



## Calculation Sheet

18/0455/CS9

Fresh Air to AP2 - Day

|                                         |       | Octave Band Centre Frequency (Hz) |             |             |             |             |             |             |             |
|-----------------------------------------|-------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                         |       | 63                                | 125         | 250         | 500         | 1k          | 2k          | 4k          | 8k          |
| <b>Noise Source</b>                     |       |                                   |             |             |             |             |             |             |             |
| Noise Source - Fresh Air                |       |                                   |             |             |             |             |             |             |             |
| <b>Sound Power Levels</b>               |       | <b>77.0</b>                       | <b>79.0</b> | <b>73.0</b> | <b>74.0</b> | <b>77.0</b> | <b>77.0</b> | <b>74.0</b> | <b>69.0</b> |
| <b>Coil and Filter Losses</b>           |       |                                   |             |             |             |             |             |             |             |
|                                         |       | -3.0                              | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        | -3.0        |
| <b>Bend Loss CJ</b>                     |       |                                   |             |             |             |             |             |             |             |
| Dimension (mm)                          | 400.0 |                                   |             |             |             |             |             |             |             |
| No. of Bends (no.)                      | 0.0   |                                   |             |             |             |             |             |             |             |
| Type - Unlined Square Bend - With Vanes |       |                                   |             |             |             |             |             |             |             |
|                                         |       | 0.0                               | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         | 0.0         |
| <b>Rect Unlined Duct Losses CJ</b>      |       |                                   |             |             |             |             |             |             |             |
| Width (mm)                              | 400.0 |                                   |             |             |             |             |             |             |             |
| Height (mm)                             | 400.0 |                                   |             |             |             |             |             |             |             |
| Length (m)                              | 1.5   |                                   |             |             |             |             |             |             |             |
|                                         |       | -0.7                              | -0.9        | -0.7        | -0.5        | -0.3        | -0.3        | -0.3        | -0.2        |
| <b>External Grille Directivity</b>      |       |                                   |             |             |             |             |             |             |             |
| Width (m)                               | 0.4   |                                   |             |             |             |             |             |             |             |
| Height (m)                              | 0.4   |                                   |             |             |             |             |             |             |             |
| Vertical (°)                            | 0.0   |                                   |             |             |             |             |             |             |             |
| Horizontal (°)                          | 45.0  |                                   |             |             |             |             |             |             |             |
|                                         |       | 0.5                               | 1.5         | 2.0         | 2.8         | 3.2         | 4.0         | 4.0         | 4.0         |



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|                                    |      | Octave Band Centre Frequency (Hz) |       |       |       |       |       |       |       |
|------------------------------------|------|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                                    |      | 63                                | 125   | 250   | 500   | 1k    | 2k    | 4k    | 8k    |
| <b>End Reflection</b>              |      |                                   |       |       |       |       |       |       |       |
| Width/Diameter                     | 0.8  |                                   |       |       |       |       |       |       |       |
| Length                             | 0.5  |                                   |       |       |       |       |       |       |       |
| Rec or Circ - Rectangular          |      |                                   |       |       |       |       |       |       |       |
| Free or Flush - Flush              |      |                                   |       |       |       |       |       |       |       |
|                                    |      | -7.2                              | -2.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| <b>Point Source Radiation Loss</b> |      |                                   |       |       |       |       |       |       |       |
| Radiation - Hemispherical          |      |                                   |       |       |       |       |       |       |       |
|                                    |      | -8.0                              | -8.0  | -8.0  | -8.0  | -8.0  | -8.0  | -8.0  | -8.0  |
| <b>Point Source Distance Loss</b>  |      |                                   |       |       |       |       |       |       |       |
| End Distance (m)                   | 20.0 |                                   |       |       |       |       |       |       |       |
|                                    |      | -26.0                             | -26.0 | -26.0 | -26.0 | -26.0 | -26.0 | -26.0 | -26.0 |
| <b>Silencer</b>                    |      |                                   |       |       |       |       |       |       |       |
| Silencer - FA Silencer             |      |                                   |       |       |       |       |       |       |       |
|                                    |      | -3.0                              | -4.0  | -8.0  | -19.0 | -18.0 | -14.0 | -11.0 | -10.0 |
| <b>Facade Reflection</b>           |      |                                   |       |       |       |       |       |       |       |
| Reflection (dB)                    | 3.0  |                                   |       |       |       |       |       |       |       |
|                                    |      | 3.0                               | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   | 3.0   |
| <b>External Receiver</b>           |      |                                   |       |       |       |       |       |       |       |
| External Receiver - AP2 - Day      |      |                                   |       |       |       |       |       |       |       |
| Sound Pressure, Lp                 |      | 32.6                              | 38.9  | 32.3  | 23.3  | 27.9  | 32.7  | 32.7  | 28.8  |

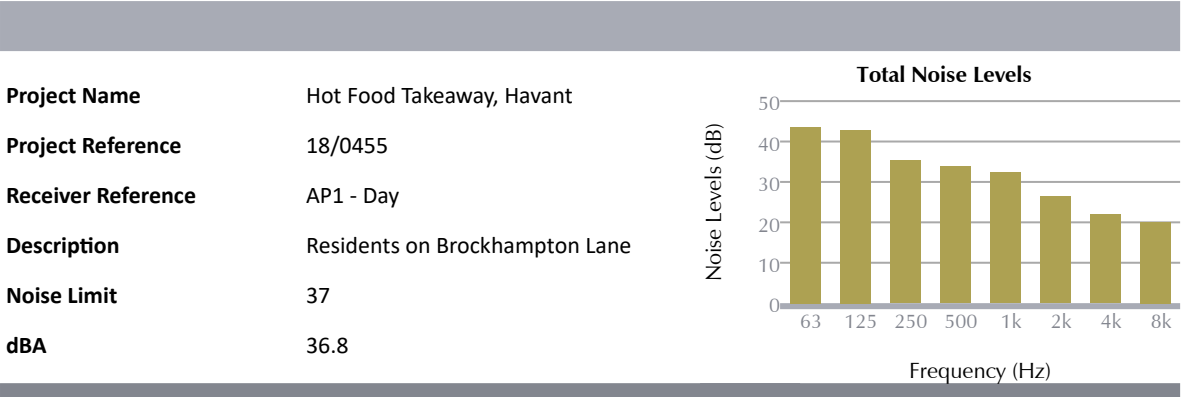


## Calculation Sheet

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Cold Store to AP2 - Night

| Octave Band Centre Frequency (Hz)  |             |             |             |             |             |             |              |              |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|
|                                    | 63          | 125         | 250         | 500         | 1k          | 2k          | 4k           | 8k           |
| <b>Noise Source</b>                |             |             |             |             |             |             |              |              |
| Noise Source - Cold Store          |             |             |             |             |             |             |              |              |
| <b>Sound Power Levels</b>          | <b>72.0</b> | <b>75.0</b> | <b>66.0</b> | <b>65.0</b> | <b>60.0</b> | <b>54.0</b> | <b>52.0</b>  | <b>51.0</b>  |
| <b>Point Source Radiation Loss</b> |             |             |             |             |             |             |              |              |
| Radiation - Quarterspherical       |             |             |             |             |             |             |              |              |
|                                    | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0        | -5.0         | -5.0         |
| <b>Point Source Distance Loss</b>  |             |             |             |             |             |             |              |              |
| End Distance (m)                   | 55.0        |             |             |             |             |             |              |              |
|                                    | -34.8       | -34.8       | -34.8       | -34.8       | -34.8       | -34.8       | -34.8        | -34.8        |
| <b>Maekawa Screening Loss</b>      |             |             |             |             |             |             |              |              |
| Path Difference (m)                | 2.0         |             |             |             |             |             |              |              |
|                                    | -12.5       | -15.1       | -17.9       | -20.8       | -23.7       | -26.7       | -29.7        | -32.7        |
| <b>Facade Reflection</b>           |             |             |             |             |             |             |              |              |
| Reflection (dB)                    | 3.0         |             |             |             |             |             |              |              |
|                                    | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         | 3.0          | 3.0          |
| <b>External Receiver</b>           |             |             |             |             |             |             |              |              |
| External Receiver - AP2 - Night    |             |             |             |             |             |             |              |              |
| <b>Sound Pressure, Lp</b>          | <b>22.7</b> | <b>23.1</b> | <b>11.3</b> | <b>7.4</b>  | <b>-0.5</b> | <b>-9.5</b> | <b>-14.5</b> | <b>-18.5</b> |



| Reference  | Noise Levels (dB) |      |      |      |      |      |      |       |
|------------|-------------------|------|------|------|------|------|------|-------|
|            | 63                | 125  | 250  | 500  | 1k   | 2k   | 4k   | 8k    |
| AC Unit    | 42.2              | 38.2 | 32.2 | 30.2 | 31.2 | 25.2 | 19.6 | 17.1  |
| Extract    | 11.1              | 20.5 | 22.9 | 19   | 12   | 9    | 6    | 1     |
| Cold Store | 38                | 41   | 32   | 31   | 26   | 20   | 18   | 17    |
| Fresh Air  | 11.7              | 14.3 | 4.5  | -8.2 | -7   | -6   | -9   | -15.9 |



**Project Name** Hot Food Takeaway, Havant

**Project Reference** 18/0455

**Receiver Reference** AP2 - Day

**Description** Residents on West Street

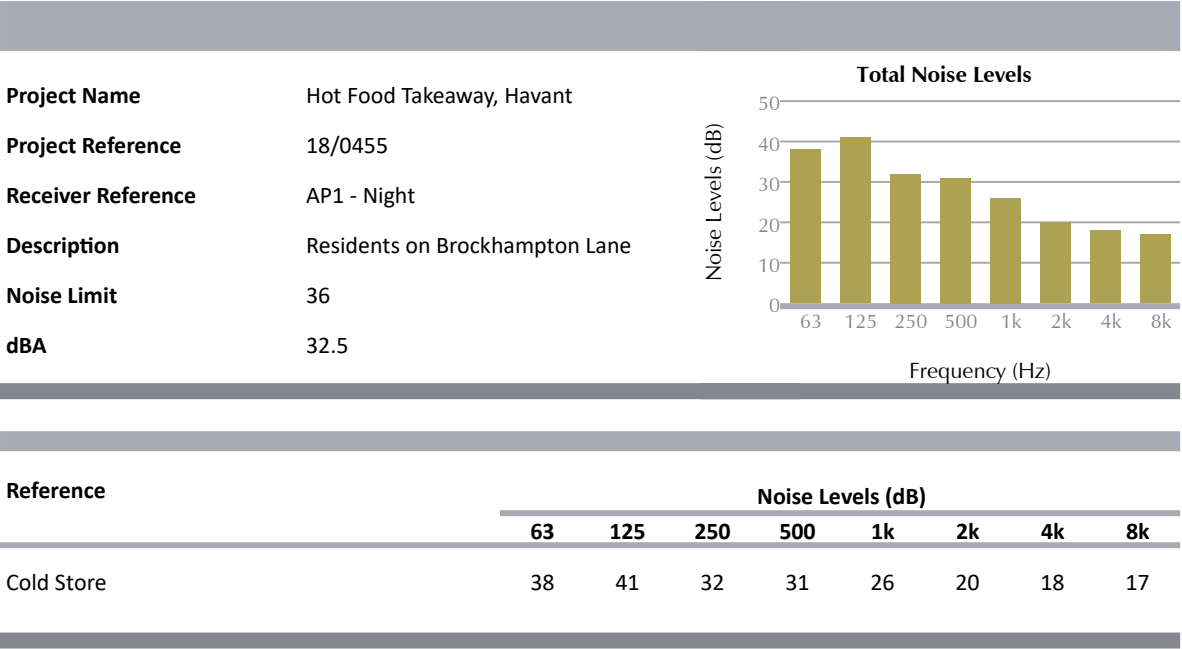
**Noise Limit** 40

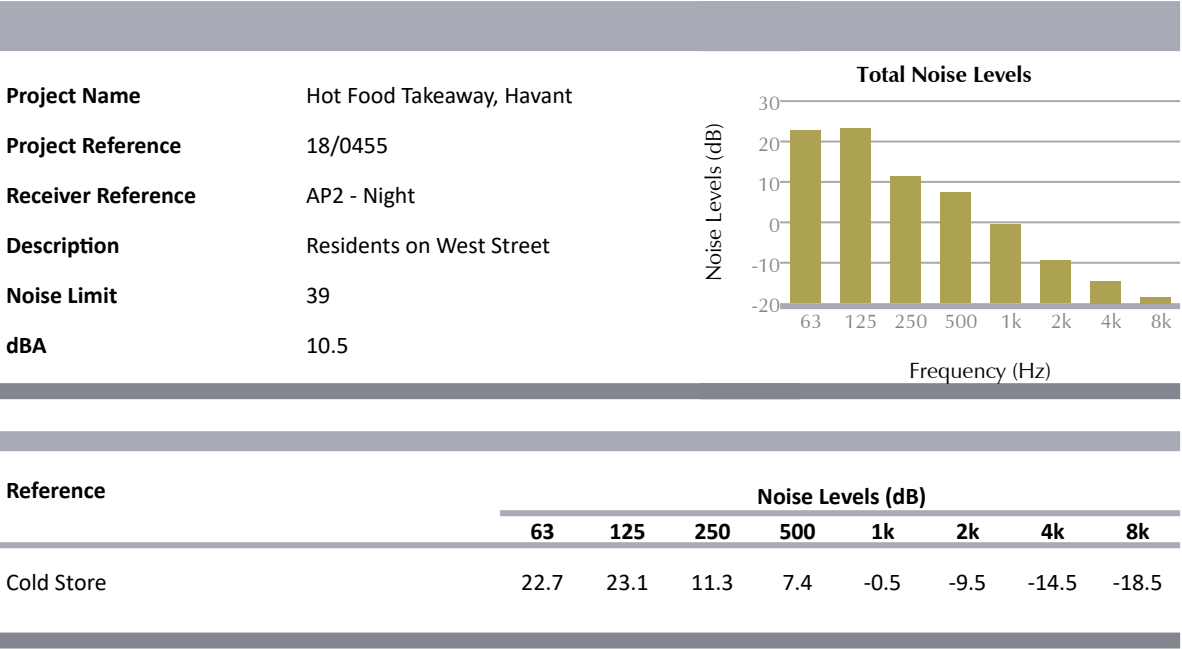
**dBA** 38.2

**Total Noise Levels**

| Frequency (Hz) | Noise Levels (dB) |
|----------------|-------------------|
| 63             | 35                |
| 125            | 38                |
| 250            | 33                |
| 500            | 25                |
| 1k             | 28                |
| 2k             | 33                |
| 4k             | 33                |
| 8k             | 29                |

| Reference  | Noise Levels (dB) |      |      |      |      |      |       |       |
|------------|-------------------|------|------|------|------|------|-------|-------|
|            | 63                | 125  | 250  | 500  | 1k   | 2k   | 4k    | 8k    |
| AC Unit    | 29.7              | 23.1 | 14.3 | 9.4  | 7.5  | -1.5 | -10   | -15.5 |
| Extract    | 8.3               | 17.7 | 20.1 | 15.2 | 8.2  | 4.2  | 1.2   | -3.8  |
| Cold Store | 22.7              | 23.1 | 11.3 | 7.4  | -0.5 | -9.5 | -14.5 | -18.5 |
| Fresh Air  | 32.6              | 38.9 | 32.3 | 23.3 | 27.9 | 32.7 | 32.7  | 28.8  |







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