



Architectural & Environmental Consultants  
Acoustics | Air Quality | Overheating

# Plant Noise Assessment

97a-117 Caversham Road, Reading

# Plant Noise Assessment

**Project:** 97A-117 CAVERSHAM ROAD, READING

**Report reference:** RP02-22227-R0

**Client:** BELLWAY HOMES LIMITED (THAMES VALLEY)  
IMPERIUM  
IMPERIAL WAY  
READING  
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## Document control:

| REVISION | ISSUE DATE       | REPORT BY                                                       | CHECKED BY                                | NOTES         |
|----------|------------------|-----------------------------------------------------------------|-------------------------------------------|---------------|
| 0        | 18 November 2024 | Annamarie Schooling, BA (Hons) TechIOA,<br>Acoustics Consultant | Tim Ives, PhD BEng CEng FIOA,<br>Director | Initial issue |
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## 1. EXECUTIVE SUMMARY

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- 1.1 Cass Allen has been instructed by Bellway Homes Limited (Thames Valley) to assess the noise impact of the proposed mechanical plant associated with the development at 97a-117 Caversham Road, Reading, on the existing noise sensitive receptors in the area and the new properties within the development. The plant is located within the plant rooms of Blocks A and B of the development.
- 1.2 The assessment was carried out in accordance with the requirements of Planning Condition 15 imposed on the development.
- 1.3 Background noise levels at the site were measured as part of a site noise survey from 5<sup>th</sup> to 11<sup>th</sup> July 2022 and were used to develop limits for plant noise emissions at the positions of the surrounding residential properties.
- 1.4 A 3D noise model of the development and surrounding area was constructed based on site layout drawings and noise data from the site noise survey. The noise breakout from the plantrooms were input to the noise model, based on manufacturer noise data for the equipment. The rated plant noise levels include character corrections in line with BS4142 methodology to account for the tonality in the noise emissions from the water booster pumps.
- 1.5 The results of the noise modelling calculations indicate that the cumulative rated plant noise levels are predicted to comply with the requirements of Planning Condition 15 at the nearest existing and proposed noise-sensitive receptors.
- 1.6 It is our view therefore that Planning Condition 15 can be discharged.

## 2. INTRODUCTION

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- 2.1 Cass Allen has been instructed by Bellway Homes Limited (Thames Valley) to assess the noise impact of the proposed mechanical plant associated with the new development at 97a-117 Caversham Road, Reading.
- 2.2 The assessment has been carried out in accordance with the requirements of Planning Condition 15 imposed on the development, which states:

*No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by the Local Planning Authority.*

*The assessment shall be carried out for in accordance with BS4142:2014+A1:2019 methodology. The predicted specific sound level (LAeq,TR) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive facade shall be at least 10dB below the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The predicted rating level, LAr,Tr (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to the nearest noise-sensitive façade (habitable window of a dwelling) shall not exceed the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The plant shall thereafter only be installed in accordance with the assessment and shall thereafter be maintained so that it operates to the same standard.*

*REASON: To safeguard the amenities of the adjoining premises and the area generally, in accordance with Policy CC8 and EN17 of the Reading Borough Local Plan 2019.*

- 2.3 This report contains technical terminology; a glossary of terms can be found at [www.cassallen.co.uk/glossary](http://www.cassallen.co.uk/glossary).



These include 119 to 123 Caversham Road shown in orange in Figure 1, as well as other sensitive receptors to the north west and south of the site, indicated in yellow in Figure 1. To the northwest is 52 to 66 Swansea Road and to the south is 87 to 93 Caversham Road

## 4. PLANT NOISE IMPACT ASSESSMENT

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### Design criteria – Mechanical plant noise

4.1 Planning Condition 15 requires that the plant noise coming from the plant rooms in Blocks A and B of the development are assessed in accordance with BS4142:2014 – *Methods for rating and assessing industrial and commercial sound* (hereafter BS4142).

4.2 The BS4142 assessment methodology can be summarised as follows:

1. Measure the existing background noise levels ( $LA_{90,T}$  dB) at the locations of nearby noise sensitive receptors during the quietest periods when the noise source(s) under investigation will operate
2. Predict or measure the noise emissions ( $LA_{eq,T}$  dB) from the noise source(s) under investigation at the location(s) of the nearby sensitive receptors, and add corrections for any distinguishable acoustic features (e.g. tones, whines, screeches, hisses etc)
3. Subtract the measured background noise levels (item 1 above) with the measured or predicted rating noise levels (item 2 above) at each sensitive receptor. BS4142 states that:

*a) Typically, the greater this difference, the greater the magnitude of the impact.*

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

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

*d) 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.*

*NOTE Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*

4.3 Planning Condition 15 requires the following criteria be complied with:

- The predicted specific sound level ( $LA_{eq,Tr}$ ) at 1 metre external to the nearest noise-sensitive facade shall be at least 10 dB below the pre-existing background sound level, ( $LA_{90,T}$ ) when all of the plant within the plant rooms is in operation. The specific sound level is the plant noise level alone, without the contribution from any other ambient sounds.
- The predicted rating level ( $L_{Ar,Tr}$ ) at 1 metre external to the nearest noise-sensitive facade shall not exceed the pre-existing background sound level ( $LA_{90,T}$ ) when all of the

plant within the plant rooms is in operation. The rated plant noise level is the specific sound level with any corrections applied for distinguishable acoustic features (tonality, impulsivity, intermittency).

- 4.4 Background noise levels (LA90) at the site were measured during a site noise survey from 5<sup>th</sup> to 11<sup>th</sup> July 2022 as part of the Cass Allen noise assessment (Ref: RP01-22227-R1). The results of this survey are outlined in Appendix 2. The measured background noise levels have been used to develop limits for noise emissions from the plant rooms at the positions of the surrounding residential properties, in accordance with the BS4142 assessment methodology. The limits are shown in Table 1 below.

**Table 1 Plant Noise Limits - Free-field Levels**

| Location                                                                                        | Specific sound levels           |                           | Rated sound levels              |                           |
|-------------------------------------------------------------------------------------------------|---------------------------------|---------------------------|---------------------------------|---------------------------|
|                                                                                                 | Period                          |                           | Period                          |                           |
|                                                                                                 | Day-time/Evening (0700-2300hrs) | Night-time (2300-0700hrs) | Day-time/Evening (0700-2300hrs) | Night-time (2300-0700hrs) |
| Existing properties to the north and south of the site (87 to 93 and 119 to 123 Caversham Road) | 44                              | 30                        | 54                              | 40                        |
| Existing properties to the northwest of the site (52 to 66 Swansea Road)                        | 29                              | 22                        | 39                              | 32                        |
| New facades within the development <sup>2</sup>                                                 | -                               | -                         | 54                              | 40                        |

**Note 1** The above limits are 'rated' noise levels. Any mechanical plant noise emissions should have appropriate corrections for the character of the noise applied and still meet these limits.

**Note 2** Appropriate rated plant noise limits are also provided for the new noise-sensitive facades within the development, in line with BS4142 methodology and the spirit of Planning Condition 15.

## Mechanical plant design

- 4.5 It is understood that the plant located within the plant rooms of Blocks A and B comprise cold water booster pump sets serving the apartments. Details of the equipment are outlined in the booster pump schedules provided by the technical team, shown in Appendix 3.

- 4.6 Locations of the plant rooms within the development are indicated on project drawings provided in Appendix 1. An outline of the plant items for Blocks A and B are summarised in Table 2 below:

**Table 2 Plant Items**

| Plant Item and Model                                | Location | Manufacturer Datasheet<br>Sound Pressure Level (at 1m)<br>(dBA) |
|-----------------------------------------------------|----------|-----------------------------------------------------------------|
| Dutypoint Cold Water Booster Set:<br>VG2-5HME04-LSM | Block A  | 58                                                              |
| Dutypoint Cold Water Booster Set:<br>VT3-10-030T    | Block B  | 60                                                              |

- 4.7 A 3D noise model of the development and surrounding area was constructed based on site layout drawings.
- 4.8 At the time of the assessment, spectral noise data for the booster sets were not available, therefore the spectral data were based on levels measured by Cass Allen from a similar booster pump. The spectrum was calibrated to the broadband sound pressure values outlined in Table 2 above. The spectral pump noise emissions were input to the model as breakout through the louvred doors.
- 4.9 Character corrections of 2 dB were applied to the water booster pump set noise emissions to account for slight perceived tonality, as per the guidelines in BS4142.
- 4.10 The 3D noise model was used to predict the noise breakout from the plant rooms and the subsequent levels of the plant noise on the habitable rooms of the development and surrounding noise sensitive receptors within the area. The predictions assumed that the plant items in both plant rooms were running simultaneously at the maximum operating duty (which is unlikely to occur regularly). The calculated cumulative rated plant noise levels at the nearest and worst-case receptors are shown in Appendix 4 and summarised in
- 4.11 Table 3 below.

**Table 3 Worst-Case Predicted Rating Noise Levels**

| Location                                                              | Predicted Rated Plant Noise Levels (L <sub>Ar</sub> ,Tr) |                           |
|-----------------------------------------------------------------------|----------------------------------------------------------|---------------------------|
|                                                                       | Day-time/Evening (0700-2300hrs)                          | Night-time (2300-0700hrs) |
| Existing properties to the north and south of the site                | 23                                                       | 23                        |
| New facades within the development to the north and south of the site | 39                                                       | 39                        |
| Existing properties to the west of the site                           | 19                                                       | 19                        |
| New facades within the development to the northwest of the site       | 28                                                       | 28                        |

4.12 The results in

4.13 Table 3 show that the rated noise levels of the proposed plant at the worst-case facades of both the existing and new development facades are predicted to be lower than the daytime and night-time rated noise limits outlined in Table 1. The proposed plant items therefore comply with the requirements of Planning Condition 15.

4.14 Based on the above, it is our view therefore that this report contains the information required to discharge Planning Condition 15.

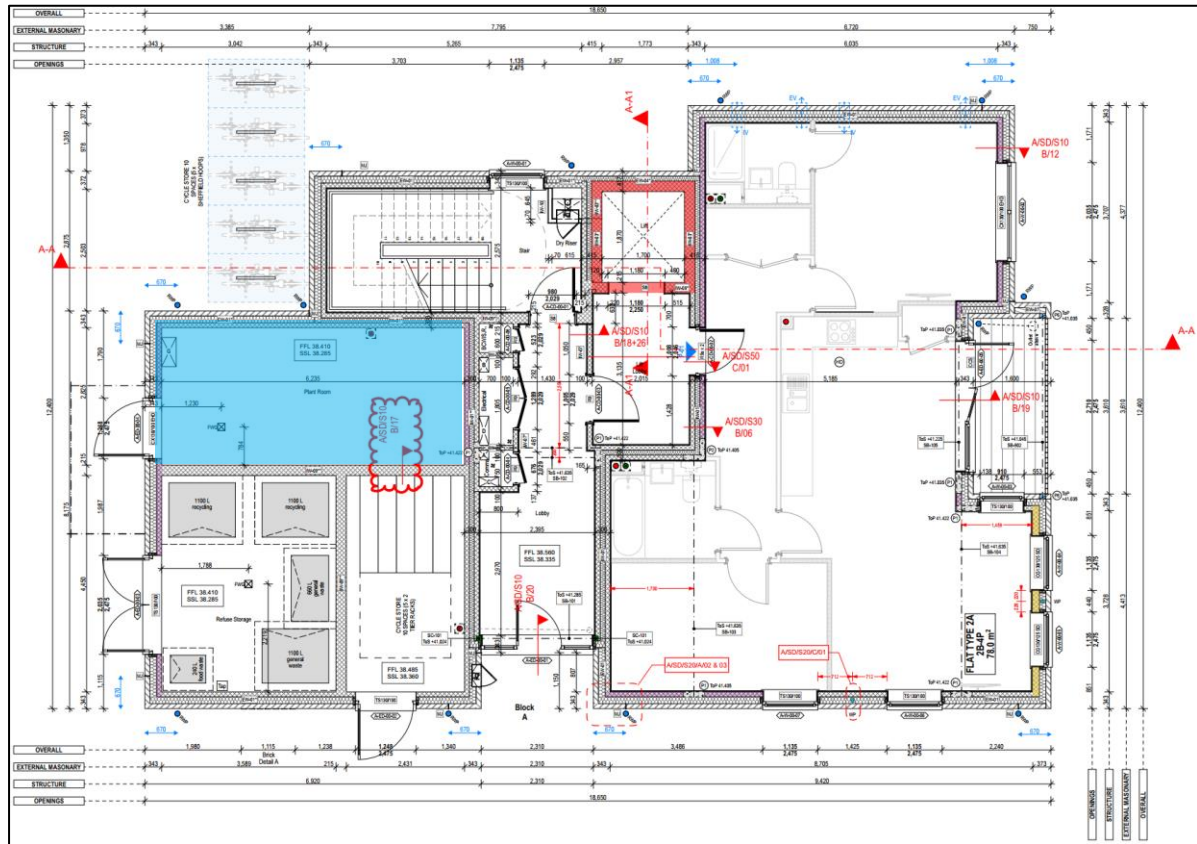
## 5. CONCLUSIONS

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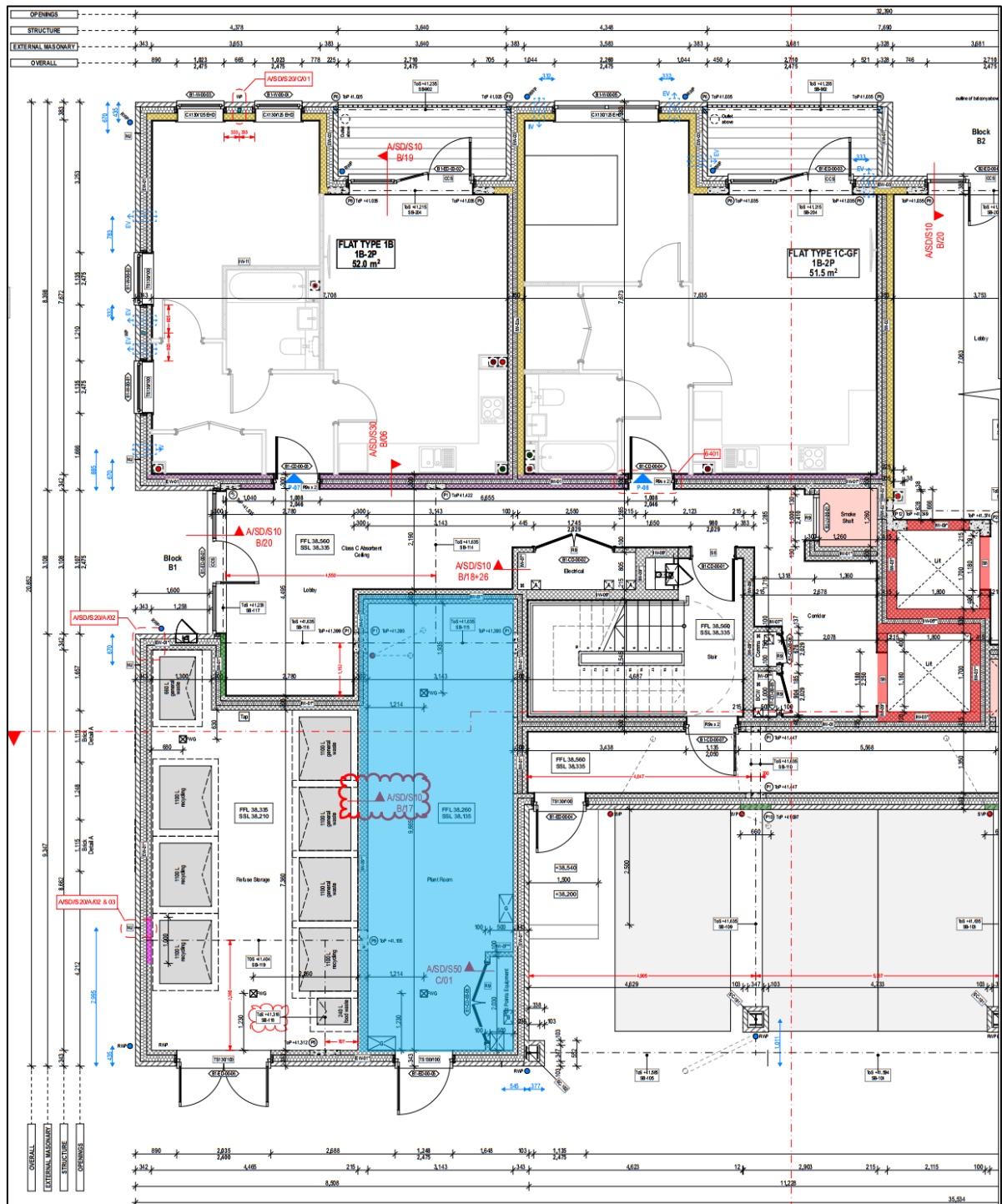
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- 5.2 The assessment was carried out in accordance with the requirements of Planning Condition 15 imposed on the development.
- 5.3 Background noise levels at the site were measured as part of a site noise survey from 5<sup>th</sup> to 11<sup>th</sup> July 2022 and were used to develop limits for plant noise emissions at the positions of the surrounding residential properties.
- 5.4 A 3D noise model of the development and surrounding area was constructed based on site layout drawings and noise data from the site noise survey. The noise breakout from the plantrooms were input to the noise model, based on manufacturer noise data for the equipment. The rated plant noise levels include character corrections in line with BS4142 methodology to account for the tonality in the noise emissions from the water booster pumps.
- 5.5 The results of the noise modelling calculations indicate that the cumulative rated plant noise levels are predicted to comply with the requirements of Planning Condition 15 at the nearest existing and proposed noise-sensitive receptors.
- 5.6 It is our view therefore that Planning Condition 15 can be discharged.

# Appendix 1 Ground Floor Plans - Plant Room Locations

## Block A Plant Room



# Block B Plant Room



## Appendix 2 2022 Survey Results

### Survey Summary:

The survey comprised short-term operator attended noise measurements and longer-term unattended noise monitoring at the site. Noise levels at the site were generally dictated by road traffic on surrounding roads.

### Survey Period:

05/07/2022 to 11/07/2022

### Survey Objectives:

- To identify noise sources that contribute to ambient noise levels at the site;
- To measure noise levels around the site over a typical day and night-time period.

### Equipment Used:

| Type                                             | Manufacturer | Model       | Serial Number |
|--------------------------------------------------|--------------|-------------|---------------|
| Sound level meter <sup>1</sup>                   | Brüel & Kjær | 2250        | 3029152       |
| Calibrator                                       | 01dB         | CAL31       | 83380         |
| Sound level meter <sup>1</sup>                   | NTi Audio    | XL2         | A2A-15506-E0  |
| Calibrator                                       | NTi Audio    | 600 000 388 | 15011         |
| Sound level meter <sup>1</sup><br>(noise logger) | Rion         | NL-32       | 01213688      |
| Sound level meter <sup>1</sup><br>(noise logger) | Rion         | NL-32       | 00903342      |
| Calibrator                                       | Rion         | NC-74       | 34551703      |

**Note 1:** All sound level meters were calibrated before and after measurement periods and no significant drift in calibration was found to have occurred. The results of the measurements are therefore considered to be representative.

### Weather Conditions:

The observed weather conditions were acceptable for acoustic measurement throughout the attended survey periods (low-medium wind speeds and no rain). Weather records for the area confirmed that weather conditions were also generally acceptable for acoustic measurement during the unattended monitoring.

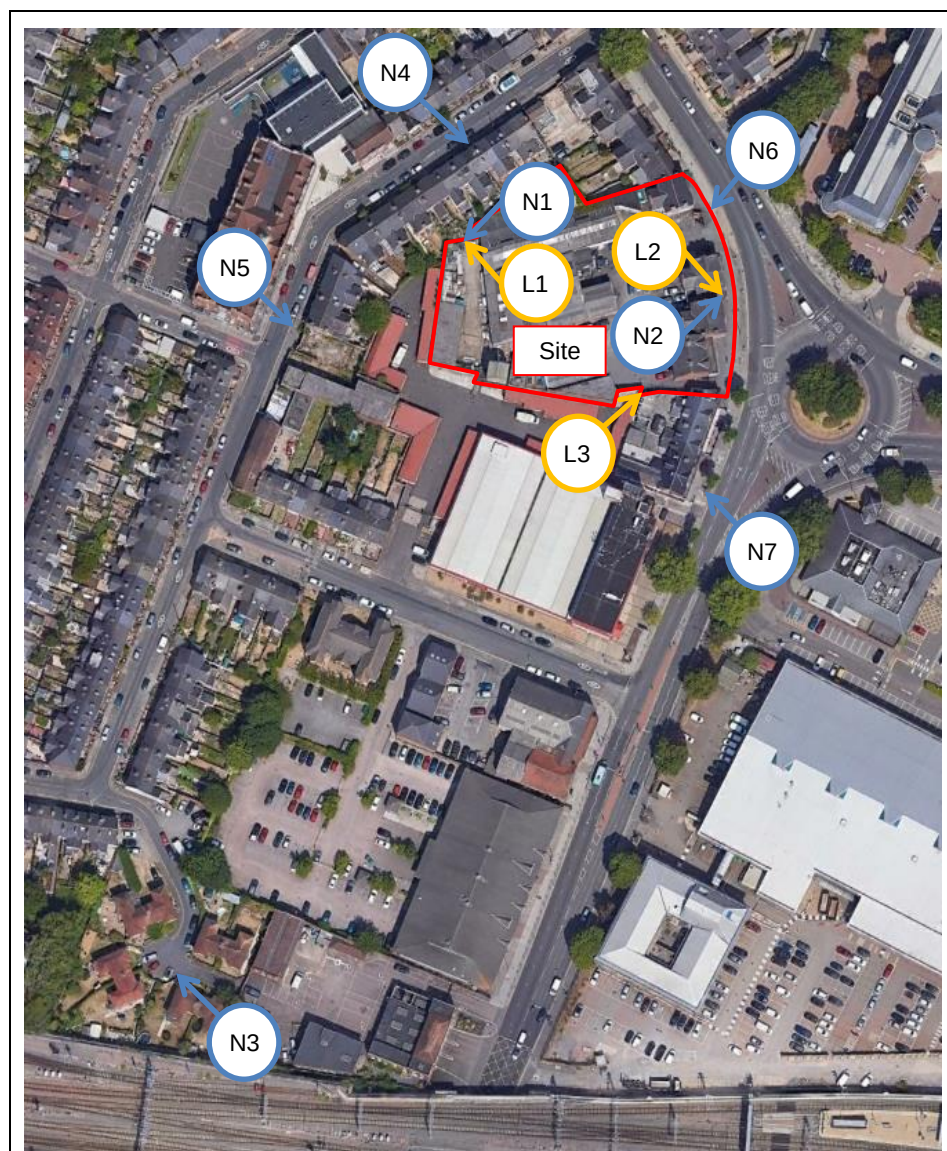
### Measurement Positions:

| Position (refer plan below) | Description                                                                                             |
|-----------------------------|---------------------------------------------------------------------------------------------------------|
| N1                          | Verification of L1 measurement                                                                          |
| N2                          | Verification of L2 measurement                                                                          |
| N3                          | Attended noise monitoring position. 3m above ground. Free-field. Line of sight to rail barrier.         |
| N4                          | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to Swansea Road |
| N5                          |                                                                                                         |

**Measurement Positions:**

| Position (refer plan below) | Description                                                                                                                              |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| N6                          | Attended noise monitoring position. 1.5m above ground. Free-field. Direct line of sight to Caversham Road                                |
| N7                          |                                                                                                                                          |
| L1                          | Unattended noise logging position. 3m above ground level. Free-field. Direct line of sight to rear facades of properties on Swansea Road |
| L2                          | Unattended noise logging position. 4.5m above ground level. Free-field. Direct line of sight to Caversham Road                           |
| L3                          | Unattended noise logging position. 4.5m above ground level. Free-field. Direct line of sight to nearby plant                             |

**Site Plan showing Measurement Positions:**



**Attended Noise Monitoring Results:**

| Date       | Position | Time  | Meas. Length | LAeq, dB | LAmx, dB | LA90, dB | Observations                                                                                                                                                                                                                                        |
|------------|----------|-------|--------------|----------|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 05/07/2022 | N1       | 12:50 | 5 mins       | 49       | 67       | 39       | Noise dictated by road traffic on surrounding roads.                                                                                                                                                                                                |
|            |          | 12:55 |              | 42       | 52       | 39       |                                                                                                                                                                                                                                                     |
|            | N2       | 13:30 |              | 67       | 82       | 62       | Noise dictated by road traffic on Caversham Road.                                                                                                                                                                                                   |
|            |          | 13:35 |              | 79       | 104      | 62       |                                                                                                                                                                                                                                                     |
|            | N3       | 14:03 | 29 secs      | 52       | 58       |          | Measurement of train pass.                                                                                                                                                                                                                          |
|            |          | 14:06 | 17 secs      | 51       | 54       |          |                                                                                                                                                                                                                                                     |
|            |          | 14:08 | 11 secs      | 51       | 56       |          |                                                                                                                                                                                                                                                     |
|            |          | 13:12 | 10 secs      | 50       | 55       |          |                                                                                                                                                                                                                                                     |
|            | N4       | 14:55 | 5 mins       | 60       | 76       | 49       | Noise levels dictated by road traffic on Caversham Road. Maximum noise levels dictated by road traffic on Swansea Road.                                                                                                                             |
|            |          | 15:00 |              | 57       | 74       | 46       |                                                                                                                                                                                                                                                     |
|            |          | 15:51 |              | 60       | 67       |          | Measurement of traffic pass on Swansea Road.                                                                                                                                                                                                        |
|            |          | 15:55 |              | 65       | 72       |          |                                                                                                                                                                                                                                                     |
|            |          | 15:56 |              | 65       | 72       |          |                                                                                                                                                                                                                                                     |
|            |          | 15:56 |              | 60       | 65       |          |                                                                                                                                                                                                                                                     |
|            |          | 15:59 |              | 59       | 64       |          |                                                                                                                                                                                                                                                     |
|            |          | 16:01 |              | 60       | 62       |          |                                                                                                                                                                                                                                                     |
|            |          | 16:02 |              | 62       | 67       |          |                                                                                                                                                                                                                                                     |
|            |          | 16:04 |              | 59       | 64       |          |                                                                                                                                                                                                                                                     |
|            | N5       | 15:10 |              | 58       | 72       | 50       | Noise levels dictated by road traffic on Caversham Road. Maximum noise levels dictated by vehicle passes on Swansea Road. Pedestrian noise from nearby school, and aircraft noise were audible during measurement but did not dictate noise levels. |
|            |          | 15:15 |              | 60       | 81       | 50       | Noise levels dictated by road traffic on Swansea Road and maximum noise levels dictated by pedestrians outside nearby school.                                                                                                                       |
|            | N6       | 15:25 |              | 73       | 84       | 67       | Noise levels dictated by road traffic on Caversham Road.                                                                                                                                                                                            |
|            |          | 15:30 |              | 74       | 86       | 67       |                                                                                                                                                                                                                                                     |
|            | N7       | 15:37 |              | 74       | 89       | 67       |                                                                                                                                                                                                                                                     |
|            |          | 15:42 |              | 72       | 82       | 67       |                                                                                                                                                                                                                                                     |
| 11/07/2022 | N6       | 12:53 | 21 secs      | 71       | 76       |          | Measurement of traffic pass on Caversham Road.                                                                                                                                                                                                      |
|            |          | 12:54 | 3 secs       | 72       | 74       |          |                                                                                                                                                                                                                                                     |
|            |          | 12:55 | 10 secs      | 71       | 73       |          |                                                                                                                                                                                                                                                     |

**Attended Noise Monitoring Results:**

| Date | Position | Time  | Meas. Length | LAeq, dB | LAmix, dB | LA90, dB | Observations               |
|------|----------|-------|--------------|----------|-----------|----------|----------------------------|
|      |          | 12:55 | 3 secs       | 70       | 71        |          |                            |
|      |          | 12:56 | 6 secs       | 71       | 74        |          |                            |
|      |          | 12:56 | 6 secs       | 76       | 79        |          |                            |
|      |          | 12:58 | 4 secs       | 71       | 72        |          |                            |
|      | N3       | 13:16 | 15 secs      | 54       | 56        |          | Measurement of train pass. |
|      |          | 13:21 | 18 secs      | 51       | 54        |          |                            |
|      |          | 13:23 | 5 secs       | 53       | 59        |          |                            |
|      |          | 13:32 | 24 secs      | 51       | 53        |          |                            |
|      |          | 13:43 | 15 secs      | 53       | 57        |          |                            |

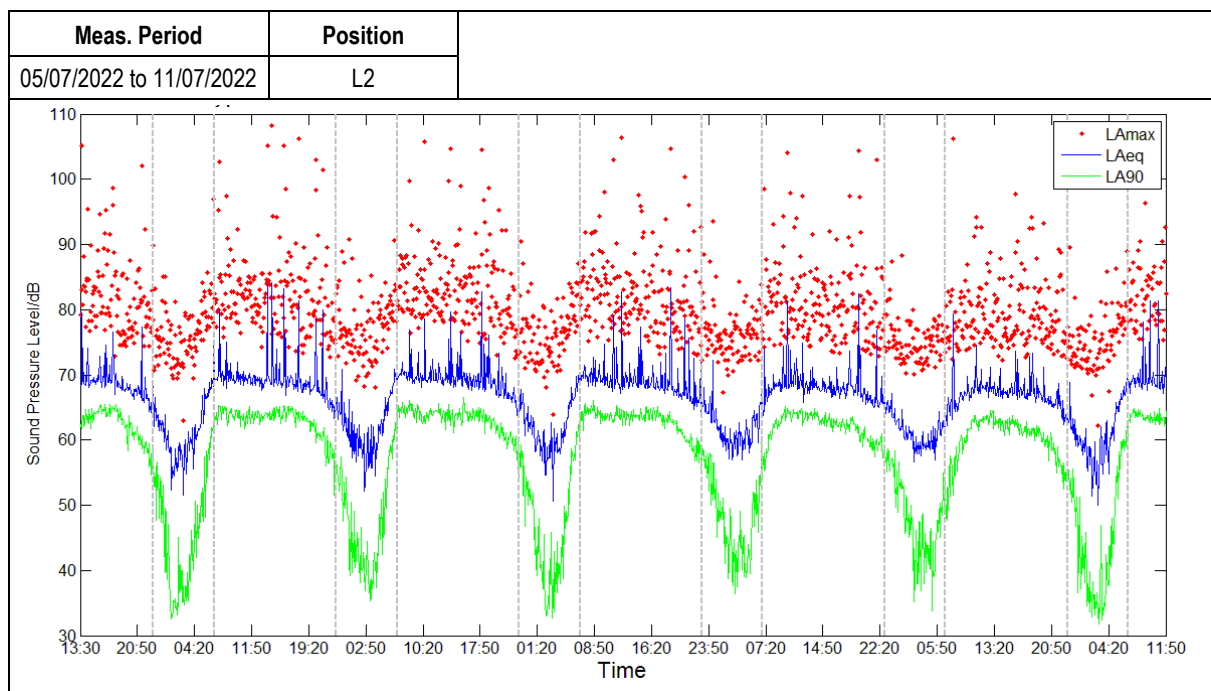
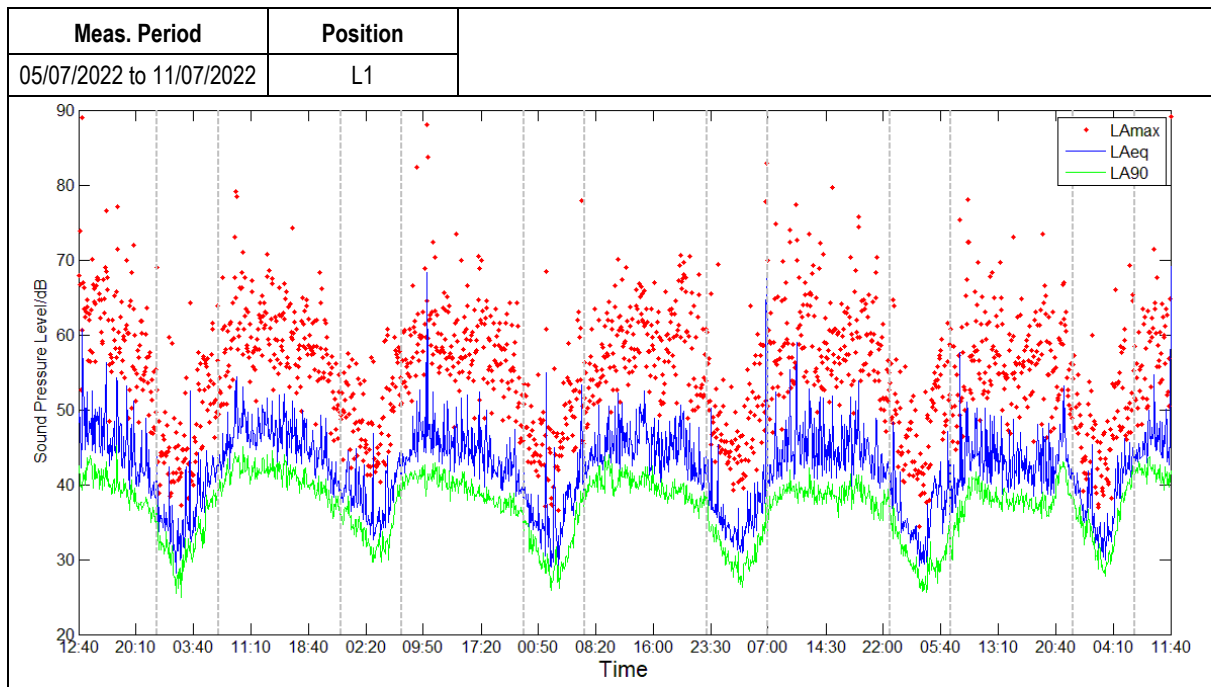
**Unattended Noise Monitoring Results:**

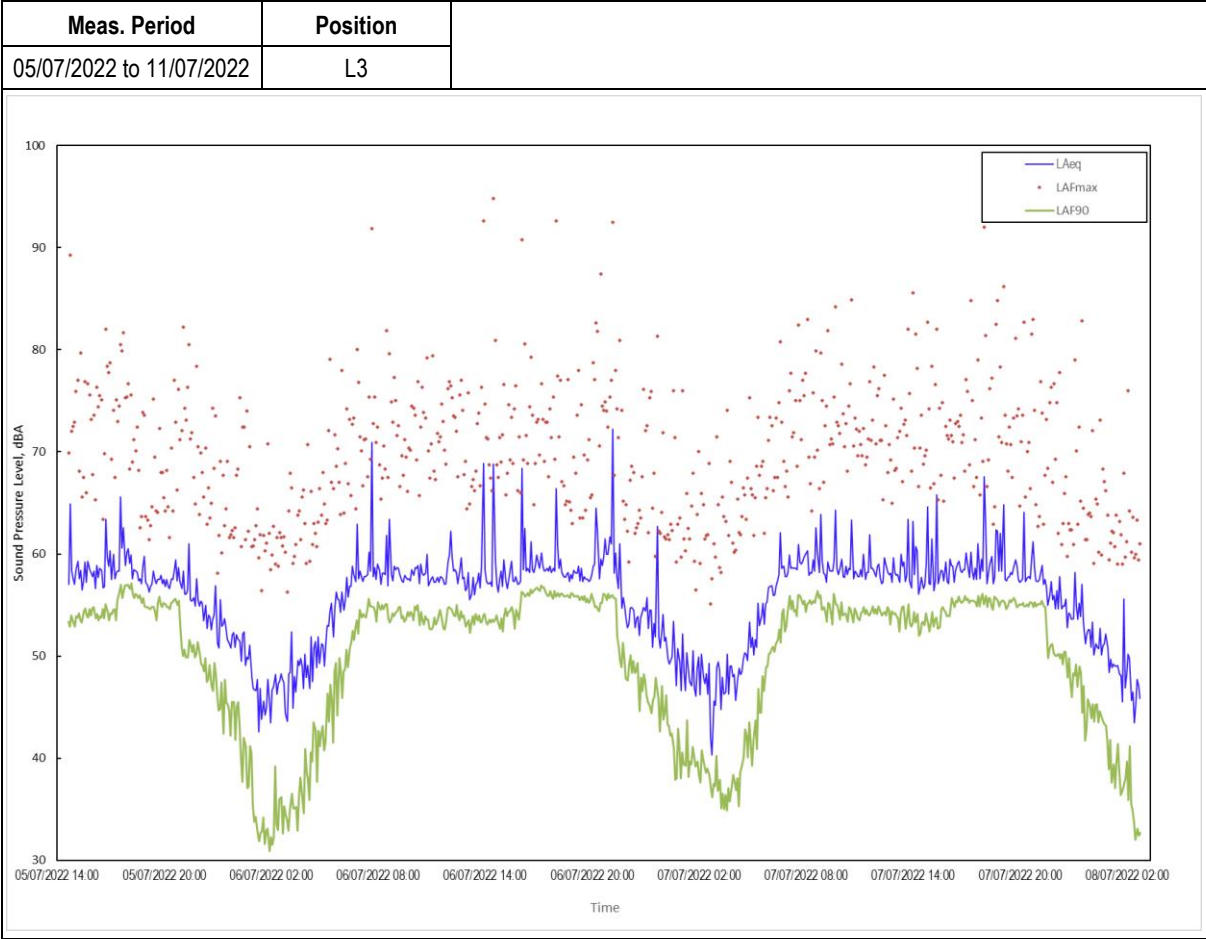
| Meas. Period             | Position | Daytime (0700-2300hrs) |                          | Night-time (2300-0700hrs) |                             |                        |
|--------------------------|----------|------------------------|--------------------------|---------------------------|-----------------------------|------------------------|
|                          |          | LAeq,16hr, dB          | LA90,1hr dB <sup>1</sup> | LAeq,8hr, dB              | LA90,5mins, dB <sup>1</sup> | LAmix, dB <sup>2</sup> |
| 05/07/2022 to 11/07/2022 | L1       | 47                     | 39                       | 42                        | 32                          | 57                     |
|                          | L2       | 70                     | 64                       | 63                        | 40                          | 81                     |
| 05/07/2022 to 08/07/2022 | L3       | 59                     | 54                       | 53                        | 45                          | 73                     |

**Note 1:** Typical lowest measured during the period shown.

**Note 2:** Highest typical maximum noise level during the night-time (not exceeded more than 10-15 times per night).

# Unattended Noise Monitoring Results:





## Appendix 3    Booster Pump Schedules

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## 6646 Carters, Reading: Apartment Block A – Booster Pump Schedule

|                                        |  |           |             |                          |                  |                 |                     |               |                 |
|----------------------------------------|--|-----------|-------------|--------------------------|------------------|-----------------|---------------------|---------------|-----------------|
| Plant/equipment Supplier.<br>Dutypoint |  |           | Drg Ref(s): | 6646-P-A-00-100-53-100   |                  |                 |                     |               |                 |
| Rev C02                                |  |           |             |                          |                  |                 |                     |               |                 |
| Model                                  |  | Duty head | No. Of      | Location                 | Noise Data (dBA) | Flow Rate (L/s) | Flow per pump (L/s) | FLC Total (A) | Power (kW)      |
| VG2-5HME04-LSM<br>Duty/Standby         |  | 3.5 Bar   | 1           | BCW Plantroom (Block A1) | 58               | 1.5             | 1.5                 | 8.1           | 0.75 (per pump) |

### Notes

1. Twin Pump, Variable Speed, High Efficiency Cold Water Booster Set, featuring: - 2 stainless steel horizontal multistage pumps with permanent magnet motors - Integrated eSM inverter drives with control and parameter editing interface - 2 WRAS approved pressure vessels - 2 pressure transducers - Individual isolation valves per pump - Non return valve per pump - Control panel - Common base frame
2. All intelligent control is within the inverters, the panel contains only a door-interlocked isolator, individual pump isolators, power on, low water, and fault lamps. A common fault volt-free contact and low water device connection contacts are included as standard.
3. WRAS approved pressure vessel to maintain energy efficiency in low demand situations, incorporating drain-down facility for ease of maintenance - Dual pressure transducer operation for accurate measurement and fault backup - Individual isolation valves per pump allowing maintenance and servicing while the unit is fully operational. - Non-return valve per pump - Integrated control panel with HMI touchscreen display for user-friendly control and operation - Use of standard spare parts resulting in ease of ongoing maintenance and reduced lifecycle costs - Common base frame containing all components allowing simple transportation and installation, incorporating anti-vibration mounts for reduction of noise transmission from mechanical components. - 16 bar maximum operating pressure.
4. Pump to be duty/standby.

## 6646 Carters, Reading: Apartment Block B1 - Booster Pump Schedule

|                                        |  |           |             |                           |                  |                 |                     |               |              |
|----------------------------------------|--|-----------|-------------|---------------------------|------------------|-----------------|---------------------|---------------|--------------|
| Plant/equipment Supplier.<br>Dutypoint |  |           | Drg Ref(s): | 6646-P-B1-00-100-53-150   |                  |                 |                     |               |              |
| Rev C02                                |  |           |             |                           |                  |                 |                     |               |              |
| Model                                  |  | Duty head | No. Of      | Location                  | Noise Data (dBA) | Flow Rate (L/s) | Flow per pump (L/s) | FLC Total (A) | Power (kW)   |
| VT3-10-030T<br>Duty/Assist/Standby     |  | 4 Bar     | 1           | BCW Plantroom<br>Block B1 | 60               | 7.6             | 3.8                 | 18            | 3 (per pump) |

### Notes

1. Triple Pump, Variable Speed, High Efficiency Cold Water Booster Sets, Featuring: 3 stainless steel vertical multistage pumps with high-speed motors allowing wide operating range - Integrated variable speed inverter drives with control and parameter editing interface - WRAS approved pressure vessel to maintain energy efficiency in low demand situations, incorporating drain-down facility for ease of maintenance - Dual pressure transducer operation for accurate measurement and fault backup - Individual isolation valves per pump allowing maintenance and servicing while the unit is fully operational - Non-return valve per pump - Integrated control panel with HMI touchscreen display for user-friendly control and operation - Use of standard spare parts resulting in ease of ongoing maintenance and reduced lifecycle costs - Common base frame containing all components allowing simple transportation and installation, incorporating anti-vibration mounts for reduction of noise transmission from mechanical components
2. WRAS approved.
3. 15 bar maximum operating pressure.
4. Pump to be duty/assist/standby.

## Appendix 4    Modelling Results

### Modelling Software:

CADNA/A Version 2024

### Modelled Scenarios:

Rated plant noise levels across the development and surrounding area.

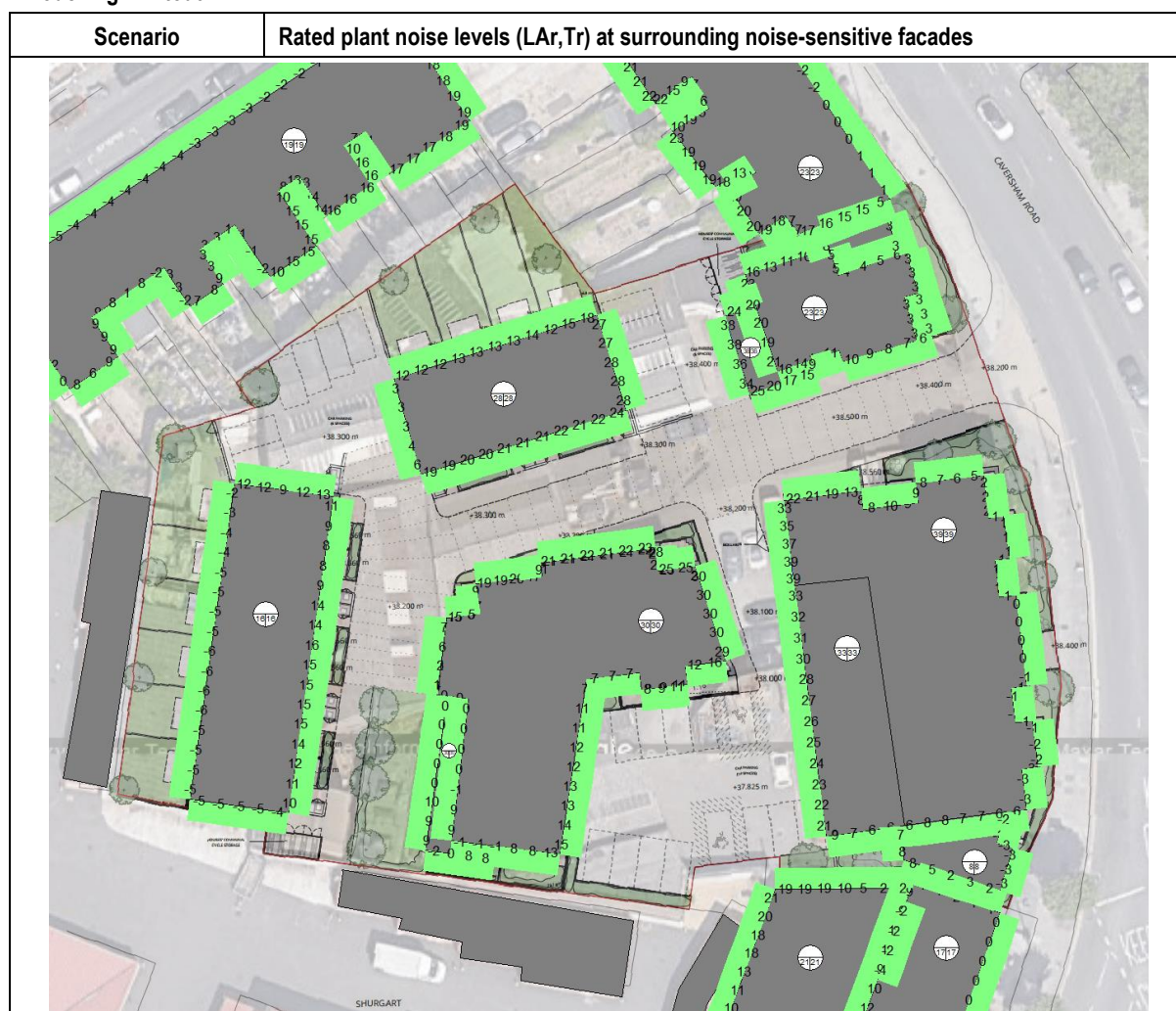
### Data inputs:

- Noise survey results
- Development layout
- Spectral Rated Pump Noise Levels

### Calculation Algorithms Used:

- ISO 9613-1:1993 Acoustics-Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere
- ISO 9613-2:1996 Acoustics-Attenuation of sound during propagation outdoors – Part 2: General method of calculation

### Modelling Printout:





## Architectural & Environmental Consultants

### Acoustics | Air Quality | Overheating

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