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**VANGUARDIA**

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A BURO HAPPOLD COMPANY

# **Co-op Live, MANCHESTER**

## **Noise Management Plan**

**VAN-102859-XX-NMP-Y-3048**

**102859**

20 May 2025

Revision P03



| Revision | Description                                 | Issued by | Date       | Checked |
|----------|---------------------------------------------|-----------|------------|---------|
| P01      | Initial draft for comment and co-ordination | TC        | 17.11.2023 | OC      |
| P02      | Updated with client comments                | TC        | 21.11.2023 | OC      |
| P03      | Updated with Canalside inclusion            | CL        | 20.05.2025 | OC      |

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author                      **Chris Lansdown**

date                              **20.05.2025**

approved                      **Olly Creedy**

signature                      *Olly Creedy*

date                              **20.05.2025**

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# 1 EXECUTIVE SUMMARY

Co-op Live is a purpose-built world class entertainment arena in Manchester, UK. The arena has been built with being a good neighbour in mind. The following document outlines the operational procedures to manage noise from the arena and Canalside activities. A full environmental impact assessment was carried out as part of the planning application that ensured the building was designed to mitigate entertainment noise. Completion testing will be carried out to ensure compliance with the EIA and associated planning requirements. In general the more sensitive side of the site for noise is towards the East along Alan Turing Way, where particular attention should be carried out.

**Music Noise** – Music noise shall be generated internally to the arena. The arena envelope has been specifically designed to meet agreed criteria during the planning stage as part of it's design. It should be ensured the acoustic line of integrity is maintained by closing key door sets and roller shutters as outlined in this document.

**Canalside Noise** – Canalside is an ancillary F&B and retail destination separate from the footprint of the arena. It includes a performance space that is an ancillary use to the main purpose of the Canalside development. Live music will be used in the space in the same way background music would be, with no publicly available tickets for live music events. Ticketed concerts / events, where the primary purpose is to feature a musical artist or performance will not be permitted in this space. Both venues will be capable of operating independently as stand-alone spaces and together as a joint event offering to customers, working to a set of operating modes set out in the operating schedule.

**External PAVA** – External PAVA is provided at the entrance areas to the arena. These are primarily used for crowd management and the usage should be minimised, especially during later hours.

**Load-in/Load-out** – The service yard is enclosed; however careful management is still required where loud works might be carried out. Dismantling of steel shall occur within the arena bowl. Service yard roller shutters shall remain closed unless a truck is passing through. Where possible vehicles shall be fitted with white noise rather than tone reverse alarms where possible.

**Deliveries and Maintenance** – Deliveries and maintenance, outside of event periods, shall normally take place only between the hours of 07:00 and 18:00 in line with the Transport Assessment provided during the Planning stages of this project.

**Plant Noise** – Any noise from plant has been designed to ensure that the noise levels at the nearest noise sensitive receiver is achieved. Over time plant equipment can become noisier if not sufficiently maintained and routine maintenance shall ensure noise from bearings or moving parts do not become degraded and give rise to increased noise levels. Any testing to stand-by or emergency generators should be carried out during social hours and kept to a minimum. Any generators used for broadcast shall be of a 'silent' type and where not possible temporary enclosures might be required.

**Patron/Crowd Noise** – Signage should be used at exits to the building to inform guests leaving to respect the neighbourhood and to keep any noise to a minimum.

## 2 INTRODUCTION

### 2.1 Purpose of Document

Vanguardia limited have been appointed by Eastlands Arena Limited (EAL) to provide a Noise Management Plan, forming part of the Arena Operations Manual, to support the premises license application for Co-op Live, Manchester UK.

An Environmental Impact Assessment (EIA) was submitted and approved as part of the planning application for the development. The EIA outlines noise criteria and targets to which the venue has been specifically designed to along with predictions of crowd and traffic noise levels. This document does not address the environmental impact of noise from the arena which has been covered as part of the planning application.

The purpose of this document is to describe the operational procedures that will form the noise management regime to minimise noise levels emanating from the arena. The operational noise management plan shall be a working document and should be updated to reflect any amendments to the noise management strategies or procedures.

### 2.2 Development Usage Overview

Co-op Live is a new multipurpose indoor arena due for completion in 2024. The arena has been specifically designed with being a good neighbour in mind.

The main noise generating sources are:

|                            |                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Arena Bowl</b>          | Shall host a variety of entertainment types, including live music concerts. The majority of entertainment events shall finish before 23:00 hours. Where events exceed 23:00 hours, these will be reviewed on a case-by-case basis.                                                                                                                          |
| <b>Canalside</b>           | Shall host a ancillary background amplified sound where the highest noise levels are expected from the performance area. The operating time shall be 08:00-22:00, with amplified music from 10:00-22:00 dependent on event mode.                                                                                                                            |
| <b>Co-op Backstage Bar</b> | A Premium area specially designed to be capable of providing exclusive entertainment, including music, post 23:00. The acoustic envelope of the building to this space has been enhanced to ensure compliance.                                                                                                                                              |
| <b>The Street</b>          | A General Admission area designed to be able to accommodate events separately from the main arena bowl either before, after or on days where there are no events in the Arena Bowl. The street is located on the West side of the building, which is shielded from the nearest residents and breakout is to be monitored as part of the completion testing. |

In addition to the above, the arena will feature concourses, VIP lounges and Suites which have been provided with small, distributed sound systems capable of background and light foreground music as well as potentially loud crowd noise levels.

Whilst the arena will generate high levels of music and crowd noise, the envelope of the building has been designed to contain the sound and provide sufficient attenuation of noise to the residential receivers.

It is understood that no entertainment shall take place externally after 22:00.

## 2.3 Site Layout and Baseline Conditions

The development is located in Manchester's Etihad Campus, to the North of the Etihad Stadium, and is surrounded by a plethora of commercial establishments. The nearest noise sensitive residential areas are shown in Figure 2-1, with the closest noise receiver being located on the opposing side of Alan Turing Way.

The EIA identifies the following residential properties to be within a radius of potential impact:

- Stuart Street (53.486018, -2.197371);
- Gibbon Street (53.485470, -2.196978);
- Broxton Street (53.489298, -2.204154); and
- Briscoe Lane (53.489879, -2.201055).

When assessing the impact of noise and the subsequent management procedures to control noise to appropriate levels, it is important to consider the baseline noise conditions. The EIA contained a full baseline noise survey completed by Buro Happold in 2019. A short-term measurement was conducted on Stuart Street, representative of the nearest noise sensitive receiver. The following observations were made (when commenting on the existing soundscape on Stuart Street), with Table 2-1 presenting the reported measurement.

*"The noise climate at this location was subjectively found to be moderately loud. Noise sources noted on site were road traffic on Alan Turing Way and Metrolink movements from the nearby tramline. Intermittent noise events included PA announcements from the Metrolink stop and airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way."*

**Table 2—1 Baseline Noise Levels at Stuart Street (representative of Nearest Noise Sensitive Receiver)**

| Location      | L <sub>Aeq,T</sub> – dBA<br>(0700hrs – 2300hrs) | L <sub>AF,max</sub> – dBA<br>(0700hrs – 2300hrs) | L <sub>A90,T</sub> – dBA<br>(0700hrs – 2300hrs) |
|---------------|-------------------------------------------------|--------------------------------------------------|-------------------------------------------------|
| Stuart Street | 63                                              | 74                                               | 56                                              |

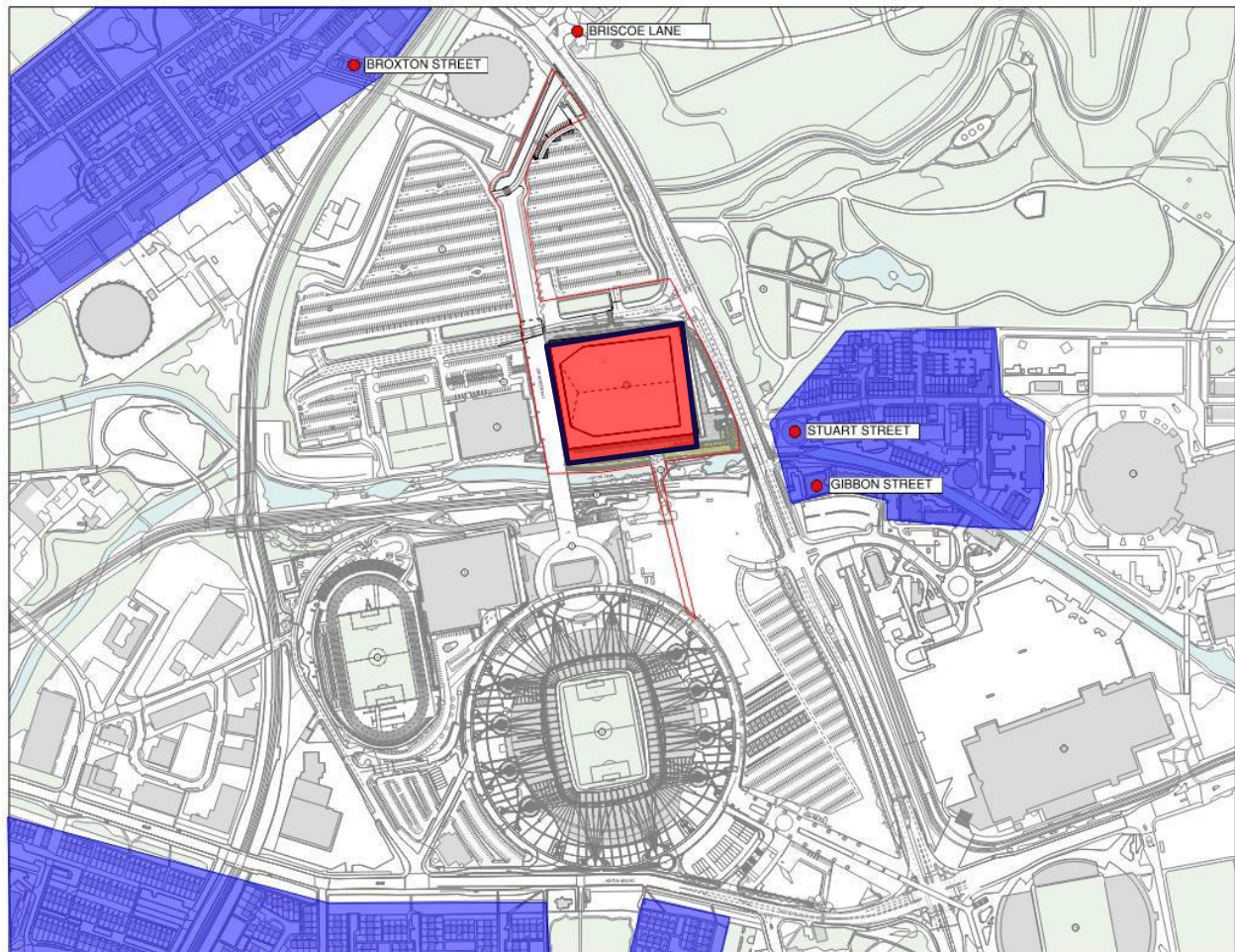


**Figure 2—1 Site Location plan (residential areas highlighted in blue)**

Public entrances to the venue are distributed around the building in each quadrant of the building. The tram stop is situated south-west of the development.

The service yard is located to the residential side of the arena, with the main atrium away from the nearest residents.

## 2.4 Key Personnel

Licensable activities at the premises will at all times be managed by the premises license holder. The venue manager shall have overall responsibility for the noise management of the venue.

Any complaints shall be handled by the reception team and passed onto the Duty Venue Manager as described in section 7.

### 3 NOISE GENERATED BY SOUND SYSTEMS

The arena shall feature 3 major sound system noise sources:

- The arena bowl – Main arena space, hosting the major events within the arena. This could include sporting events, family shows (ie: Disney on Ice, Walking with Dinosaurs) or Music Concerts. In general events will not operate past 23:00.
- The backstage bar – Small capacity VIP Lounge hosting exclusive after parties. Will operate past 23:00.
- The Street – General Admission space hosting pre and post arena bowl events as well as stand alone events. Will operate past 23:00
- Canalside – A small-scale performance area, hosting ancillary F&B and a limited number of private hire events. It will operate between 10:00-22:00 on event and non-event days.

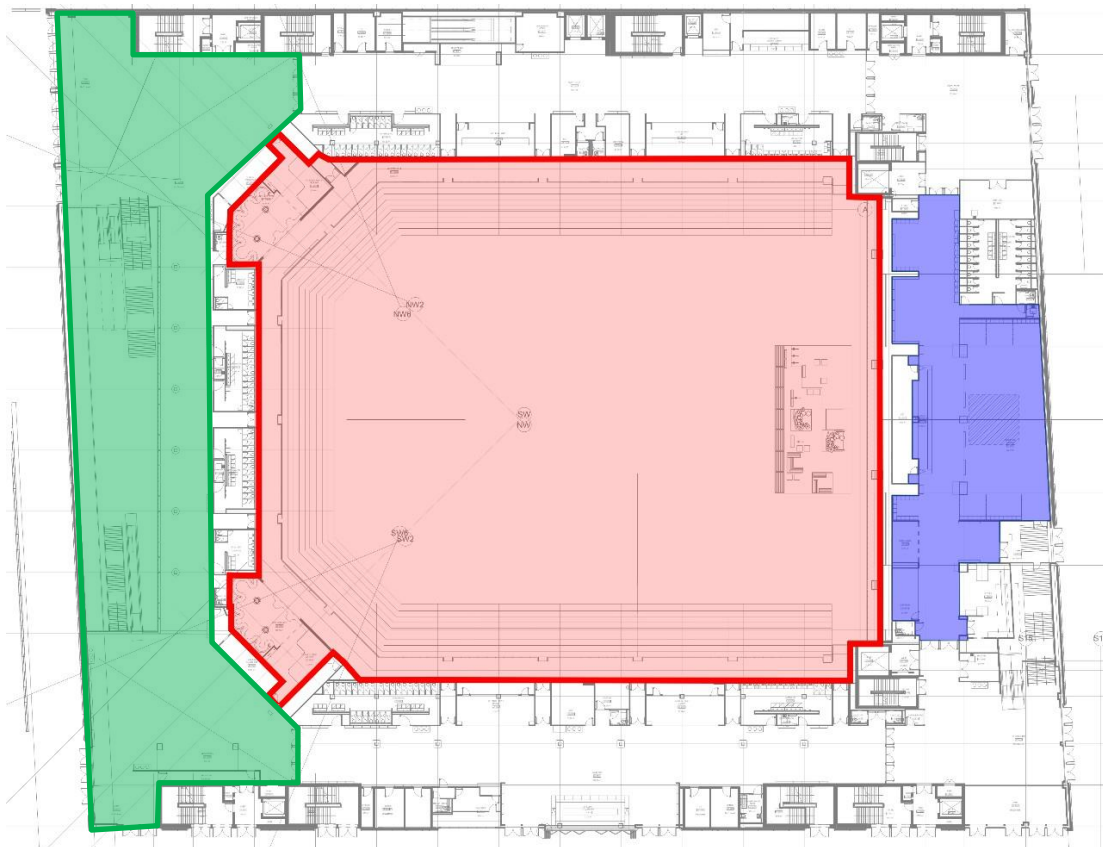


**Figure 3—1 Identification of Major Music Noise Sources. (Red = Bowl, Blue = Back Stage Bar, Green = The Street). Note: Canalside is to the south of the Image and the Nearest Noise Sensitive Receiver is the East of the Image.**

Dressing rooms, lounges and suites have small, distributed, sound systems for the purposes of background, light foreground music and public address, however, these are not expected to be audible outside of the building and no further management is required.

The concourse to the south of the development can be opened to the canalside. When the concourse is open then careful monitoring of external noise is required to ensure no nuisance is being caused to any neighbouring properties.

### 3.1 Arena Bowl

The arena bowl is fully enclosed by a continuous line of integrity. The arena envelope has been purpose designed to the intended use of the arena. The design has been based on typical levels representative of unrestricted entertainment and the agreed noise limits at residential properties forming the planning submission.

The key information from the EIA has been reproduced below in Table 3-1. More detailed information can be found in the EIA and planning submission.

**Table 3—1 Arena Internal Levels, External Limits and Subsequent Required Attenuation**

|                                 | Octave Band Centre Frequency (Hz) |     |     |     |      |      |      | dBA |
|---------------------------------|-----------------------------------|-----|-----|-----|------|------|------|-----|
|                                 | 63                                | 125 | 250 | 500 | 1000 | 2000 | 4000 |     |
| Internal Noise Level            | 116                               | 110 | 104 | 101 | 100  | 92   | 88   | 104 |
| Limits at Residential Receivers | 52                                | 46  | 42  | 41  | 42   | 32   | 19   | 44  |
| Building Envelope (in-situ)     | 35                                | 33  | 31  | 37  | 42   | 33   | 34   | -   |

The sound insulation of the arena bowl shall be demonstrated through post completion testing by Vanguardia.

The doors to the arena form a significant part of the acoustic strategy and careful management is required to ensure that the noise envelope is not compromised. During operation of music events the following measures will be considered:

- Doors to the arena bowl should be closed unless being used for access.
- Doors on the North Foyer should be closed unless being used for access.
- Roller shutters between the arena bowl and service yard should be closed and remain closed unless of an emergency.
- Roller shutters between the service yard and external areas should be closed and remain closed unless of an emergency.
- Doors between the bowl and service yard should be closed unless being used for access.
- Doors between the service yard and external areas should be closed unless being used for access.
- Gantry access doors should be closed and remain closed unless of an emergency.

### 3.2 Co-op Backstage Bar

The external wall of the Co-op Backstage Bar has been enhanced to enable high internal noise levels outside of the normal operational hours of the venue.

The sound insulation of the Co-op backstage bar shall be demonstrated through post completion testing by Vanguardia.

The Co-op backstage bar features doors on the eastern elevation, facing the nearest residential receiver. These doors have been lobbied to increase sound insulation. The doors should be closed unless for access. These will be required to be managed to ensure compliance.

In addition, doors to the GA concourses at the North and South ends should be closed as well as the doors leading to external areas; unless for access.

### 3.3 Concourses, Suites and Lounges

Concourse, suites and lounges shall feature small, distributed sound systems for the purposes of background and moderate foreground music. These systems shall be operated at a reduced volume with notably less sub-bass frequencies compared to the arena bowl and backstage bar.

The external walls of the arena have been acoustically rated such to provide sufficient attenuation to the residential receivers, as described in the EIA. Access doors to the arena should be closed unless for access. No further management is expected to be required for suites and lounge sound systems under normal operations.

For any out of hours events then access shall be encouraged via the West entrances to minimise any noise to the sensitive areas to the East.

### 3.4 External Sound Systems

External sound systems shall be used for crowd management, emergency purpose and low background music only. Their usage shall be limited, and background music should only be used prior to an event and will not be used when patrons are exiting the venue.

### 3.5 Canalside

Canalside includes a performance space that is an ancillary use to the main purpose of the Canalside development. Split into two areas (performance and background), the performance space has been defined where the highest noise levels are expected. Loudspeakers are directed away from residents and local facilities. Suitable noise levels have been defined in the noise report, however, specific levels will be 'set' during commissioning. The predicted noise levels satisfy the requirements of Manchester City Council guidance and demonstrate that the noise impact from music associated with the Canalside development is unlikely to give rise to complaint.

## 4 OPERATIONAL NOISE

### 4.1 Load-in and Load-out

Where possible, load-in and load out activities shall be conducted in either the arena bowl or the service yard with roller shutters and doors closed to form a continuous acoustic enclosure to attenuate noise.

Practical steps shall be taken to minimise noise impact during load in/out which are outlined below. In many cases these features are common practice.

- Briefing session or document to all touring personal prior to the event.
  - o Refrain from shouting when communicating;
  - o Refrain from dropping scaffold bars;
  - o Carefully place down any Mojo barrier rather than dropping it to the arena floor;
  - o Carefully tip flight cases into trucks;
  - o Use of rubber mallets;
  - o Keep all doors closed;
  - o Limit activity outside of the acoustically enclosed areas to a minimum.
- The service yard is designed for use by 12 vehicles at any one time. Remaining vehicles will be parked off-site although a limited amount may be parked along the service road to the East side of Blue Car Parks for a limited time until space is available inside the Service Yard..
- A maximum site speed limit of 10mph should be observed.
- Heavy Goods Vehicles will not have idling engines. When unused the vehicle should be stopped.
- The amount trucks need to manoeuvre should be minimised and number of trucks manoeuvring simultaneously should be minimised as far as possible.
- Vehicles should use broadband noise reversing alarms, if available, rather than high-frequency narrow band alarms.
- Service yard doors should be closed at all times unless a truck is passing through. Vehicle access should be minimised where possible.
- De-rigging and loading of trussing or other metal work should take place within the arena bowl as far as possible with the acoustic envelope closed to utilise the high level of sound attenuation this provides.
- Trucks driving into the arena floor to be loaded up decreasing travel time of flight cases and fork-lift trucks as well as keeping noise within the main acoustic envelope of the development.

## 4.2 Deliveries and Maintenance

Arena deliveries shall be via the arena service yard.

Deliveries shall normally only take place between the hours of 07:00 and 18:00. Doors of the service yard shall be closed whilst the delivery is being unloaded (ie: only opened for access). The engine of the truck shall also be deactivated and not left in an idling state. At Canalside all deliveries and servicing will take place through Co-op Live, utilising current arrangements through the service yard on Sports City Way. Movement between Co-op Live and Canalside will take place on the podium between the two venues at appropriate operating times.

Where possible delivery times shall be staggered to avoid multiple deliveries at the same time.

Maintenance operations, including but not limited to, street cleaning, jet washing, emergency generator testing and construction shall normally only take place between the hours of 08:00 and 18:00.

Any glass collections can be particularly noisy and where possible it is recommended that any glass waste collections are carried out during daytime hours between 08:00 and 18:00. Where it is not possible any waste collection must be monitored and supervised to ensure minimal noise disturbance to the East of the site. The waste compound is located to the west of the site, which provides some level of screening to residents. Any waste from Canalside is expected to be minimal. It will be 2 bins maximum for customers to dispose of packaging, 2 food bins in the kitchen and 2 bottle bins for the bar. All waste created from product creation will be absorbed into the current waste regimes of Co-op Live, including storage and disposal, ensuring no additional waste holding areas are created.

The compactor located in the service yard shall be operated when the service yard doors are closed.

## 5 CROWD NOISE

### 5.1 Internal Crowd Noise

Whilst high crowd levels will be generated internally in the arena, it is unlikely these will exceed the music noise levels generated and thus the measures in place for attenuating music noise levels will likely attenuate crowd noise levels sufficiently for both the bowl and concourse areas.

Please refer to section 3 of this noise management plan for details on the envelopes of the associated areas and the noise management strategies for maintaining the acoustic integrity of the envelope.

### 5.2 Arena Egress

The impact of crowd noise on the noise sensitive receivers was studied in the EIA. Table 10.17 of the EIA describes the impact of operational crowd noise at residential properties to be negligible. Please refer to the EIA for more details.

The impact of crowd noise can be minimised through practical and suitable operational measures. These include, but are not limited to:

- Egress strategies outlined in the operational plan to quickly and effectively disperse crowds away from the area, including the provision of sufficient transport links;
- Keeping exit and paths unblocked and free moving (to be complete by stewards);
- Signage externally on egress routes to clearly direct people in the direction they need to go;
- Direct and keep people away from the noise sensitive receivers. It is understood that the main public entrance, city centre and metro link are all on the opposite side of the arena to the nearest noise sensitive receiver.
- Sufficient steward presence and strategic placement to move the public on and avoid loitering, particularly into the late hours of the night;
- Stewards can also intervene where suitable, safe and required to any disruptive or loud behaviour;
- Signage internal to the arena, such as via the IPTV system, to display 'Please be respectful of our neighbours and leave quietly' messages as people are exiting the arena;
- Pre and Post show entertainment/bar offerings to stagger the arrival and exit times of people.
- Apart from an Emergency Evacuation or where required to improve crowd movement, patrons will be encouraged to not use Alan Turning Way as a way into or away from the arena

Please note that a separate document detailing the proposed arena egress procedure is available for further information on this subject.

### 5.3 Co-op Backstage Bar Egress

Egress from the Co-op Backstage Bar will likely occur in the early hours of the morning. This shall be for a smaller capacity of people, which will naturally reduce the noise impact

Due to the proximity of the backstage bar to the nearest residents, careful management of people leaving is required. Clear signage shall be provided to ensure people leave quietly and respect the neighbours. The arena management will have a process in place to direct customers away from that part of the site as efficiently as possible.

## 5.4 The Street

Egress from The Street from time to time may take place in the early hours of the morning. As this space exits on the West side of the arena, it is furthest from the nearest residents. However, arena management will have processes in place to ensure that noise from customers is kept to a minimum and the movement of customers away from the arena is done away from the residents,

## 5.5 Canal Front

The arena features an outdoor area overlooking the canal, which is approximately 150m from the nearest noise sensitive receiver. Whilst the distance is so great that it is unlikely for crowd noise to be an issue above the existing baseline noise measurements, it is recommended signage is used to remind people to be respectful of the neighbours to reduce the likelihood of excessive noise levels as well as steward presence to manage proceedings.

## 5.6 Canalside Egress

Fan dispersal for Canalside shall replicate the main arena, ensuring 'be a good neighbour' approach adopted.

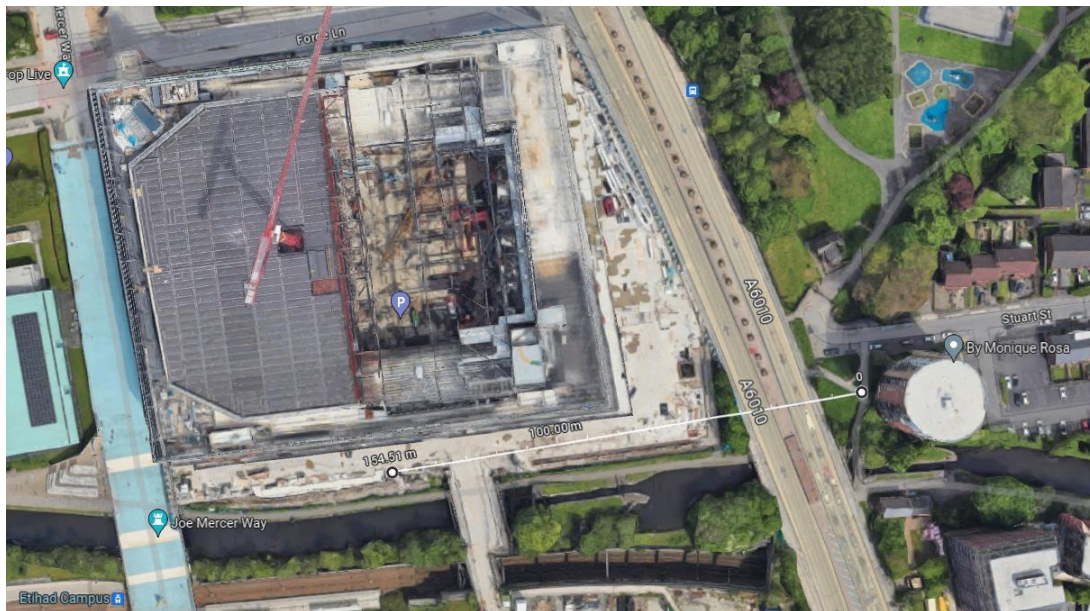


Figure 5—1 Canal front location relative to nearest Noise Sensitive Receiver

## 6 PLANT NOISE

### 6.1 Permanent Plant

The design of permanent plant associated with the scheme has been designed such that no operational intervention is required.

### 6.2 Temporary Event Plant

It is proposed that any temporary plant, such as generators associated with broadcast events or plant for Ice shows, are dealt with on a temporary ad-hoc basis. When temporary plant is located on the dedicated external broadcast area, then silent type generators shall be used whenever possible and this will be recommended to any incoming broadcaster and event owner. Where external plant equipment is expected to be audible at the nearest residential receiver, then additional temporary barriers shall be provided (Eg. Echo barrier).

Temporary plant should not operate past 23:00 where possible. Where it may be required to operate past 23:00 hours, low noise plant should be selected and any night operating modes which decrease noise levels should be engaged along with any temporary barriers.

### 6.3 Special Effects/ Pyrotechnics

The discharge of any CO<sub>2</sub> cannons or pyrotechnics post show shall commence in the arena bowl only with the acoustic envelope closed. This shall provide sufficient attenuation which would likely render noise from these activities inaudible within a bedroom at the nearest noise sensitive receiver.

## 7 COMPLAINTS PROCEDURE

### 7.1 Procedure

In the unlikely event a complaint is received, information about the complaint shall be recorded and passed onto the Duty Venue Manager for investigation.

The complaints procedure shall follow a standard Identification, Investigation, Action and Recording procedure; outlined in Figure 7-1 below. Contact details for the arena for noise complaints will be advertised to the local residents pre opening in April 2024.

**Identification** – Complaint is raised with the venue either directly from a local resident or a local resident via the local authority. This is recorded by the venue.

The receiver of the complaint shall try to get as much information from the complainant. Such as but not limited to:

- Location
- Time
- Type of Noise (music, pedestrian etc)
- Context of noise (swearing, very loud, abusive etc)
- Duration

**Investigation** – The Duty Venue Manager has overall responsibility for the management of noise levels. They should be made aware of any noise related complaint and shall instruct a suitable member of their team to investigate the complaint to establish the primary cause. This may involve monitoring the location in which the complaint came from during upcoming events.

**Action** – if a reasonable complaint has been identified then suitable actions need to be made to mitigate the noise complaint within a reasonable time. In some cases, the noise source might have already stopped, but measures should be taken to avoid future complaints.

**Recording** – Once the cause of the complaint is established, reasonable and practical measures to reduce the likelihood of the complaint re-occurring should be taken. This change should be monitored at the next suitable event to assess its effectiveness. If successful, any adapted or updated operational procedures should be reflected in the operational management plan.

Contact details will be made available prior to the first event in the arena.

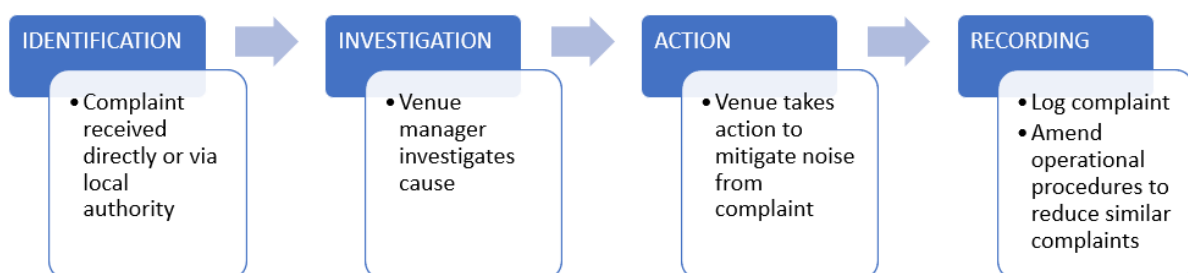


Figure 7—1 Complaints Protocol

## 8 NOISE AT WORK

### 8.1 Noise at work Regulations

The Control of Noise at Work Regulations 2005 (the Noise Regulations) came into force for all industry sectors in Great Britain on 6 April 2006 (except for the music and entertainment sectors where they came into force on 6 April 2008). The Control of Noise at Work Regulations 2005 specify action values and exposure limit values for daily personal noise exposure (or weekly personal noise exposure) and peak sound levels.

Daily personal noise exposure (LEP,d) is a measure of the total noise received by an employee over the working day. Daily personal noise exposures depend both on noise levels experienced at work and on the time spent in the noise. A high level noise for a short time will give the same noise exposure as a lower level noise for a longer time, if the total sound energies of the two noises are the same. For an eight-hour working day, the average noise level over the eight hours is numerically equal to the daily personal noise exposure. For example, an employee working for 8 hours in a noise level of 75 dB(A) will have a noise exposure of 75 dB(A) LEP,d. However, if the time spent is less than 8 hours the noise exposure will be less than 75 dB(A) LEP,d, and if the time is longer than eight hours the noise exposure will be more than 75 dB(A) LEP,d.

Weekly personal noise exposure (LEP,w) is a measure of the total noise received by an employee during a working week. It is similar to the daily noise exposure but is calculated for a 40-hour week (five 8-hour days) instead of an 8-hour day. (International standards use the symbol LEX,8h in place of LEP,w)

Peak sound pressure level (LCpeak) is the instantaneous C-weighted peak sound pressure level occurring at any time during the working day.

#### The lower exposure action values are

- 80 dB(A) LEP,d or 80 dB(A) LEP,w - ie a daily or weekly personal noise exposure of 80 dB(A)
- 135 dB(C) LCpeak - ie a peak sound pressure level of 135 dB(C).

#### The upper exposure action values are

- 85 dB(A) LEP,d or 85 dB(A) LEP,w - ie a daily or weekly personal noise exposure of 85 dB(A)
- 137 dB(C) LCpeak - ie a peak sound pressure of 137 dB(C).

#### The exposure limit values are

- 87 dB(A) LEP,d or 87 dB(A) LEP,w - ie a daily or weekly personal noise exposure of 87dB (A); ie
- 140 dB(C) LCpeak - ie a peak sound pressure of 140 dB(C).

The exposure action values are ambient noise levels in the workplace at the worker's location and do not take into account the effect of any hearing protection. The exposure limit values however, do take the effect of hearing protection into account.

Employers must ensure that risk from the exposure of employees to noise is either eliminated at source or, where this is not reasonably practicable, reduced to as low a level as is reasonably practicable.

If one of the lower exposure action values is likely to be exceeded, an employer needs to carry out a risk assessment to assess whether any employees are likely to be exposed to noise at or above a lower exposure action value, an upper exposure action value, or an exposure limit value.

## 8.2 Lower exposure action value

Where noise exposures exceed the lower exposure action value the employer must make suitable hearing protection available to any employee who wants to use it, though employees do not have to wear it. The employer must also provide information and training on the following;

- the nature of risks from exposure to noise;
- the organisational and technical measures taken in order to reduce noise exposures;
- the exposure limit values and upper and lower exposure action values;
- the significant findings of the risk assessment;
- the availability and provision of personal hearing protectors and their correct use;
- why and how to detect and report signs of hearing damage;
- the entitlement to health surveillance and its purposes;
- safe working practices to minimise exposure to noise; and
- the collective results of any health surveillance undertaken.

## 8.3 Upper exposure action value

If any employee is likely to be exposed to noise at or above an upper exposure action value, the employer must reduce exposure to as low a level as is reasonably practicable by establishing and implementing a programme of organisational and technical measures, excluding the provision of personal hearing protectors, which is appropriate to the activity. Specific measures to consider are;

- other working methods which reduce exposure to noise;
- choice of appropriate work equipment emitting the least possible noise, taking account of the work to be done;
- the design and layout of workplaces, work stations and rest facilities;
- suitable and sufficient information and training for employees, such that work equipment may be used correctly, in order to minimise their exposure to noise;
- reduction of noise by technical means;
- appropriate maintenance programmes for work equipment, the workplace and workplace systems;
- limitation of the duration and intensity of exposure to noise; and
- appropriate work schedules with adequate rest periods.

## 8.4 Noise at work actions

It is expected that even with durations of 10 minutes in the main arena bowl the daily limits will be exceeded for the upper exposure action levels. It is the duty of the employer to ensure the following measures are taken place;

- Provide the worker with training about hearing damage and protection.
- Provide suitable hearing protection, which must be worn

Areas where high-noise levels are likely to be experienced to exceed the upper action levels include the backstage bar and the West Atrium spaces. Noise levels should be monitored, and the required actions taken in accordance with the HSE control of noise at work regulations.

There is potential for all other areas of the building (lounges, plantrooms etc) to exceed the lower action noise level and all staff shall be suitable trained and provided with hearing protection.

Regular monitoring of noise levels across the venue should be carried out to determine the actions required to be taken.

## 9 STAFF TRAINING

All staff working at the premises will be trained in the content of the NMP and be aware of their duties and responsibilities under it. The Licensee will ensure that all relevant staff will adhere to their duties. Records of staff training will be kept alongside the NMP to demonstrate that all staff have been trained in its content and are aware of their duties and responsibilities.

The noise management procedure will be reviewed on an annual basis or whenever there is a significant change at the premises, whichever is sooner.

## **APPENDIX A: ENVIRONMENTAL STATEMENT – VOLUME 2, MARCH 2020, SECTION 10, PARTIAL ONLY**

The following Appendix contains a partial extract from Volume 2 of the Environmental Statement related to the scheme, dated March 2020; provided to Vanguardia.

A full version of the Environmental Statement is available through the Manchester City Council planning portal.



# 10 Noise and Vibration

## Introduction

- 10.1 This Chapter of the ES has been prepared by BuroHappold and assesses the likely noise impacts of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts and the likely residual impacts after these methods have been adopted.
- 10.2 This Chapter is accompanied by four technical appendices:
- Noise Survey Results (Appendix 10.1);
  - Construction Noise Assessment (Appendix 10.2);
  - Construction Traffic Noise (Appendix 10.3); and
  - Operational Traffic Noise (Appendix 10.4).
- 10.3 This report's author holds a BSc (Hons), PGDip, and is a full member of the Institute of Acoustics.

## Limitations and Assumptions

- 10.4 It is considered good practice (and is required in certain standards such as BS 4142:2014) to consider the degree of uncertainty inherent in any engineering calculations or predictions as well as details of difficulties (for example, technical deficiencies or lack of knowledge). Uncertainty should be reported and minimised wherever possible. Professional engineering consultants should acknowledge that all calculation-based modelling practices are ultimately an approximation (and this is reflected in standards such as BS 4142:2014).
- 10.5 However, rather than ignore this fact or consider the results absolute, it is considered good practice to honestly report factors which can affect the robustness of any assessment. The following is considered relevant to the project.

## Distance and ground conditions

- 10.6 Ultimately, algorithms used to calculate distance attenuation are approximations. However, within all calculations, ground absorption and diffusion (which can be helpful in terms of attenuating sound with distance) have been set to pessimistic levels (i.e. assuming reflective ground).
- 10.7 In this way, a worst-case scenario can be modelled, increasing the robustness of the assessment.

## Instrumentation

- 10.8 The instrumentation used is calibrated by UKAS-approved laboratories in accordance with the required schedule of frequency. It is, however, noted that the degree of measurement tolerance of most Class 1 sound level analysers is approximately 1-2 dB, meaning that two independently verified meters could measure the same sound level and report marginally differing values.
- 10.9 There is little that can realistically be done to avoid this phenomenon; however, this supports the assertion that professional judgement must be used in concert with quantitative values when making conclusions in support of the assessment.

## Construction methodology

- 10.10 The construction methodology, plant selections and specific procedures on the Site have not been defined at this stage. An Outline Construction Management Plan by Turner and Townsend dated January 2020 (Appendix 5.1) provides a preliminary construction plan so that assumptions can be made regarding the likely activities and the type of machinery to be used during the site development.

### **Noise sensitive receptors**

- 10.11 Receptors have been selected to account for existing receptors and any residential developments in the area that are currently under construction or are approved for development and which will be completed during the operational development construction phase of the Proposed Development.

### **Cumulative assessment**

- 10.12 Due to distance attenuation, the only schemes that have been considered for the cumulative assessment are those within 200 m of the Proposed Development red line boundary. As no development falls within the 200 m radius from the Proposed Development, the cumulative noise and vibration effect can be assumed to have a negligible significance of effect.

### **Range of Events**

- 10.13 It is expected that events in the opening year of 2023 will be in the region of 120 No. events and increasing to approximately 180 events by the year of 2026. The assessment of noise and vibration has been completed based on 180 No. events a year at the Proposed Development to represent the expected upper end of event numbers.

### **Legislative and Policy Context**

- 10.14 This ES chapter has been considered in the context of up to date planning policy, as follows.

#### **National Planning Policy**

- National Planning Policy Framework (2019);
- The Noise Policy Statement for England (2010); and
- National Planning Practice Guidance on Noise (2019).

#### **Local Planning Policy**

- Manchester Core Strategy, Saved Policies of the UDP (2012)
- Manchester City Council (MCC), Planning and Noise, Technical Guidance (2015)

#### **Relevant British Standards**

- British Standard 4142:2014 Method for rating and assessing industrial and commercial sound;
- British Standard 7385:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration;
- British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting;
- British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise;
- British Standard 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration; and
- British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.

#### **Other policy and guidance**

- World Health Organisation (WHO), Guidelines for community noise (1999);
- Calculation of Road Traffic Noise (CRTN);
- Design Manual for Roads and Bridges (DMRB);
- CALTRANS transportation and construction induced vibration guidance manual (2013); and
- Institute of Environmental Management & Assessment (IEMA), Guidelines for environmental noise assessment (2014).

## Assessment Methodology and Significance Criteria

### EIA scoping

- 10.15 The approach to the assessment methodology has been agreed through an EIA Scoping process with MCC.
- 10.16 The residential properties which could potentially be affected are to the north, east and west of the Proposed Development, and are listed below (OS coordinates in brackets):
- Stuart Street (53.486018, -2.197371);
  - Gibbon Street (53.485470, -2.196978);
  - Broxton Street (53.489298, -2.204154); and
  - Briscoe Lane (53.489879, -2.201055).
- 10.17 The scoping opinion for the development from MCC (dated 15 January 2020, ref. JA/DMN) states, *"Impact on the canal corridor and infrastructure should also be considered within this assessment in order to determine any potential impacts from vibrations and machinery during the construction phase given that vibrations could undermine the stability of associated infrastructure"*. As such, this has been addressed in this assessment
- 10.18 A map of the Site is provided for reference in Figure 10.1.

### Baseline study methodology

- 10.19 Noise monitoring surveys were undertaken to determine the existing background noise levels near the identified noise sensitive receptors (NSRs) and at the proposed site boundary. As such, measured traffic noise data has been used for baseline assessments. The attended and unattended surveys were carried out from Tuesday 18 June 2019 at 11:00 hours to Wednesday 20 June 2019 at 11:00 hours, at Locations 1, 2 and 3 (as presented in Figure 10-2). These dates and times were chosen to measure noise levels during an event (Metallica concert on the evening of the 18th June 2019) at the nearby Etihad stadium. These measurements are considered worst-case for the Proposed Development including consideration of football matches which are likely to have a lower attendance and limited use of sound systems i.e. lower noise level generation. However, where 'baseline' noise levels have been presented, these have been chosen according to noise levels when there was no event at the Etihad i.e. baseline conditions. The measurements were conducted with the microphone positioned on a tripod and located approximately 1.5 m above ground level. Results from this noise survey can be found in Appendix 10.1.
- 10.20 The measurements were conducted using a Class 1 sound level meter, which was calibrated before and after the measurements. No significant drift was observed. The meter was set to record the noise levels in 15-minute intervals. Weather conditions during the surveys were generally dry with periods of precipitation, temperature approx. 15°C, and wind speeds up to 10 m/s (occasionally gusty).
- 10.21 As the Proposed Development is located more than 25 m from the nearest greatest source of vibration, i.e. the Metrolink line to the south, it is expected that vibration impact will be negligible in terms of the impact upon the building. This follows BS 5228-2 advice that indicates that vibration activities are generally only considered when located 20 m or less from sensitive locations. As such, a pre-development baseline vibration survey has not been undertaken.

### Assessment Approach

- 10.22 This ES chapter has been undertaken in accordance with best practice and has been informed by the guidance documentation described in the following Section "Assessment of effect". Specific guidance has been referenced within each of the assessments. Effect prediction has used a range of recognised calculation and modelling methodologies, which have been coordinated through the use of standard acoustic theory.
- 10.23 The assessment methodologies include:

## Construction noise

- Construction noise prediction methodology (ABC method of BS 5229-1, 2009);
- Construction noise significance (Annex E of BS 5228-1, 2009);
- Construction vibration significance (BS 5228-2:2009+A1:2014; and,
- Construction traffic noise prediction methodology (Design Manual for Roads and Bridges, 2011).

## Operational noise environmental impact

- Mechanical plant and equipment prediction method (BS 4142, 2014);
- Traffic noise prediction methodology (Design Manual for Roads and Bridges, 2011, "DMRB"); and
- Internal and external noise criteria from external noise sources (BS 8233, 2014; IEMA Noise Impact Assessment, 2016; and the World Health Organisation's "guidelines for community noise" (WHO).

10.24 This assessment considers the potential effect on the surrounding area from noise and vibration during the construction and operational phases of the Proposed Development.

10.25 The methodology for assessing the significance of effect is based on the sensitivity of the receptor and the numerical difference between the baseline level and predicted level.

## Assessment of effects

### Receptor sensitivity

10.26 The criteria used to assess receptor sensitivity is described in Table 10.1.

Table 10.1 Criteria for determining receptor sensitivity

| Sensitivity | Criteria                                                                                                                                                                                                                                                                                          |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High        | The receptor has little ability to absorb change without altering its present character, or it is of international or national importance. Examples: Residential properties, hospitals, care homes, hotels, schools, universities, research facilities, national parks.                           |
| Moderate    | The receptor has moderate capacity to absorb change without significantly altering its present character, or it is of high importance. Examples: Offices, shops, outdoor amenity spaces (e.g. parks and gardens), long distance footpaths, doctor surgeries, sport facilities, places of worship. |
| Low         | The receptor is tolerant to change without detriment to its character, or it is of low or local importance. Examples: Warehouses, light industry, car parks, agricultural land.                                                                                                                   |
| Negligible  | Heavy industry, motorways and railway line.                                                                                                                                                                                                                                                       |

10.27 For the assessment of the Proposed Development, high sensitivity receptors have been assessed to identify the worst-case impacts. Other moderate / low / negligible sensitivity receptors are the same distance or further away than the identified high sensitivity receptors, and therefore as long as residential receptors are not adversely affected then less sensitive receptors will also not be adversely affected.

10.28 For this assessment the canal side is considered a low sensitivity receptor with regard to construction vibration effects.

## Identified receptors and their sensitivity

10.29 The identified closest high sensitivity receptors along with their noise and vibration sensitivities are identified in Figure 10.2 and presented in Table 10.2.

Table 10.2 Identified receptors and their sensitivity

| NSR # | Receptor       | Sensitivity | Justification |
|-------|----------------|-------------|---------------|
| A     | Stuart Street  | High        | Residential   |
| B     | Gibbon Street  | High        | Residential   |
| C     | Broxton Street | High        | Residential   |
| D     | Briscoe Lane   | High        | Residential   |

Note that moderate / low / negligible sensitivity receptors have not been identified in Figure 10.2 and Table 10.2 for the reasons stated in paragraph 10.27 above.

### Magnitude of change / impact

10.30 The criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, are described in Table 10.3.

Table 10.3 Criteria for determining magnitude of change / impact

| Magnitude  | Criteria                                                                                                                                                                                                                                                                              |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Large      | Total loss or major / substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character / composition / attributes will be fundamentally changed.                                                                 |
| Medium     | Loss or alteration to one or more key elements/features of the baseline conditions such that post development character / composition / attributes of the baseline will be materially changed.                                                                                        |
| Small      | A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible / detectable but not material. The underlying character / composition / attributes of the baseline condition will be similar to the pre-development circumstances/situation. |
| Negligible | Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.                                                                                                                                                                 |

10.31 Table 10.4 presents a summary of the quantitative criteria used to assess the magnitude of impact of each assessment.

Table 10.4 Summary of criteria for determining the magnitude of impact

| Magnitude | Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                             |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|           | Construction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Operational                                                                                                                                 |
| Large     | <ul style="list-style-type: none"> <li>• <b>Construction noise:</b><br/>+10.0 dB &gt; Assessment category</li> <li>• <b>Construction traffic:</b><br/>5.0 dB or more - <math>L_{A10,18\text{hours}}</math> noise change</li> <li>• <b>Construction vibration on humans:</b><br/>10 mm·s<sup>-1</sup> PPV or more</li> <li>• <b>Construction vibration on buildings:</b><br/>Greater than:<br/>– 60 mm/s at 4 Hz increasing to 80 mm/s at 15 Hz<br/>– 80 mm/s at 15 Hz increasing to 200 mm/s at 40 Hz and above</li> </ul> | <b>Operational traffic:</b><br>10.0 dB or more - $L_{A10,18\text{hours}}$ noise change<br><b>Operational noise:</b><br>+10.0 dB or more     |
| Medium    | <ul style="list-style-type: none"> <li>• <b>Construction noise:</b><br/>5.0 to 10.0 dB &gt; Assessment category</li> <li>• <b>Construction traffic:</b><br/>3.0 to 4.9 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> <li>• <b>Construction vibration on humans:</b><br/>1.0 mm·s<sup>-1</sup> PPV or more</li> </ul>                                                                                                                                                                                          | <b>Operational traffic:</b><br>5.0 to 9.9 dB - $L_{A10,18\text{hours}}$ noise change<br><b>Operational noise:</b><br>5.0 to 10.0 dB or more |

| Magnitude  | Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                         |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Construction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Operational                                                                                                                                                                                                             |
|            | <ul style="list-style-type: none"> <li>• <b>Construction vibration on buildings:</b><br/>Greater than:<br/>– 30 mm/s at 4 Hz increasing to 40 mm/s at 15 Hz<br/>– 40 mm/s at 15 Hz increasing to 100 mm/s at 40 Hz and above</li> </ul>                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                         |
| Small      | <ul style="list-style-type: none"> <li>• <b>Construction noise:</b><br/>3.0 to 5.0 dB &gt; Assessment category</li> <li>• <b>Construction traffic:</b><br/>1.0 to 2.9 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> <li>• <b>Construction vibration on humans:</b><br/>0.3 to 1.0 mm·s<sup>-1</sup> PPV</li> <li>• <b>Construction vibration on buildings:</b><br/>Greater than:<br/>– 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz<br/>– 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above</li> </ul> | <ul style="list-style-type: none"> <li>• <b>Operational traffic:</b><br/>3.0 to 4.9 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> <li>• <b>Operational noise:</b><br/>0.0 to 5.0 dB</li> </ul>             |
| Negligible | <ul style="list-style-type: none"> <li>• <b>Construction noise:</b><br/>1.0 to 3.0 dB &gt; Assessment category</li> <li>• <b>Construction traffic:</b><br/>0.1 to 0.9 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> <li>• <b>Construction vibration on humans:</b><br/>0.14 to 0.3 mm·s<sup>-1</sup> PPV</li> <li>• <b>Construction vibration on buildings:</b><br/>Lower than:<br/>– 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz<br/>– 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above</li> </ul>  | <ul style="list-style-type: none"> <li>• <b>Operational traffic:</b><br/>0.1 to 2.9 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> <li>• <b>Operational noise:</b><br/>-10.0 (or less) to 0.0 dB</li> </ul> |
| No change  | <ul style="list-style-type: none"> <li>• <b>Construction noise:</b><br/>&lt; Assessment category</li> <li>• <b>Construction traffic:</b><br/>0.0 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> </ul>                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• <b>Operational traffic:</b><br/>0.0 dB - <math>L_{A10,18\text{hours}}</math> noise change</li> </ul>                                                                           |

### Significance evaluation

10.32 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 10.5.

Table 10.5 Matrix for determining effect significance

|                      |            | Magnitude of change / impact |            |                |            |
|----------------------|------------|------------------------------|------------|----------------|------------|
|                      |            | Large                        | Medium     | Small          | Negligible |
| Receptor sensitivity | High       | Major                        | Major      | Moderate/Minor | Negligible |
|                      | Moderate   | Major                        | Moderate   | Minor          | Negligible |
|                      | Low        | Moderate/Minor               | Minor      | Minor          | Negligible |
|                      | Negligible | Negligible                   | Negligible | Negligible     | Negligible |

10.33 Note that moderate and major effects are considered to be 'significant' for the purposes of this assessment.

10.34 Effects can also be described, for example, as:

- Beneficial or adverse;
- Permanent or reversible;
- Short, medium or long term; and

- Significant (major or substantial) or insignificant (indiscernible or minor).

## Baseline Conditions

### Current baseline

- 10.35 The Site is positioned to the north of the Sportcity, Etihad Campus, Manchester. It is bounded by Sportcity Way to the north, Alan Turing Way to the east, the Ashton Canal to the south, and Joe Mercer Way to the west. Additionally, the 60,000 capacity Etihad Stadium is to the south of the Site, Manchester Tennis and Football Centre to the west, National Squash Centre to the south-west, and the Metro tram stop for Sportcity, Etihad Campus to the south.
- 10.36 The residential properties which could potentially be affected by the proposed works are to the north, east and west of the Proposed Development, and are listed below (OS coordinates in brackets):
- Stuart Street (53.486018, -2.197371);
  - Gibbon Street (53.485470, -2.196978);
  - Broxton Street (53.489298, -2.204154); and
  - Briscoe Lane (53.489879, -2.201055).
- 10.37 The assessment baseline is considered to be the noise and vibration climate in the area just before the scheme commences construction.
- 10.38 Figure 10.2 outlines the location of the noise survey measurement positions that are described in the following sections.

### Short-term Measurement Position 1 (ST-1) – Joe Mercer Way

- 10.39 The noise climate at this location was found to be subjectively quiet. Noise sources noted on site were road traffic from Alan Turing Way and Metrolink movements from the nearby Etihad Campus stop. Intermittent noise events included PA announcements from the Metrolink stop and airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way.

### Short-term Measurement Position 2 (ST-2) – Sportcity Way

- 10.40 The noise climate at this location was found to be subjectively quiet. Intermittent noise events included noise from metal road ironmongery (when driven over) and from airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way.

### Short-term Measurement Position 3 (ST-3) – Stuart Street (NSR)

- 10.41 The noise climate at this location was subjectively found to be moderately loud. Noise sources noted on site were road traffic on Alan Turing Way and Metrolink movements from the nearby tramline. Intermittent noise events included PA announcements from the Metrolink stop and airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way.

### Long-term Measurement Position 1 (LT-1) – Alan Turing Way

- 10.42 A long-term survey was carried out over 48 hours at the south east corner of the proposed site opposite the NSR on Alan Turing Way (see Figure 10.2).
- 10.43 A full set of results from the noise survey can be found in Appendix 10.1. However, Table 10.6 summarises the baseline noise level data that is used in this assessment.

Table 10.6 Baseline noise level data used in the assessment

| Measurement Position | L <sub>Aeq,T</sub> - dBA      | L <sub>AF,max</sub> - dBA | L <sub>A90,T</sub> - dBA |
|----------------------|-------------------------------|---------------------------|--------------------------|
|                      | Daytime (07:00 – 23:00 hours) |                           |                          |
| ST-1                 | 51                            | 67                        | 48                       |
| ST-2                 | 60                            | 77                        | 50                       |

| Measurement Position                    | L <sub>Aeq,T</sub> - dBA | L <sub>AF,max</sub> - dBA | L <sub>A90,T</sub> - dBA |
|-----------------------------------------|--------------------------|---------------------------|--------------------------|
| ST-3                                    | 63                       | 74                        | 56                       |
| LT-1                                    | 69                       | 81                        | 57                       |
| <b>Night-time (23:00 – 07:00 hours)</b> |                          |                           |                          |
| LT-1                                    | 63                       | 79                        | 45                       |

#### Future baseline - 2026 (without the development in place)

- 10.44 The future baseline conditions in absence of the Proposed Development are considered to be as follows. If the development did not go ahead, site conditions could experience these changes:
- Buildings/infrastructure development;
  - Tramlines are likely to be busier; and,
  - Potential for higher noise levels across site due to busier roads.
- 10.45 It is expected that events in the opening year (2023) will be in the region of 120 No. event, increasing to approximately 180 No. events by 2026. The assessment has therefore been undertaken using the anticipated upper end of 180 No. events in 2026.
- 10.46 It is likely that there would be minimal differences between “with development” and “do nothing” approach for noise in terms of the impact on the local area.

#### Identification and Evaluation of Significant Effects

##### Construction effects

- 10.47 Construction has the potential to generate high levels of noise and vibration through activities such as material movements, earthworks, ground improvement and piling, crushing and breaking. These activities have been assessed in Appendix 10.2. It is understood that the Site is currently an overspill surface level car park without any structures; as such this report does not require assessment of any demolition of buildings.
- 10.48 As the Proposed Development is located more than 25 m from the nearest residential receptor, i.e. the residential buildings to the east, it is expected that vibration impact will be negligible to residents and residential buildings in terms of ground-borne noise and vibration due to piling works. This follows BS 5228-2 advice that indicates that vibration activities are generally only considered when located 20 m or less from sensitive locations. As such, a pre-development baseline vibration survey and assessment has not been undertaken.
- 10.49 In addition, scoping opinion for the development from MCC (dated 15 January 2020, ref. JA/DMN) states, “*Impact on the canal corridor and infrastructure should also be considered within this assessment in order to determine any potential impacts from vibrations and machinery during the construction phase given that vibrations could undermine the stability of associated infrastructure*”.
- 10.50 For the purposes of this assessment, historical data found in BS 5288-2, has been used to determine the likely vibrational impact from piling activities on the nearest part of the canal side retaining wall.
- 10.51 It is understood that bored piling works, or similar high energy vibrational activities, will be taking place no less than 9 m from the canal corridor to the south of the development. Furthermore, it is understood that the site geology is rock with a shallow top layer of clay. Rock in this instance is considered a worst-case assessment.
- 10.52 Table 10.7 presents an example from BS 5228-2 equivalent to the activities proposed on-site, and applicable to this assessment.

Table 10.7: Case history data on vibration levels measured during impact rotary piling (source: BS 5228-2)

| Year and location       | Soil conditions                               | Pile dimensions                    | Mode         | Plan distance | Measured peak particle velocity (PPV) |
|-------------------------|-----------------------------------------------|------------------------------------|--------------|---------------|---------------------------------------|
| 1982 Halifax (W. Yorks) | Loose rock fill over weathered rock over rock | 500 mm diameter 15 m to 17 m depth | Boring       | 10 m          | 0.8 mm/s                              |
|                         |                                               |                                    | Base ramming | 10 m          | 1.5 mm/s                              |

10.53 Magnitude of impact is considered negligible for proposed piling activities to the nearest canal side wall based on the example above and criteria for vibrational effect on buildings (see Table 10.4) i.e. vibrational levels are expected to be significantly below 15 mm/s at 4 Hz and 20 mm/s at 15 Hz at a distance of 9 m from piling activities.

10.54 For this assessment Ashton Canal is considered a low sensitivity receptor as detailed in Table 10.1. As such, the effect of significance of piling activities on Ashton Canal is considered to be negligible.

Table 10.8: Significance of effect due to construction activities – Vibration

| NSR #            | Receiver sensitivity | Site Preparation | General site activities |
|------------------|----------------------|------------------|-------------------------|
| E – Ashton Canal | Low                  | Negligible       | Negligible              |

10.55 Construction vehicle movements also have the potential to generate noise, although typically the increase in road traffic associated with construction is minor, particularly in comparison to heavily trafficked roads such as those in the vicinity of the Site.

10.56 Construction work operations are usually characterised by temporary increases in ambient noise levels, which may result in short-term disturbance to nearby receptors, including an increase of traffic noise levels due to construction traffic. Likewise, ground-borne vibration can lead to human disturbance and/or building damage.

10.57 Some of the existing noise-sensitive receptors which have already been identified are around the boundaries of the Site, the residential areas being the ones more prone to suffer from construction disturbances. These impacts will be most significant during the early stages of the project, for example during groundworks, and sub and superstructure work of the Proposed Development. However, residential receptors are noted as being located at large separation distances.

10.58 In-line with MCC, Planning and Noise, Technical Guidance (2015), BS 5228-2 indicates that construction activities (particularly piling) “generally only generate vibration impacts when they are located less than 20 metres from sensitive locations”. A construction vibration assessment has therefore not been undertaken for the identified receptors as they are located more than 20 metres from the Site. As such, the magnitude of impact on the nearest buildings is expected to be negligible.

10.59 The inherited site position before starting construction can be seen in Figure 10.3.

10.60 Based on the predicted noise levels from construction (found in Appendix 10.2), the significance of effect from construction noise at each identified NSR is summarised in Table 10.9. It should be noted that these significances are based on unmitigated noise levels with no hoardings around the perimeter of the Site. Therefore, this is representative of a worst-case scenario.

Table 10.9 Significance of effect due to construction activities – Noise

| NSR #                              | Receiver sensitivity | Site Preparation | General site activities |
|------------------------------------|----------------------|------------------|-------------------------|
| A – Properties along Stuart Street | High                 | Negligible       | Negligible              |

| NSR #                               | Receiver sensitivity | Site Preparation | General site activities |
|-------------------------------------|----------------------|------------------|-------------------------|
| B – Properties along Gibbon Street  | High                 | Negligible       | Negligible              |
| C – Properties along Broxton Street | High                 | Negligible       | Negligible              |
| D – Properties along Briscoe Lane   | High                 | Negligible       | Negligible              |

### Construction traffic

10.61 Annual average weekday (AAWT) baseline traffic flow counts were carried out by the project transport consultant and are fully detailed in Appendix 10.3. Observed and construction traffic flows have been used to assess the magnitude of impact on the NSRs due to construction traffic. These are based on the worst-case scenario i.e. the greatest number of predicted construction traffic flows.

Table 10.10 Significance of effect at NSRs from construction traffic

| NSR #                               | Receiver sensitivity | Magnitude of impact | Effect significance |
|-------------------------------------|----------------------|---------------------|---------------------|
| A – Properties along Stuart Street  | High                 | Negligible          | Negligible          |
| B – Properties along Gibbon Street  | High                 | Negligible          | Negligible          |
| C – Properties along Broxton Street | High                 | Negligible          | Negligible          |
| D – Properties along Briscoe Lane   | High                 | Negligible          | Negligible          |

### Construction effects summary

Table 10.11 Summary of effects during construction on existing receptors

| Receptor                           | Sensitivity | Description of effect                        | Magnitude of change / impact | Effect significance |
|------------------------------------|-------------|----------------------------------------------|------------------------------|---------------------|
| A – Properties along Stuart Street | High        | Construction noise due to site preparation   | Negligible                   | Negligible          |
|                                    |             | Construction noise due to site activities    | Negligible                   | Negligible          |
|                                    |             | Construction vibration – effect on humans    | Negligible                   | Negligible          |
|                                    |             | Construction vibration – effect on buildings | Negligible                   | Negligible          |
|                                    |             | Construction traffic noise                   | Negligible                   | Negligible          |
| B – Properties along Gibbon Street | High        | Construction noise due to site preparation   | Negligible                   | Negligible          |
|                                    |             | Construction noise due to site activities    | Negligible                   | Negligible          |
|                                    |             | Construction vibration – effect on humans    | Negligible                   | Negligible          |
|                                    |             | Construction vibration – effect on buildings | Negligible                   | Negligible          |
|                                    |             | Construction traffic noise                   | Negligible                   | Negligible          |
|                                    | High        | Construction noise due to site preparation   | Negligible                   | Negligible          |

| Receptor                            | Sensitivity | Description of effect                        | Magnitude of change / impact | Effect significance |
|-------------------------------------|-------------|----------------------------------------------|------------------------------|---------------------|
| C – Properties along Broxton Street |             | Construction noise due to site activities    | Negligible                   | Negligible          |
|                                     |             | Construction vibration – effect on humans    | Negligible                   | Negligible          |
|                                     |             | Construction vibration – effect on buildings | Negligible                   | Negligible          |
|                                     |             | Construction traffic noise                   | Negligible                   | Negligible          |
| D – Properties along Briscoe Lane   | High        | Construction noise due to site preparation   | Negligible                   | Negligible          |
|                                     |             | Construction noise due to site activities    | Negligible                   | Negligible          |
|                                     |             | Construction vibration – effect on humans    | Negligible                   | Negligible          |
|                                     |             | Construction vibration – effect on buildings | Negligible                   | Negligible          |
|                                     |             | Construction traffic noise                   | Negligible                   | Negligible          |
| E – Ashton Side                     | Low         | Construction vibration – effect on buildings | Negligible                   | Negligible          |

## Operational Effects

### Operational noise from entertainment noise

10.62 The following criterion is from MCC, Planning and Noise, Technical Guidance document:

*"A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open.*

*Entertainment noise ( $L_{Aeq}$ ) should be controlled to 10 dB below the background noise level ( $L_{A90}$ ) without the entertainment noise present, in each octave band at the nearest noise sensitive location"*

10.63 The MCC, Planning and Noise, Technical Guidance document also provides advice on structurally connected venues by comparing the entertainment noise levels against a noise curve (Moorhouse et al., 2005) in order to assess likelihood of low frequency noise complaints. These levels provide a good practical basis to assess low frequency noise. Furthermore, as stated in the MCC guidance:

*"They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces.*

*Therefore a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be:*

*'Music noise levels in the 63Hz and 125Hz octave centre frequency bands ( $L_{eq}$ ) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB ( $L_{eq}$ ), respectively'.*

*This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue."*

An attenuation of 5 dB, achieved by a façade containing an open window, has been applied at these low frequencies in order to derive an external noise level limit.

10.64 In addition, MCC guidance states that:

*"Depending on the circumstances it could be that both the above criteria are applicable for the same development (new entertainment venue)".*

10.65 It is noted, that  $L_{A90}$  noise levels at Measurement Position 3 and the Long-Term Measurement Position are similar. As such,  $L_{A90}$  spectral noise levels for use in the assessment to satisfy MCC criterion have been taken from the Long-Term Measurement Position and are considered representative of the nearest NSR.

10.66 For reference,  $L_{A90}$  spectral noise levels from the Long-Term Measurement position are presented in the table below. It should be noted that, daytime noise levels as presented below are taken between 21:00 to 23:00 hours, on a non-event day, to reflect the expected worst-case baseline values during typical operating hours.

Table 10.12 Measured  $L_{A90}$  spectral noise levels at the Long-Term Measurement Position

| Location                                           | Time Period                       | Target Incident $L_{eq,T}$ Noise Level Limits (dB)<br>at Octave Band Centre Frequencies (Hz) |     |     |     |    |    |    |    | dBA |
|----------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------|-----|-----|-----|----|----|----|----|-----|
|                                                    |                                   | 63                                                                                           | 125 | 250 | 500 | 1K | 2k | 4k | 8k |     |
| NSR A -<br>Properties<br>along<br>Stuart<br>Street | Daytime<br>(07:00-23:00 hours)    | 57                                                                                           | 52  | 52  | 51  | 52 | 42 | 29 | 21 | 54  |
|                                                    | Night-time<br>(23:00-07:00 hours) | 51                                                                                           | 46  | 44  | 42  | 42 | 32 | 26 | 20 | 45  |

10.67 Operational noise in the form of entertainment noise is considered a long-term effect in this case.

10.68 In-line with the above, the following noise level limits for noise break-out from the Proposed Development is proposed at 1m from the nearest NSR window. These are based on both sets of noise entertainment criteria i.e. 10 dB below background noise levels and low frequency internal noise limits.

Table 10.13 Incident spectral noise level limits for the proposed arena at 1m from the nearest NSR (#1)

| Location                                           | Time Period                       | Target Incident $L_{eq,T}$ Noise Level Limits (dB)<br>at Octave Band Centre Frequencies (Hz) |     |     |     |    |    |    |    | dBA |
|----------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------|-----|-----|-----|----|----|----|----|-----|
|                                                    |                                   | 63                                                                                           | 125 | 250 | 500 | 1K | 2k | 4k | 8k |     |
| NSR A -<br>Properties<br>along<br>Stuart<br>Street | Daytime<br>(07:00-23:00 hours)    | 52*                                                                                          | 46* | 42  | 41  | 42 | 32 | 19 | 11 | 44  |
|                                                    | Night-time<br>(23:00-07:00 hours) | 52*                                                                                          | 46* | 34  | 32  | 32 | 22 | 16 | 10 | 35  |

\* Based on the Moorhouse et al. internal noise limit for assessment of low frequency noise with 5 dB addition to account for the attenuation of a façade containing an open window (see 10.63).

10.69 Should an assessment of noise break-out levels be subject to façade reflections (e.g. the windows are closed on the NSR) then the noise level limits detailed above are subject to a 3 dB addition in all octave band frequencies.

10.70 It is noted that NSR A is the most exposed NSR and compliance with the above should protect other NSRs by default.

- 10.71 The following internal noise level limits are proposed within the 'bowl' of the Proposed Development. It is understood that the 'bowl' will enclose the main stage and performance arena, and that the structure forming the concourse areas surrounding it will significantly mitigate noise transmission into the concourse / external areas.

Table 10.14 Internal noise levels within the 'bowl'

| Description                                              | Noise levels at Octave Band Centre Frequencies (Hz) |     |     |     |     |    |    | dBA |
|----------------------------------------------------------|-----------------------------------------------------|-----|-----|-----|-----|----|----|-----|
|                                                          | 63                                                  | 125 | 250 | 500 | 1K  | 2k | 4k |     |
| Internal concert noise level<br>L <sub>Aeq,5min</sub> dB | 116                                                 | 110 | 104 | 101 | 100 | 92 | 88 | 104 |

- 10.72 Vanguardia acoustics have stated the following, "An assumption has been made on the expected crowd noise in the foyer and concourse areas based on measured sound levels at other venues. This dominates the sound levels in these areas more than the impact of the sound from the arena bowl." It has therefore been assumed, by Vanguardia acoustics, that in the foyer and concourse areas the noise levels will not exceed L<sub>Aeq</sub> 80-85 dBA from combined transmission from the arena 'bowl', background music and crowd noise.
- 10.73 Vanguardia acoustics have specified the combined sound insulation performance for the envelope of the Proposed Development (as shown in Table 10.15), which is expected to be suitable in order to control noise break-out such that it meets the target incident noise levels at the nearest NSR as detailed above. It is worth noting that Vanguardia acoustics have provided spectral values for the 'bowl', and a single-figure sound insulation performance (R<sub>w</sub>) for the outer façades.

Table 10.15 Noise Break-Out Envelope Sound Insulation Requirements

| Description                                                    | Sound insulation at Octave Band Centre Frequencies (Hz) |     |     |     |    |    |    | R <sub>w</sub> |
|----------------------------------------------------------------|---------------------------------------------------------|-----|-----|-----|----|----|----|----------------|
|                                                                | 63                                                      | 125 | 250 | 500 | 1K | 2k | 4k |                |
| Sound insulation for 'bowl' envelope                           | 40                                                      | 38  | 36  | 42  | 47 | 38 | 39 | -              |
| Façade areas outside the 'bowl'<br>e.g. foyer, concourse areas | -                                                       | -   | -   | -   | -  | -  | -  | 40             |

- 10.74 In-line with the details above, the significance of effect from operational entertainment noise at each identified NSR is summarised in Table 10.16. It should be noted that these significances are based on assumed Vanguardia noise levels within the arena and proposed sound insulation requirements of the arena constructions.

Table 10.16 Significance of effect due to entertainment noise from OVG

| NSR #                               | Receiver sensitivity | Significance of effect |
|-------------------------------------|----------------------|------------------------|
| A – Properties along Stuart Street  | High                 | Negligible             |
| B – Properties along Gibbon Street  | High                 | Negligible             |
| C – Properties along Broxton Street | High                 | Negligible             |
| D – Properties along Briscoe Lane   | High                 | Negligible             |

### Operational noise from crowd noise

- 10.75 Guidance on the impact assessment of crowd noise associated with the Proposed Development is based on the magnitude of impact criteria outlined in Table 10.4 above.
- 10.76 Operational noise in the form of crowd noise is considered a long-term effect in this case.
- 10.77 To calculate the effect from crowd noise, an environmental 3D model has been created with CadnaA noise modelling software version 2019. Existing noise sources (roads and rail traffic) have been included in the model and it has been calibrated to the measured noise levels presented in Table 10.6. Known spectral sound power values for raised voices (taken from Building Bulletin 93 (BB93)) have been used within the noise model of the Proposed Development and surrounding area in order to predict noise levels at the nearest NSRs.
- 10.78 Raised voice sources have been placed in expected external congregation areas on the south and east boundaries of the Proposed Development within the noise model. Worst case noise levels from crowd noise is based on 10% of the 23,500 capacity arena speaking with a raised voice i.e. 2,350 No. of raised voices.
- 10.79 Crowd noise has been compared to baseline  $L_{Aeq,T}$  daytime noise levels at Measurement Position 3. It is worth noting that baseline night-time  $L_{Aeq,T}$  noise levels (as measured at the Long-term Measurement Position) are no greater than this, regardless. Modelled results presenting noise predictions without and with crowd noise can be seen in Figures 10.4 and 10.5 respectively.
- 10.80 Based on the predicted noise levels from crowd noise associated with the Proposed Development at each identified NSR the effect is summarised in Table 10.17.

Table 10.17 Significance of effect due to crowd noise

| NSR #                               | Receiver sensitivity | Significance of effect |
|-------------------------------------|----------------------|------------------------|
| A – Properties along Stuart Street  | High                 | Negligible             |
| B – Properties along Gibbon Street  | High                 | Negligible             |
| C – Properties along Broxton Street | High                 | Negligible             |
| D – Properties along Briscoe Lane   | High                 | Negligible             |

- 10.81 Furthermore, it can be seen in Figures 10.4 and 10.5 that crowd noise impact on the canal corridor is likely to be localised. As such, crowd noise is likely to be up to 5 dB above the baseline noise measurement of  $L_{Aeq}$  51 dBA at ST-1 within a 10 m of large groups (approx. 200 No.) of people. This is considered a small magnitude of effect according to operational noise criteria.

### Operational noise from fixed plant and equipment

- 10.82 The impact of noise from mechanical services and plant will be informed by BS4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' in-line with the following MCCTG criterion:

*"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5 dB ( $L_{Aeq}$ ) below the typical background ( $L_{A90}$ ) level at the nearest noise sensitive location."*

- 10.83  $L_{A90,T}$  spectral noise levels to satisfy the MCC plant noise criterion have been taken from the Long-Term Measurement Position. It is observed that measured  $L_{Aeq,T}$  and  $L_{A90,T}$  noise levels at the Long-Term Measurement Position are similar on event and non-event days indicating that events at the Etihad have a minimal impact on overall daytime and night-time noise levels.
- 10.84 Operational noise in the form of fixed plant and equipment noise is considered a long-term effect in this case.
- 10.85 Rating levels are given in the table below in-line with MCC criteria. It should be noted that (as the selection of plant is not currently known) these rating levels do not include any required

corrections for acoustically distinguishable features. On this basis, correction factors may need to be applied to final selections, to cover the effect of certain acoustic features such as the tonality, impulsivity and intermittency, in general accordance with BS 4142:2014+A1:2019.

Table 10.18 Measured background noise levels and limiting rating plant noise levels at NSRs

| NSR | Modal measured<br>daytime background<br>noise level<br>LA90,15min dBA<br>(07:00-23:00) | Plant daytime rating<br>limit at 1 metre from<br>NSR Facades<br>LA <sub>r,Tr</sub> dBA<br>(07:00-23:00) | Modal measured<br>night-time<br>background noise<br>level<br>LA90,15min dBA<br>(23:00-07:00) | Plant night-time<br>rating limit at 1<br>metre from NSR<br>Facades LA <sub>r,Tr</sub> dBA<br>(23:00-07:00) |
|-----|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| All | 57                                                                                     | 52                                                                                                      | 45                                                                                           | 40                                                                                                         |

10.86 It should also be noted that the limits detailed above are for all items of plant operating simultaneously. If there are multiple plant units then the sound pressure level of each item would need to be lower in order to factor in the cumulative effect.

10.87 Assuming that all external plant is selected in accordance with the above, the effect on receptors is shown in the table below.

Table 10.19 Significance of effect at NSRs from operational noise from fixed plant and equipment

| NSR #                               | Receiver sensitivity | Magnitude of impact | Effect significance |
|-------------------------------------|----------------------|---------------------|---------------------|
| A – Properties along Stuart Street  | High                 | Negligible          | Negligible          |
| B – Properties along Gibbon Street  | High                 | Negligible          | Negligible          |
| C – Properties along Broxton Street | High                 | Negligible          | Negligible          |
| D – Properties along Briscoe Lane   | High                 | Negligible          | Negligible          |

### Operational traffic noise

10.88 Annual average weekday (AAWT) baseline traffic flow counts were carried out by the project transport consultant and are fully detailed in Appendix 10.4 and a summary of findings is shown in the tables below. Observed and predicted traffic flows have been used to assess the magnitude of impact on the NSRs due to operational traffic.

10.89 Operational noise in the form of traffic noise is considered a long-term effect in this case.

Table 10.20 Significance of effect at NSRs from operational traffic at year of opening

| NSR #                               | Receiver sensitivity | Magnitude of impact | Effect significance |
|-------------------------------------|----------------------|---------------------|---------------------|
| A – Properties along Stuart Street  | High                 | Negligible          | Negligible          |
| B – Properties along Gibbon Street  | High                 | Negligible          | Negligible          |
| C – Properties along Broxton Street | High                 | Negligible          | Negligible          |
| D – Properties along Briscoe Lane   | High                 | Negligible          | Negligible          |

Table 10.21 Significance of effect at NSRs from operational traffic 15 years after project opening

| NSR #                               | Receiver sensitivity | Magnitude of impact | Effect significance |
|-------------------------------------|----------------------|---------------------|---------------------|
| A – Properties along Stuart Street  | High                 | Negligible          | Negligible          |
| B – Properties along Gibbon Street  | High                 | Negligible          | Negligible          |
| C – Properties along Broxton Street | High                 | Negligible          | Negligible          |
| D – Properties along Briscoe Lane   | High                 | Negligible          | Negligible          |

### Operational effects summary

Table 10.22 summary of operational effects on existing receptors

| Receptor                            | Sensitivity | Description of effect                                    | Magnitude of change / impact | Effect significance |
|-------------------------------------|-------------|----------------------------------------------------------|------------------------------|---------------------|
| A – Properties along Stuart Street  | High        | Operational noise from entertainment noise               | Negligible                   | Negligible          |
|                                     |             | Operational noise from crowd noise                       | Negligible                   | Negligible          |
|                                     |             | Operational noise from fixed plant and equipment         | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise at year of opening             | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise 15 years after year of opening | Negligible                   | Negligible          |
| B – Properties along Gibbon Street  | High        | Operational noise from entertainment noise               | Negligible                   | Negligible          |
|                                     |             | Operational noise from crowd noise                       | Negligible                   | Negligible          |
|                                     |             | Operational noise from fixed plant and equipment         | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise at year of opening             | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise 15 years after year of opening | Negligible                   | Negligible          |
| C – Properties along Broxton Street | High        | Operational noise from entertainment noise               | Negligible                   | Negligible          |
|                                     |             | Operational noise from crowd noise                       | Negligible                   | Negligible          |
|                                     |             | Operational noise from fixed plant and equipment         | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise at year of opening             | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise 15 years after year of opening | Negligible                   | Negligible          |
| D – Properties along Briscoe Lane   | High        | Operational noise from entertainment noise               | Negligible                   | Negligible          |
|                                     |             | Operational noise from crowd noise                       | Negligible                   | Negligible          |
|                                     |             | Operational noise from fixed plant and equipment         | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise at year of opening             | Negligible                   | Negligible          |
|                                     |             | Operational traffic noise 15 years after year of opening | Negligible                   | Negligible          |

## Climate change and adaptation

- 10.90 The noise and vibration assessments are based on non-climate related sources; therefore, a change in the climate conditions is not expected to change the operational noise and vibration assessment carried out.

## Mitigation Measures

- 10.91 Examples of mitigation measures that can be used to control construction noise are found in Section 8 of BS 5228-1:2009+A1:2014:
- Selecting quieter plant and equipment;
  - Turning equipment off when they are not in use;
  - Providing enclosures around fixed plant like power generators or using mains power;
  - Ensuring that all plant and equipment is well maintained;
  - Keep internal haul routes well maintained and avoid steep gradients;
  - Use rubber linings in chutes and dumpers to reduce impact noise;
  - Minimise drop heights of materials;
  - Start plant up sequentially rather than simultaneously;
  - Move fixed plant away from identified noise sensitive receptors;
  - Modify existing plant with noise attenuation packages such as acoustic enclosures and attenuators;
  - Avoid using diesel power generators and use local electricity grid wherever possible;
  - For impact driven piling, a non-metallic dolly between the hammer and the driving helmet should be used;
  - Introducing an acoustic shroud for impact driven piles;
  - Choose a quieter piling method; and
  - Avoiding unnecessary revving of engines.

## Cumulative Effects

- 10.92 Due to distance attenuation, the only schemes that have been considered for the cumulative assessment are those within 200 m of the Proposed Development red line boundary.
- 10.93 The aerial image shown in Figure 10.6 contains a blue circle, which has a radius of 200 m. No cumulative schemes lie within this circle.
- 10.94 As no development falls within the 200 m radius from the Proposed Development, the cumulative noise and vibration effect can be assumed to have a negligible significance of effect.
- 10.95 On this basis the Committed Developments identified in Appendix 2.4 have not been considered further.

## Residual Effects

- 10.96 The following table summarises the complete residual effects during both construction and operation.

Table 10.23 Summary of Receptors, Likely Significant Effects, Mitigation Measures, and Residual Effects

| NSR                                | Description                                                  | Pre-mitigation significance | Mitigation Method                                                                                | Means of Implementation | Post-Mitigation Significance and Duration |
|------------------------------------|--------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------|
| A – Properties along Stuart Street | Construction noise due to Site Preparation                   | Moderate / Minor adverse    | Implementation of a CMP which includes the mitigation measures outlined above (Paragraph 10.91). | N/A                     | Negligible                                |
|                                    | Construction noise due to site activities                    | Moderate / Minor adverse    | Implementation of a CMP which includes the mitigation measures outlined above (Paragraph 10.91). | N/A                     | Negligible                                |
|                                    | Construction vibration effect on humans                      | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Construction vibration effect on buildings                   | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Construction traffic noise                                   | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Operational noise from entertainment noise                   | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Operational noise from crowd noise                           | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Operational noise from fixed plant and equipment             | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Operational noise from traffic noise, year of opening        | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Operational noise from traffic noise, 15 years after opening | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
| B – Properties along Gibbon Street | Construction noise due to Site Preparation                   | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Construction noise due to site activities                    | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |
|                                    | Construction vibration                                       | Negligible                  | N/A                                                                                              | N/A                     | Negligible                                |

| NSR                                 | Description                                                  | Pre-mitigation significance | Mitigation Method | Means of Implementation | Post-Mitigation Significance and Duration |
|-------------------------------------|--------------------------------------------------------------|-----------------------------|-------------------|-------------------------|-------------------------------------------|
|                                     | effect on humans                                             |                             |                   |                         |                                           |
|                                     | Construction vibration effect on buildings                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Construction traffic noise                                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from entertainment noise                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from crowd noise                           | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from fixed plant and equipment             | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from traffic noise, year of opening        | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from traffic noise, 15 years after opening | Negligible                  | N/A               | N/A                     | Negligible                                |
| C – Properties along Broxton Street | Construction noise due to Site Preparation                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Construction noise due to site activities                    | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Construction traffic noise                                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Construction vibration effect on humans                      | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Construction vibration effect on buildings                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from entertainment noise                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                     | Operational noise from crowd noise                           | Negligible                  | N/A               | N/A                     | Negligible                                |

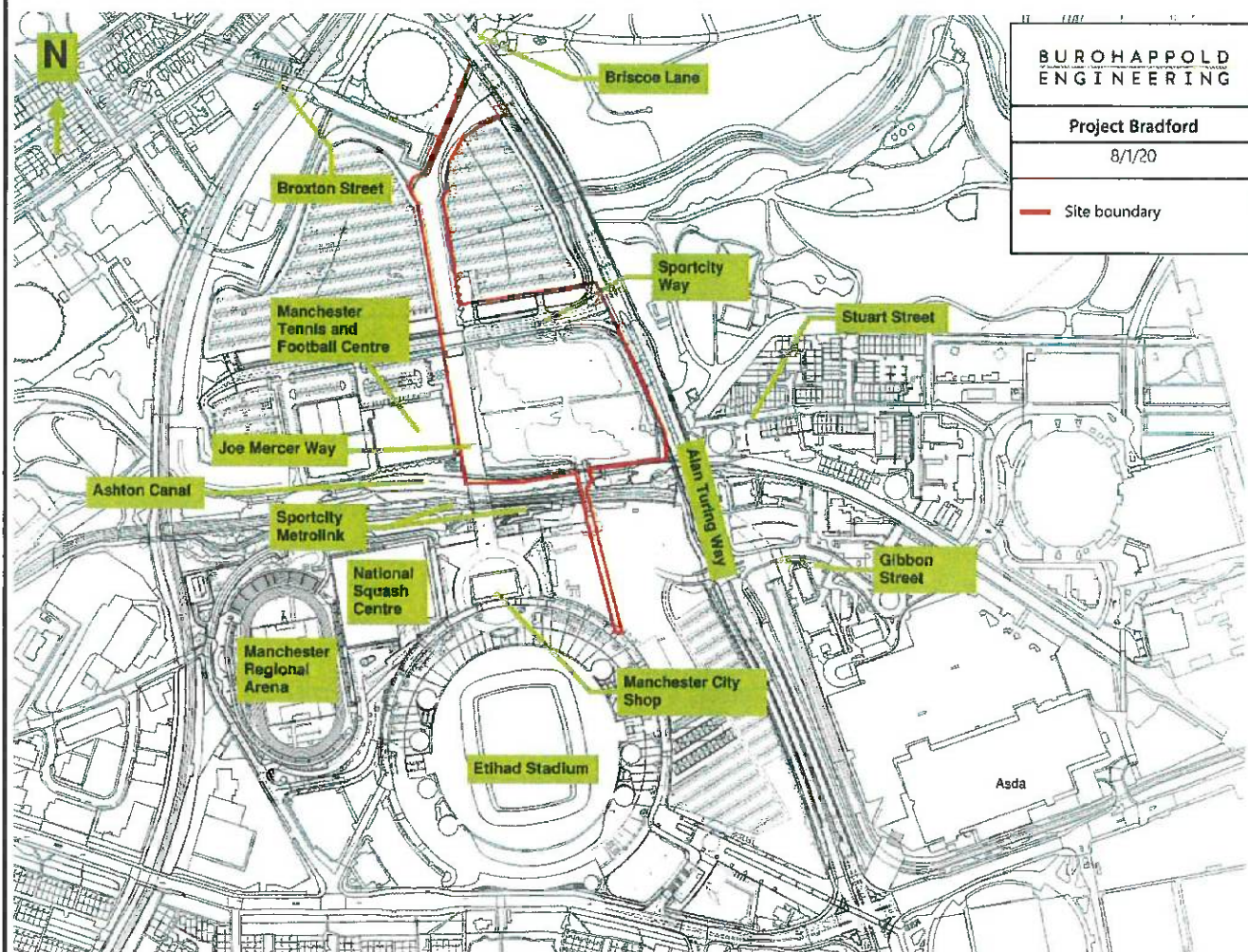
| NSR                               | Description                                                  | Pre-mitigation significance | Mitigation Method | Means of Implementation | Post-Mitigation Significance and Duration |
|-----------------------------------|--------------------------------------------------------------|-----------------------------|-------------------|-------------------------|-------------------------------------------|
|                                   | Operational noise from fixed plant and equipment             | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from traffic noise, year of opening        | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from traffic noise, 15 years after opening | Negligible                  | N/A               | N/A                     | Negligible                                |
| D – Properties along Briscoe Lane | Construction noise due to Site Preparation                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Construction noise due to site activities                    | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Construction traffic noise                                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Construction vibration effect on humans                      | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Construction vibration effect on buildings                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from entertainment noise                   | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from crowd noise                           | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from fixed plant and equipment             | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from traffic noise, year of opening        | Negligible                  | N/A               | N/A                     | Negligible                                |
|                                   | Operational noise from traffic noise, 15 years after opening | Negligible                  | N/A               | N/A                     | Negligible                                |
| E – Ashton Canal                  | Construction vibration                                       | Negligible                  | N/A               | N/A                     | Negligible                                |

| NSR | Description         | Pre-mitigation significance | Mitigation Method | Means of Implementation | Post-Mitigation Significance and Duration |
|-----|---------------------|-----------------------------|-------------------|-------------------------|-------------------------------------------|
|     | effect on buildings |                             |                   |                         |                                           |

## Reference List

10.97 This ES Chapter has been prepared by reference to the following:

- British Standards Institution, (2014). BS 4142:2014 Methods for rating and assessing industrial and commercial sound.
- British Standards Institution, (2009). BS 5228-1: 2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.
- British Standards Institution, (2009). BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.
- British Standards Institution, (2008). BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.
- British Standards Institution, (1993) BS 7385: 1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration.
- British Standards Institution, (2014). BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings.
- BuroHappold Engineering, (2019) OVG Manchester, EIA Scoping Report.
- Department for Environment Food and Rural Affairs (DEFRA) (2010). Noise Policy Statement for England (NPSE).
- Design Manual for Roads and Bridges, (2011). Volume 11. Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7, HD 213/11, Noise and Vibration.
- Manchester City Council (MCC) (2015). Planning and Noise, Technical Guidance.
- Ministry for Housing, Communities and Local Government (MHCLG) (2019). National Planning Policy Framework, MHCLG.
- Ministry for Housing, Communities and Local Government (MHCLG) (2019). National Planning Practice Guidance on Noise, MHCLG.
- Jones & Stokes (2004). Transportation- and construction-induced vibration guidance manual. June. (J&S 02-039.) Sacramento, CA. Prepared for California Department of Transportation, Noise, Vibration, and Hazardous Waste Management Office, Sacramento, CA.



|                 |                               |               |     |
|-----------------|-------------------------------|---------------|-----|
| <b>Figure:</b>  | 10-1                          |               |     |
| <b>Title:</b>   | Noise and Vibration Site plan |               |     |
| <b>Project:</b> | OVG Manchester                |               |     |
| <b>Date:</b>    | December 2019                 | <b>Scale:</b> | NTS |



|                 |                                                          |               |     |
|-----------------|----------------------------------------------------------|---------------|-----|
| <b>Figure:</b>  | 10-2                                                     |               |     |
| <b>Title:</b>   | Noise monitoring positions and noise sensitive receivers |               |     |
| <b>Project:</b> | OVG Manchester                                           |               |     |
| <b>Date:</b>    | December 2019                                            | <b>Scale:</b> | NTS |

Tom Cotter  
Vanguardia Limited  
The Ministry  
79-81 Borough Road  
London SE1 1DN  
T. +44 (0) 2039 682 460

21 Station Road West  
Oxted. Surrey  
RH8 9EE  
T +44 (0) 1883 718 690

2nd Floor Eastgate  
2 Castle Street  
Castlefield  
Manchester M3 4LZ  
T +44(0) 161 233 5000

Email: [tom.cotter@vanguardia.co.uk](mailto:tom.cotter@vanguardia.co.uk)