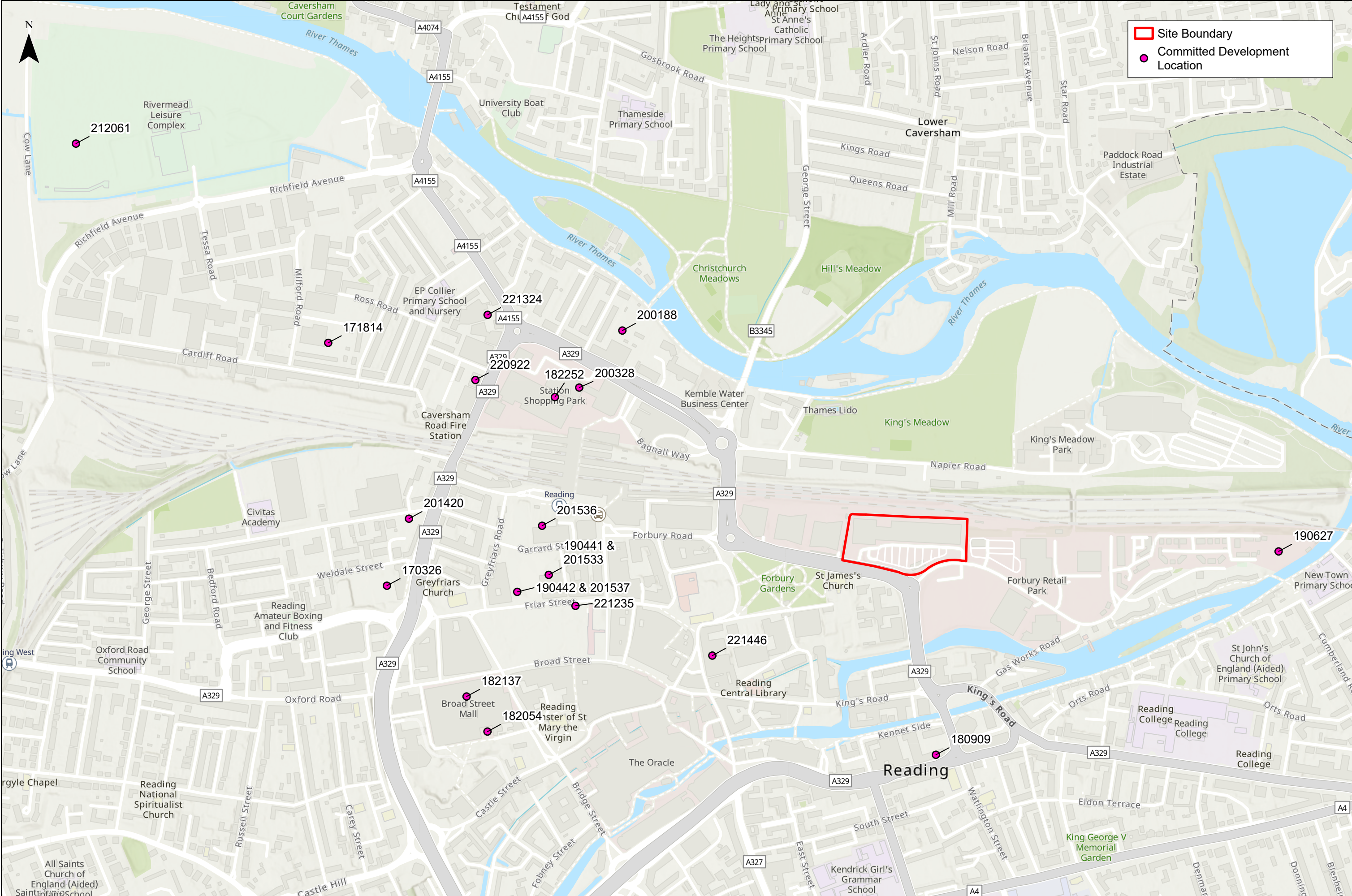




Site Boundary

Committed Development Location

Stantec	Client abrdn
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Appendix H.1 Site Suitability Assessment

Site Suitability Assessment

1.1.1 The Proposed Development shall incorporate residential uses that are sensitive to noise and vibration effects. The suitability of the Site for residential development considers the following:

- The feasibility to achieve appropriate internal noise levels for living rooms / bedrooms; and
- The noise levels in external residential amenity areas.

Internal Noise Levels – Residential Uses

1.1.2 External noise levels have been modelled across the Proposed Development Site and on the Proposed Development buildings. The results from the modelling provided in present the highest predicted façade sound pressure levels for each elevation and the required sound insulation performance (the reduction in noise that the façade needs to provide) so that internal sound pressure levels are no higher than $L_{Aeq,16h}$ 35 dB during the day in living rooms and bedrooms and $L_{Aeq,8h}$ 30 dB during the night time in bedrooms.

1.1.3 Figure 8.13 presents the façade location key to be read in conjunction with Table 8.29.

Table 8.1: Predicted Sound Pressure Levels and Façade Sound Insulation

Building	Façade reference (Figure 8.13)	Highest Daytime sound pressure level on Façade ($L_{Aeq,16hr}$ dB)	Highest Night-time sound pressure level on Façade ($L_{Aeq,8hr}$ dB)	Overall Living Room façade sound insulation ($R'_w + C_{tr}$) to achieve recommended internal noise levels	Overall Bedroom façade sound insulation ($R'_w + C_{tr}$) to achieve recommended internal noise levels
W1	Red	66	61	31	37
	Orange	60	55	25 ^[1]	30
	Blue	55	50	20 ^[1]	25 ^[1]
W2	Red	66	61	31	37
	Orange	60	55	25 ^[1]	30
	Blue	52	47	17 ^[1]	22 ^[1]
W3	Red	68	63	33	35
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	55	50	20 ^[1]	20 ^[1]
W4	Red	67	62	32	35
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	55	50	20 ^[1]	20 ^[1]
C1	Red	66	61	31	37
	Orange	60	55	25 ^[1]	30
	Blue	54	49	19 ^[1]	25 ^[1]
	Green	50	45	15 ^[1]	20 ^[1]
C2	Red	66	61	31	37
	Orange	60	55	25	30
	Blue	55	50	20 ^[1]	25 ^[1]
	Green	50	45	15 ^[1]	20 ^[1]

Building	Façade reference (Figure 8.13)	Highest Daytime sound pressure level on Façade ($L_{Aeq,16hr}$ dB)	Highest Night-time sound pressure level on Façade ($L_{Aeq,8hr}$ dB)	Overall Living Room façade sound insulation ($R'_w + C_{tr}$) to achieve recommended internal noise levels	Overall Bedroom façade sound insulation ($R'_w + C_{tr}$) to achieve recommended internal noise levels
C3	Red	67	62	32	35
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	54	49	19 ^[1]	20 ^[1]
C4	Red	67	62	32	35
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	56	51	21 ^[1]	20 ^[1]
E1	Red	66	61	31	37
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	55	50	20 ^[1]	20 ^[1]
E2	Red	67	62	32	39
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	55	50	20 ^[1]	20 ^[1]
E3	Red	67	62	32	35
	Orange	65	60	30	30
	Blue	60	55	25 ^[1]	25
	Green	55	50	20 ^[1]	20 ^[1]
E4	Red	66	61	31	35
	Orange	63	58	28	30
	Blue	60	55	25 ^[1]	25 ^[1]
	Green	55	50	20 ^[1]	20 ^[1]

^[1] Minimum of $R'_w + C_{tr}$ 27 dB will be achieved with hermitically sealed thermal double glazing

- 1.1.4 The bedroom overall façade sound insulation requirements presented above are based on controlling average night-time noise levels to achieve suitable internal noise levels. For façades directly overlooking the road and rail, the façade will also need to provide suitable control of maximum night-time noise events.
- 1.1.5 The highest not normally exceeded maximum night-time noise level at the Site is considered to be L_{AFmax} 70-84 dB, depending on location. This is based on cross-analysis of the measurement survey and Extrium noise level database.
- 1.1.6 Frequency analysis of the typical maximum events may allow in the C_{tr} correction to be omitted when setting the facade requirement for bedrooms. This would effectively reduce the required glazing build-up. Detailed analysis of this should be undertaken as the building design develops for each phase.
- 1.1.7 Depending on room layouts and glazing percentage areas, the performances listed in **Table 8.29** could decrease. Therefore, the results presented are considered conservative.

- 1.1.8 Example glazing build-ups and ventilation strategies that can provide the necessary acoustic losses are presented in **Table 8.30**.

Table 8.2: Example Glazing Build-Ups and ventilation strategies

Overall facade sound insulation, $R_w + C_{tr}$ (dB)	Example glazing configuration	Ventilation strategy
28-29	6.8 mm acoustic laminate/16 mm cavity /6 mm glass	Acoustically attenuated passive ventilation (eg, trickle vents)
30-32	8.8 mm acoustic laminate /16 mm cavity/6 mm glass	Acoustically attenuated passive ventilation (eg, trickle vents)
33-35	8.8 mm acoustic laminate/16 mm/10 mm glass	High performance acoustically attenuated passive ventilation
36-38	8.8 mm acoustic laminate/16 mm/10 mm glass	Mechanical ventilation (eg, whole house ventilation)

- 1.1.9 The precise design details of the façade will be finalised as the design of the Proposed Development progresses; however, **Table 8.30** demonstrates that appropriate glazing specifications and ventilation strategies that can meet the indoor ambient noise level criteria recommended in BS 8233 (British Standards Institute, 2014).
- 1.1.10 Noise predictions indicate that suitable internal noise levels can be achieved within the Proposed Development through the implementation of appropriate glazing.

Control of Overheating

- 1.1.11 Guidance on external noise levels from transport noise sources and the assessment of risk in an overheating condition is given in the Acoustics Ventilation and Overheating, Residential Design Guide (ANC, 2020).
- 1.1.12 A Level 1 assessment of noise ingress during an overheating condition has been carried out which requires the development to be categorised in relation to the limits shown in **Table 8.31**.

Table 8.3: Level 1 assessment limits for noise from transport sources (overheating condition)

Risk category for Level 1 assessment	External free-field noise level	
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Negligible	$L_{Aeq} \leq 52$ dB	$L_{Aeq} \leq 47$ dB
Low	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 57$ dB	$L_{Aeq} > 47$ dB and $L_{Aeq} \leq 52$ dB
Medium	$L_{Aeq} > 57$ dB and $L_{Aeq} \leq 62$ dB	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 55$ dB
High	$L_{Aeq} > 62$ dB	$L_{Aeq} > 55$ dB

- 1.1.13 The guide also states that where L_{AFmax} 78 is normally exceeded during the night-time period, a level 2 assessment is recommended.
- 1.1.14 The Level 1 assessment indicates that the Proposed Development falls into the high risk category at a number of facades and therefore a Level 2 assessment is required.
- 1.1.15 The following will need to be considered:

- Duration of period where additional ventilative cooling is required (to be assessed by others, typically part of a TM59 assessment (CIBSE, 2017))
 - How wide the external windows would need to be open to control overheating (to be assessed by others, typically part of a TM59 assessment)
 - Design, extent and construction of attenuated passive ventilation.
- 1.1.16 It is recommended that the Energy Statement describes the measures, other than the use of opening windows, that can be incorporated within the design that reduce overheating within the apartments. Typically, these measures will include:
- Minimising internal heat generation through energy efficient designs that reduce the amount of heat entering the building by:
 - Reducing the proportion of glass;
 - Reducing the glazing's G-value;
 - Installing internal blinds; and
 - Adopting balconies to increase external solar shading.
 - Exposing thermal mass within the apartments;
 - Operating the mechanical ventilation on "boost" mode; and
 - Providing shared amenity which will be comfort cooled.
- 1.1.17 Through a combination of the above and other measures, such as fans within bedrooms, the total amount of time that windows will need to be open to control overheating is expected to be reduced. It is recommended that the overheating strategies developed during subsequent design phases provide feedback on the duration of time when overheating is expected to occur and the extent of opening required, so that further analyses of internal noise levels and their effects can be provided.

Assessment of Residential Outdoor Amenity Areas

- 1.1.18 Resident's external amenity is being provided in the following ways:
- Private amenity – balconies and terraces;
 - Shared amenity – Podium roof of West Blocks; and
 - Public Realm.
- 1.1.19 The noise levels in each of the above identified areas have been reviewed with respect to compliance with BS 8233 (British Standards Institute, 2014) recommendations for outdoor residential amenity.
- 1.1.20 In all the assessments the colours in the **Figure 8.14**, **Figure 8.15** and **Figure 8.16** represent the following:
- Green - indicates full compliance with BS 8233 recommendations (i.e. is no higher than $L_{Aeq,16hr}$ 55 dB);

- Yellow indicates a deviation of up to 10 dB from BS 8233 recommendations (i.e. up to and including $L_{Aeq,hr}$ 65 dB); and
- Red indicates deviation of more than 10 dB from BS 8233 recommendation.

Private Amenity (Balconies)

- 1.1.21 This section considers outdoor amenity for the Proposed Development. Private amenity (balconies) should where practicable achieve the recommendations in BS 8233 of $L_{Aeq,16h}$ 55 dB.
- 1.1.22 It is noted in BS 8233 that the recommendations for ambient noise levels are not strictly intended for balconies in urban areas, with the guidance intended for gardens or terraces. Nevertheless, the recommendations have been referenced to provide a comparison.
- 1.1.23 **Figure 8.14** to **Figure 8.16** show images from the 3D environmental noise model of the Proposed Development, with the colours on the façades representing the predicted noise levels on the balconies positions in that location.
- 1.1.24 **Figure 8.14** shows that there are private amenity spaces where the BS 8233 recommendations will be achieved (green). These locations are primarily on the façades facing away from the roads and railway.
- 1.1.25 In addition, there are also extensive areas where noise levels are predicted to be $L_{Aeq,16h}$ 56-65 dB (up to 10 dB above the recommendations). In these areas, noise levels are unlikely to reduce their functionality (i.e. ability to hold a conversation without a raised vocal effort) and given the context be acceptable to the occupants.
- 1.1.26 In the areas shown in red (ie $L_{Aeq} > 65$ dB) ability to hold a conversation without a raised vocal effort would be impaired. In these areas, consideration for semi-enclosed balcony spaces (eg winter gardens) is recommended, or provision of alternative amenity space (discussed below).

Assessment of Shared Private Amenity

- 1.1.27 Shared private amenity, though not open to members of the public are provided on the podiums of the west blocks. The predicted noise levels in the shared amenity are shown in **Figure 8.15**.
- 1.1.28 **Figure 8.15** illustrates that all but a small section of the shared amenity is expected to meet the BS 8233 recommendations, i.e. all occupants of the Proposed Development will have access to areas where appropriate noise levels for relaxation are achieved.

Public Realm

- 1.1.29 **Figure 8.16** illustrates that all the public realm there will be areas where the BS 8233 recommendations will be met. These areas are limited to between Blocks B and C. With noise levels in the central courtyard higher and seen to be partly influenced by noise generated by the use of the outside areas associated with the commercial units.

Public Open Spaces

- 1.1.30 The nearest Public Open Space is Forbury Public Gardens, approximately 50 m to the southwest of the Site.

Vibration in residences

Tactile vibration

- 1.1.31 BS 6472 (British Standards Institute, 2008) states that the assessment should be based on the axis along which the highest VDV is measured. At measurement location V, the highest VDV was measured on the Z axis.
- 1.1.32 Published timetables indicate that approximately 500 trains pass on the tracks between 07:00 – 23:00. At night, between 23:00 – 07:00, the number of trains operating along this line is expected to be approximately 250 trains.
- 1.1.33 Based on the maximum vibration values from **Table 8.14** and on the number of trains passing on the tracks between 07:00 – 23:00 and 23:00 – 07:00, the equivalent VDV's over a 16 hour day and an 8 hour night are given in **Table 8.32**.

Table 8.4 – Equivalent vibration dose values

Location	Maximum VDV measured ($\text{m/s}^{1.75}$)	Equivalent VDV ($\text{m/s}^{1.75}$)	
		Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
V	0.006	0.05	0.04

- 1.1.34 These predicted equivalent VDV's, during the daytime and night periods are lower than the thresholds of the 'low probability of adverse comment' categories in **Table 8.10**.
- 1.1.35 Levels experienced may vary depending on the type of train and position of the future buildings. However, the measured vibration levels were below the lowest BS 6472 threshold, and a significant increase in the number of trains would be required for the threshold to be exceeded. Based on this, tactile vibration due to trains is unlikely to exceed the limits for the Proposed Development.

Ground borne noise

- 1.1.36 Ground borne noise within the Proposed Development was predicted using an empirical formula described in the ANC guidelines.
- 1.1.37 The highest vibration measurements have been analysed and, based on these, predicted ground borne noise levels from the vibration measurements at location V are not expected to exceed a level of L_{AFmax} 32 dB.
- 1.1.38 Of the train passes captured during the survey period, all the predicted levels were lower than the criteria discussed in **Paragraph 8.4.73**.
- 1.1.39 On this basis, ground borne noise in the proposed residences is unlikely to result in adverse comment. The predicted values are for worst-case ground floor conditions. Noise levels from this source are expected to be lower at upper floor levels.

Site Suitability Conclusions

- 1.1.40 The Site suitability assessments indicate that appropriate conditions for residential development can be achieved. A planning condition to secure that the recommended indoor ambient noise are met is recommended, given the reliance on façade sound insulation mitigation.

Appendix H.2 Figures



Figure 8.1: The Noise and Vibration Study Area (courtesy of Google Earth Pro)



Figure 8.2: Survey measurement locations (courtesy of Google Earth Pro)