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52 - 55 FRIAR STREET & 12 GREYFRIARS ROAD, READING

NOISE IMPACT ASSESSMENT REPORT

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NOISE IMPACT ASSESSMENT REPORT

CIP Property (AIPT) Limited

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1 INTRODUCTION

- 1.1.1 WSP | Parsons Brinckerhoff has been appointed by CIP Property (AIP) Limited to undertake a noise impact assessment for a proposed residential led mixed use development on land at 52 – 55 Friar Street and 12 Greyfriars Road, Reading.
- 1.1.2 The purpose of this noise impact assessment report is to determine the suitability of the site for the proposed residential and retail, office or leisure uses. Consideration is also given to the sound producing elements of the development, including the determination of noise emission limits and an indication of the issues to be addressed during detailed design.
- 1.1.3 This report is necessarily technical in nature therefore to assist the reader a glossary of acoustic terminology is included in **Appendix A**.

2 SITE DESCRIPTION

2.1 CURRENT SITE

- 2.1.1 The development site is situated in the centre of Reading and is bounded to the south by an existing student accommodation building and by Friar Street, with existing commercial and residential buildings beyond. To the west is Greyfriars Road with existing mixed commercial and residential buildings beyond and there are existing commercial and residential buildings immediately adjacent to the northern and eastern site boundaries.
- 2.1.2 The site is currently occupied by a three-storey building comprising a supermarket at ground floor level with disused residential apartments above.

2.2 PROPOSED DEVELOPMENT

- 2.2.1 The proposals comprise redevelopment of the site to provide up to 137 residential dwellings above 660 sqm ground floor retail, leisure and/or office uses.
- 2.2.2 An indicative redline boundary and indicative scheme layout drawings are included in **Appendix B**.

3

LEGISLATION AND GUIDANCE

3.1 CONSULTATION WITH READING BOROUGH COUNCIL

- 3.1.1 At the outset of the project consultation was undertaken with the Environmental Health Department of Reading Borough Council (RBC) to agree a methodology for the baseline noise survey. Following completion of the baseline noise survey, further consultation was undertaken in order to agree the assessment methodology. Specifically the following survey and assessment methodologies were agreed or discussed.

BASELINE NOISE SURVEY METHODOLOGY

- 3.1.2 Two measurement locations should be adopted on the western and southern façades of the existing building, with the microphone at a distance of 1 m from the façade and at the approximate height of the lowest proposed residential receptors (i.e first floor height).
- 3.1.3 Measurements should be undertaken for at least 24-hours and should include a Friday or Saturday night period. These measurement locations should be used to establish the noise levels generated by Greyfriars Road and Friar Street respectively. The locations should also be used to establish the prevailing background (L_{A90}) sound levels during quiet periods of the daytime and night-time, when road traffic noise is minimised. The background sound levels will be used to derive noise level limits in accordance with BS 4142:2014: *Methods for rating and assessing industrial and commercial sound*.

ASSESSMENT METHODOLOGY

TRANSPORTATION NOISE IMPACT ON PROPOSED RESIDENTIAL DEVELOPMENT

- 3.1.4 Drawing upon the results of the baseline noise survey the suitability of the site for the proposed residential development will be determined.
- 3.1.5 The assessment will be based on compliance with appropriate noise level criteria for residential development, such as the guidance contained within BS 8233:2014: *Guidance on sound insulation and noise reduction for buildings*. The assessment will demonstrate how suitable internal noise levels can be achieved through the specification of suitable façade elements, with particular attention being given to glazing and ventilation units. External noise levels in amenity spaces will also be considered.

PLANT AND DELIVERY NOISE ASSESSMENT

- 3.1.6 As the details of the specific plant items associated with the proposed retail, office or leisure uses will not be known until the detailed design stage, it was discussed with RBC that plant noise emission limits should be set in accordance with BS 4142:2014: *Methods for rating and assessing industrial and commercial sound*. It was noted during consultation that BS 4142:2014 states the following:

“Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.”

- 3.1.7 In accordance with the above statement, it is considered that an appropriate noise level limit would be a rating level limit equal to background sound level. RBC requested that the noise level limit be selected to minimise the potential for 'background creep'. This is not a concept which is detailed within any relevant British Standards, guidance or relevant planning policy documents. Through conversations with the dealing Environmental Health Officer (EHO) it is understood that RBC considers background creep to be the increase of background noise levels through subsequent development.
- 3.1.8 Given that background creep is not a concept recognised in relevant guidance, including RBC's own planning policy documents, and that it would lead to a more onerous limit being imposed that would be the case with an assessment in accordance with BS 4142, it has not been considered. Instead, the assessment has been based on relevant British Standards in order to ensure the assessment is as appropriate. Therefore with regard to fixed plant and delivery noise, a noise level limit has been determined in accordance with BS 4142. A rating level limit equal to the background sound level has been determined, which corresponds to the specific sound source having a low impact in accordance with the standard.

DEVELOPMENT GENERATED ROAD TRAFFIC NOISE

- 3.1.9 Given the site is in an area where the surrounding road network is subject to significant traffic flows, it was agreed that it would not be necessary to consider development generated road traffic noise, as the impact of a small number of additional vehicle movements is likely to be negligible.
- 3.1.10 A summary of relevant planning policy and British Standards is included below.

3.2 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

- 3.2.1 Published in March 2012, this document sets out the Government's planning policies for England and supersedes a number of previous Planning Policy Guidance Notes and Planning Policy Statements (amongst other documents), including Planning Policy Guidance Note 24: Planning and Noise. In contrast to PPG 24, reference to noise is scant within the NPPF. However, it does make the following references to noise in the section entitled Conserving and enhancing the natural environment:

"The planning system should contribute to and enhance the natural and local environment by...[a number of points including]...preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability".

"Planning policies and decisions should aim to:

avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

3.3 PLANNING PRACTICE GUIDANCE

- 3.3.1 Last updated on the 24th December 2014, this is a web-based resource issued for use by the Department for Communities and Local Government (DCLG). It is stated that the guidance is to complement the NPPF and provide advice on how to deliver its policies. The Planning Practice Guidance replaced the former “*in beta*” version which was launched in October 2013 for testing and comment under the title “*National Planning Practice Guidance*”.
- 3.3.2 The section on noise includes a table that summarises “*the noise exposure hierarchy, based on the likely average response*” which offers “*examples of outcomes*” relevant to the NOEL, LOAEL and SOAEL¹ effect levels described in the *Noise Policy Statement for England* (NPSE) dated March 2010.
- 3.3.3 During consultation with the dealing EHO discussions centred around setting noise level limits in accordance with relevant British Standards in place of defining numerical values for LOAELs and SOAELs, therefore this assessment relies on noise level criteria from relevant British Standards.

3.4 READING BOROUGH COUNCIL – CORE STRATEGY AND SITES AND DETAILED POLICIES DOCUMENT

- 3.4.1 In addition to the overarching national planning policy documents, RBS’s ‘Core Strategy’ document sets out the overall planning strategy and principles for development in Reading and the ‘Sites and Detailed Policies’ document which sets out the detailed policies the council uses when considering planning applications and identifies sites for development and protection.
- 3.4.2 Both of these documents make reference to noise and the general principles for the protection of residents are outlined, however, no detailed noise level criteria or assessment requirements are provided.

- 3.5 Therefore in this assessment reference has been made to the guidance within relevant British Standards.

3.6 BS 8233:2014: GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS (BS 8233)

- 3.6.1 This Standard provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.
- 3.6.2 The guidance provided includes appropriate internal and external noise level criteria which are applicable to dwellings exposed to steady external noise sources. It is stated in the British Standard that it is desirable for internal ambient noise level not to exceed the criteria set out in Table 1.

¹ NOEL (No Observed Effect Level); LOAEL (Lowest Observed Adverse Effect Level); and SOAEL (Significant Observed Adverse Effect Level).

Table 1: Summary of internal ambient noise level criteria for habitable rooms from BS 8233:2014

ACTIVITY	LOCATION	PERIOD	
		07:00 TO 23:00 HOURS, I.E. DAYTIME	23:00 TO 07:00 HOURS, I.E. NIGHT-TIME
Resting	Living Room	35 dB L _{Aeq,16h}	-
Dining	Dining Room/area	40 dB L _{Aeq,16h}	-
Sleeping (daytime resting)	Bedroom	35 dB L _{Aeq,16h}	30 dB L _{Aeq,8h}

3.6.3 Whilst BS 8233 recognises that a guideline value may also be set in terms of SEL or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated. Accordingly, reference has been made in this assessment to the World Health Organisation (WHO) *Guidelines for Community Noise* 1999, as detailed in Section 3.5 below.

3.6.4 With respect to external amenity space such as gardens and patios, it is stated that it is desirable that the noise level does not exceed 50 dB L_{Aeq,16h}, with an upper guideline value of 55 dB L_{Aeq,16h} which would be acceptable in noisier environments. It is then confirmed that higher external noise criteria may be appropriate under certain circumstances, such as within city centres, urban areas, and locations adjoining the strategic transportation network, where it may be necessary to compromise between elevated noise levels and other factors such as convenience of living, and efficient use of land resource.

3.6.5 Of particular relevance to the proposed scheme is the guidance provided on balconies and roof gardens, specifically the following is stated:

“Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB L_{Aeq,T} or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.”

3.6.6 For the proposed development it is considered that the small balcony areas should not be subject to noise level limits but roof garden areas and the central courtyard space should achieve the 55 dB(A) criterion mentioned above.

3.7 GUIDELINES FOR COMMUNITY NOISE

3.7.1 This World Health Organisation (WHO) document is wide ranging in its description of the effects of community noise. It provides information about the effects of noise that may occur at certain levels of exposure. For dwellings, the critical effects of noise are taken to be sleep disturbance, annoyance and speech interference.

3.7.2 The external and internal ambient noise level L_{Aeq} criteria in BS 8233:2014 are concordant with those contained within the WHO guidelines.

3.7.3 It is stated in the guidelines that, "For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night". Accordingly, for the purpose of this assessment, and in absence of any specific L_{AFmax} criterion being detailed within BS 8233:2014, the criterion of 45 dB L_{AFmax} has been adopted from the guidelines.

3.8 BRITISH STANDARD 4142: 2014 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND (BS 4142)

3.8.1 British Standard 4142 describes methods for rating and assessing the following:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

3.8.2 The method uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. It is stated in the British Standard that the methodology is applicable for the assessment of sound from plant and activities associated with existing industrial and/or commercial uses at proposed residential dwellings.

3.8.3 The Standard effectively compares and rates the difference between the rating level and the typical background sound level ($L_{A90,T}$) in the absence of the noise source being assessed.

3.8.4 It is advised that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) when the noise source in question is likely to operate or is proposed to operate in the future.

3.8.5 When comparing the rating level with the background sound level, BS 4142 states:

- a) *"Typically, the greater this difference, the greater the magnitude of impact.*
- b) *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- c) *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- d) *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

3.8.6 The assessment methodology is applicable for the assessment of industrial and/or commercial sound at proposed new dwellings, as previously discussed. However, the guidance also states:

"NOTE Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the

appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.”

- 3.8.7 In this assessment consideration has been given to the guidance contained within both BS 4142 and BS 8233, in order to ensure that the development proposals are considered in context of the prevailing noise environment and that the most appropriate assessment methodology is adopted.

4 BASELINE NOISE SURVEY

4.1 OVERVIEW

- 4.1.1 To inform the assessment, and as agreed with the dealing EHO, a detailed baseline noise survey was undertaken in the vicinity of the proposed development site. This survey was undertaken to determine the current prevailing noise environment at the site including the noise levels generated by local road traffic sources and the prevailing noise environment at the nearest noise sensitive receptors.
- 4.1.2 The baseline noise survey was conducted over a four day period using two unattended continuous monitoring locations on the facades of an existing student accommodation building immediately adjacent to the proposed development site at the junction of Friars Street and Greyfriars Road, as labelled in **Appendix B**.
- 4.1.3 The noise survey commenced at approximately 14:00 hours on Thursday 04th August, and concluded at approximately 15:00 hours on Monday 08th August 2016.

4.2 MEASUREMENT LOCATIONS

- 4.2.1 The measurement locations adopted throughout the survey are labelled in **Appendix B** and are described below:
- Measurement Location 1 – On the southern façade of the existing student accommodation building, fronting Friar Street at a height of approximately 5 m above local ground. This measurement location was adopted for a continuous four day period, in order to measure noise emissions from the Friar Street and to establish typical background sound levels during periods where road traffic noise levels were at a minimum (e.g. 22:00 – 23:00 hours during the daytime period and 02:00 – 03:00 hours during the night-time period).
 - Measurement Location 2 – On the western façade of the existing residential building fronting onto Greyfriars Road at a height of approximately 5 m above local ground. This measurement location was adopted for a continuous four day period, in order to measure noise emissions from the Greyfriars Road and to establish typical background sound levels during periods where road traffic noise levels were at a minimum (e.g. 22:00 – 23:00 hours during the daytime period and 02:00 – 03:00 hours during the night-time period).
- 4.2.2 The measurement locations were approximately 1 m from the façade of the existing student accommodation building; a correction has been applied to the measured noise levels to account for reflections from the building, as described in the Measurement Results section of this report. The student accommodation building houses the closest identified noise sensitive receptors and therefore the measurement locations are considered to be representative of the nearest noise sensitive receptors.

4.3 METEOROLOGICAL CONDITIONS

- 4.3.1 The survey spanned a number of days during which weather conditions suitable for environmental noise monitoring prevailed, with winds generally ranging from still conditions to a light breeze and with the majority of the survey period remaining dry. The results across the survey were broadly consistent indicating that weather conditions did not adversely affect the measured noise levels.

4.4 MEASUREMENT EQUIPMENT

- 4.4.1 The baseline noise survey measurements were undertaken using Class 1 specification noise measuring equipment as detailed in Table 2 below:

Table 2: Noise measurement equipment

MEASUREMENT LOCATION	MEASUREMENT EQUIPMENT	MAKE AND MODEL	SERIAL NUMBER
1 (Friar Street)	Sound Level Meter	01dB-METRAVIB Solo Master	65704
	Pre-amplifier	01dB-Stell PRE 21 S	16925
	Microphone	Microtech Gefell GmbH MCE212	153382
	Calibrator	01dB-Metravib Cal 21	34134167
2 (Greyfriars Road)	Sound Level Meter	01dB-METRAVIB Solo Master	60532
	Pre-amplifier	01dB-Stell PRE 21 S	13150
	Microphone	Microtech Gefell GmbH MCE212	65593
	Calibrator	01dB-Stell Cal 21	1120240

- 4.4.2 The sound level meters were calibrated to traceable standards within the preceding two years and the portable calibrators within the preceding 12 months. The sound level meters were calibrated both prior to and upon completion of the survey. No significant drift was noted to have occurred.

4.5 MEASUREMENT RESULTS

- 4.5.1 A summary of the measured noise levels is included in Table 3 below, and a time history trace is included in **Appendix C**. A -3 dB correction has been applied to the levels in Table 3 to account for the measurement locations being 1 m from a reflecting façade, in accordance with BS 4142. The stated levels can therefore be considered to be free-field.

Table 3: 24-hour measurement results, Measurement Locations 1 and 2, free-field

MEASUREMENT LOCATION	PERIOD	MEASUREMENTS OF ROAD TRAFFIC NOISE ¹ L _{Aeq,T} dB	TYPICAL BACKGROUND SOUND LEVEL ² L _{A90,15m} dB	TYPICAL MAXIMUM NOISE LEVEL ³ L _{AFmax} dB
1 (Friar Street)	Daytime 07:00 – 23:00	65	50	n/a
	Night-time 23:00 – 07:00	62	43	67
2 (Greyfriars Road)	Daytime 07:00 – 23:00	60	49	n/a
	Night-time 23:00 – 07:00	57	45	64

1 Taken to be the logarithmic average of the Friday and Saturday daytime periods and Friday to Saturday and Saturday to Sunday night-time periods. Sunday daytime periods and Sunday to Monday night-time periods have not been considered, as traffic flows on Sunday are typically lower and would reduce the average noise level.

2 Taken to be the minimum of the L_{A90,15m} values from the periods detailed in note 1 above, minimum values were considered to best represent the typical background noise level during these periods.

3 The typical L_{AFmax} noise level has been derived by taking the 90th percentile of 1 second L_{AFmax} noise levels for the night-time period.

4.5.2

Based on the measured noise levels presented in Table 3, a site suitability assessment has been undertaken to determine whether a suitable noise environment can be achieved for the proposed residential and retail, leisure and/or office uses.

5

SITE SUITABILITY ASSESSMENT

5.1

ACOUSTIC MODELLING

5.1.1

Drawing on the results of the baseline survey, a detailed acoustic model of the site has been created to calculate the level of noise at the façades of the proposed development during the daytime and night-time periods. The model has been generated using the CadnaA® noise modelling software. The following assessment methodology has been adopted for the modelling exercise:

- The model was set to apply the prediction methodology set out in the Department of Transport, Welsh office document *Calculation of Road Traffic Noise* (CRTN) 1988 for the prediction of road traffic noise.
- The levels of road traffic noise from Friar Street and Greyfriars Road have been modelled and calibrated drawing on the results of the baseline survey at Measurement Locations 1 and 2 respectively, as detailed in **Appendix B**.
- The model also includes buildings surrounding the development site. The heights of these elements were estimated by onsite observations and readily available street view photography.
- The proposed buildings have been modelled based on drawings sent by the LDA Chartered Architects (as included in **Appendix B**).
- For the assessment of ambient noise levels, a height of 6.5 m was modelled at the location of the worst affected building façades. Dwellings at this height would be directly above the proposed retail, leisure and/or office uses and would be the closest dwellings to the surrounding road network.
- The model assumed that the propagation path was over entirely acoustically hard ground ($G=0$), to best reflect local ground cover.

5.2

ASSESSMENT OF EXTERNAL AMBIENT LEVELS

5.2.1

An assessment of the predicted ambient noise levels has been undertaken in order to establish the impact of the prevailing noise climate on the future residents of the proposed development.

5.2.2

Assessment Locations have been chosen to be representative of the noise levels in the proposed garden amenity spaces and the balcony areas of the worst affected dwellings. The adopted assessment locations are labelled in **Appendix D** and are described below:

- Assessment Location 1 – In the courtyard area in the centre of the development and at a height of 1.5 m above local ground.
- Assessment Location 2 – At the location of the worst affected balcony area fronting Greyfriars Road. At a height of 6.5 m above local ground.
- Assessment Location 3 – At the location of the worst affected balcony areas fronting Friar Street. At a height of 6.5 m above local ground.
- Assessment Location 4 – In the centre of the lowest proposed roof garden area on top of the building fronting onto Friar Street. At a height of 1.5 above the roof area.

- Assessment Location 5 – In the centre of the second lowest roof garden area at a horizontal distance of approximately 20 m from Friar Street. At a height of 1.5 above the roof area.
- Assessment Location 6 – In the centre of the highest proposed roof garden area at a horizontal distance of approximately 25 m from Friar Street. At a height of 1.5 above the roof area.

5.2.3 The approximate heights of Assessment Locations 1 to 7 are detailed in Table 4 below.

Table 4: Approximate heights of adopted assessment locations

ASSESSMENT LOCATION	APPROXIMATE HEIGHT (M)
1	1.5
2	6.5
3	6.5
4	22.5
5	27.5
6	33.5

5.2.4 According to BS 8233 it is desirable that noise levels in external amenity areas do not exceed 50 dB $L_{Aeq,16h}$, with an upper guideline value of 55 dB $L_{Aeq,16h}$ that would be acceptable in noisier environments. For the courtyard amenity space, 55 dB $L_{Aeq,16h}$ is therefore considered as the upper guideline value.

5.2.5 Noise limits should not be necessary for small balcony areas intended for uses such as drying washing or growing pot plants, therefore there is no applicable noise limit for Assessment Locations 2 and 3. For Assessment Locations 4, 5 and 6 the daytime criterion of 55 dB $L_{Aeq,16h}$ should be achieved in accordance with the standard.

5.2.6 The predicted ambient noise levels at each assessment location are presented in Table 5 below together with the BS 8233 criteria for external amenity spaces.

Table 5: Predicted ambient noise levels at each assessment location, free-field

ASSESSMENT LOCATION	Description	PERIOD	PREDICTED EXTERNAL LEVEL $L_{Aeq,T}$ dB [A]	BS 8233 CRITERIA $L_{Aeq,T}$ dB [B]	DIFFERENCE ¹ [A] – [B]
1	Central courtyard	Daytime 07:00 – 23:00	44	50	-6
2	Balcony Greyfriar Street	Daytime 07:00 – 23:00	59	N/A	N/A
3	Balcony Friar Street	Daytime 07:00 – 23:00	63	N/A	N/A
4	Roof garden 1	Daytime 07:00 – 23:00	48	55	-7
5	Roof garden 2	Daytime 07:00 – 23:00	43	55	-12
6	Roof garden 3	Daytime 07:00 – 23:00	45	55	-10

1. Negative numbers indicate that the criteria have been achieved.

5.2.7 It can be seen from Table 5 that at all of the assessment locations the adopted noise level criteria are predicted to be achieved and an appraisal of noise mitigation measures for these spaces is not considered to be warranted.

5.3 ASSESSMENT OF INTERNAL AMBIENT LEVELS

5.3.1 In addition to the assessment of external noise levels undertaken above, an assessment of predicted internal noise levels has been undertaken. Assessment Locations 2 and 3 have been adopted for this assessment, as they are representative of the worst affected dwellings adjacent to Friar Street and Greyfriars Road. The proposed bedroom spaces are slightly closer to the Friar Street and Greyfriars Road when compared with the lounge locations, and the predicted noise levels are 1 dB higher because of this, therefore the noise levels in the table below have been corrected to account for this difference in level.

5.3.2 Table 6 below details the predicted external noise levels at the above assessment locations, the applicable internal noise level criteria and the necessary level difference to achieve the internal criteria.

Table 6: Predicted external ambient noise levels and required level differences, free-field at 6.5 m height.

ASSESSMENT LOCATION	ROOM TYPE	PERIOD, PARAMETER	PREDICTED EXTERNAL LEVEL [A]	INTERNAL CRITERION [B]	LEVEL DIFFERENCE [A]-[B]
Assessment Location 2 (Greyfriars Road)	Bedroom	Daytime 07:00 - 23:00, L _{Aeq,16h}	60	35	25
		Night-time 23:00 - 07:00, L _{Aeq,8h}	57	30	27
		Night-time 23:00 - 07:00, L _{AFmax}	64	45	19
	Living/Dining area	Daytime 07:00 - 23:00, L _{Aeq,16h}	59 ¹	35	25
Assessment Location 3 (Friar Street)	Bedroom	Daytime 07:00 - 23:00, L _{Aeq,16h}	64	35	29
		Night-time 23:00 - 07:00, L _{Aeq,8h}	61	30	31
		Night-time 23:00 - 07:00, L _{AFmax}	67	45	22
	Living/Dining area	Daytime 07:00 - 23:00, L _{Aeq,16h}	63 ¹	35	28
1. Noise levels outside lounge spaces are slightly lower (circa 1 dB) than those outside bedrooms, as the lounge spaces are set further back from road in alcoves.					

5.3.3 A -15 dB correction can be applied to external free-field levels to estimate internal levels, as detailed within the simplified method from BS 8233. Comparing this 15 dB correction with the required level differences from Table 6 indicates that the adopted internal noise level criteria would be exceeded with open windows.

- 5.3.4 It can also be seen from Table 6 that during the night-time the level difference required to achieve the $L_{Aeq,T}$ criteria is greater than that required to achieve the L_{AFmax} criterion. Therefore, the level of noise mitigation for bedrooms will be dictated by the $L_{Aeq,T}$ criteria. Consideration has been given to generic mitigation measures in the mitigation section of this report.

6 MITIGATION

- 6.1.1 It has been identified in the previous section that the internal criteria stated within BS 8233 and agreed with RBC are unlikely to be achieved at Assessment Locations 7 and 8 with windows open, which is to be expected, and certainly not unusual given the urban location of the site.

- 6.1.2 In the first instance consideration has been given to the attenuation that could be afforded by the building envelope. Accordingly, a series of noise break-in calculations have been undertaken as detailed in the following section.

6.2 NOISE BREAK-IN CALCULATIONS

- 6.2.1 Following the “rigorous calculation” method detailed within BS 8233, and based on the scheme layout drawings included in **Appendix B**, a series of detailed noise break-in calculations have been undertaken.

- 6.2.2 Table 7 below details the predicted internal noise levels at the location of the worst affected dwellings, accounting for the performance of standard double glazing of the configuration 6 mm glass / 12 mm air gap / 6 mm glass. A glazing unit of this type would be expected to achieve 29 dB (R_w+C_{tr}).

Table 7: Predicted internal noise levels, accounting for 29 dB (R_w+C_{tr}) glazing units, free-field, dB

ASSESSMENT LOCATION	ROOM TYPE	PERIOD/ PARAMETER	PREDICTED EXTERNAL NOISE LEVEL	INTERNAL NOISE LEVEL CRITERIA	PREDICTED INTERNAL NOISE LEVEL
Assessment Location 2 (Greyfriars Road)	Bedroom	Daytime 07:00 - 23:00, $L_{Aeq,16h}$	60	35	29
		Night-time 23:00 - 07:00, $L_{Aeq,8h}$	57	30	27
		Night-time 23:00 - 07:00, L_{AFmax}	64	45	34
	Living/ Dining area	Daytime 07:00 - 23:00, $L_{Aeq,16h}$	59 ¹	35	29
Assessment Location 3 (Friar Street)	Bedroom	Daytime 07:00 - 23:00, $L_{Aeq,16h}$	64	35	33
		Night-time 23:00 - 07:00, $L_{Aeq,8h}$	61	30	29

ASSESSMENT LOCATION	ROOM TYPE	PERIOD/ PARAMETER	PREDICTED EXTERNAL NOISE LEVEL	INTERNAL NOISE LEVEL CRITERIA	PREDICTED INTERNAL NOISE LEVEL
		Night-time 23:00 - 07:00, LAFmax	67	45	36
	Living/ Dining area	Daytime 07:00 - 23:00, LAeq,16h	63 ¹	35	33
1. Noise levels outside lounge spaces are slightly lower (circa 1 dB) than those outside bedrooms, as the lounge spaces are set further back from road in alcoves.					

- 6.2.3 From Table 7 above it can be seen that with standard double glazing of an arrangement similar to 6 mm glass / 12 mm air gap / 6 mm glass, the adopted internal noise level criteria will be achieved during the daytime and night-time periods.
- 6.2.4 The above calculations do not make any allowance for the incorporation of permanent ventilation to the dwellings. Where appropriate, the preferred choice of ventilation is through the use of natural ventilation openings such as trickle vents, air-bricks and passive ventilation devices. Such ventilators can be used to meet the requirements of the Building Regulations Approved Document F for background ventilation. The future occupants would then have the option of keeping windows closed for most of the time and opening windows for rapid ventilation. It is currently proposed that units fronting onto Friars Street and Greyfriars Road, up to and including the 3rd floor, will have mechanical ventilation for air quality reasons and for these dwellings, windows will normally be closed. For higher floors passive ventilation systems are proposed.
- 6.2.5 The Building Research Establishment (BRE) has published an Information Paper on the acoustic performance of such passive ventilation systems. IP4/99: 1999: Ventilators: *Ventilation and Acoustic Effectiveness* details a study into the sound reduction performance of fourteen different window mounted trickle ventilators and seven different through-wall passive ventilators. The measured sound reduction performance of open window mounted trickle vents, after taking into account flanking sound paths (i.e. sound paths that do not travel directly through the vent) and the effective area of the ventilator ranged between 14 and 40 dB(A) depending on the model. It can therefore be seen that window mounted trickle vents are available that meet the requirements of the Building Regulations Approved Document F for background ventilation and also provide a sound insulation performance that meets or exceeds that required from the glazing elements.
- 6.2.6 It should be noted that for this development high performing passive ventilation systems or mechanical ventilation may be required for the worst affected spaces.
- 6.2.7 The above glazing calculations are intended to be for planning purposes only. More detailed calculations will be required for the procurement of the glazing units at detailed design stage.

7 NOISE EMISSION LIMITS

- 7.1.1** The proposed development includes ground floor retail, leisure and/or office uses. These elements of the development may have associated fixed plant items and may have deliveries, which could generate sound externally, potentially affecting both existing receptors and the residential elements of the proposed development itself.
- 7.1.2** At this stage, details of the proposed nature, type, number and location of any such plant items are not known. Accordingly, it is appropriate to specify suitable noise emission limits to which any such plant and/or delivery operations should conform.
- 7.1.3** The limits applicable to fixed plant items and delivery operations should be determined in accordance with BS 4142:2014 as summarised in the Legislation and Guidance section of this report. Where the rating noise levels generated by the proposed noise sources are equal to the prevailing background noise levels, the standard states the following:
- 7.1.4** The closest noise sensitive receptors to the development have been identified as existing properties on Friar Street and Greyfriars Road immediately adjacent to the proposed development, as labelled in **Appendix C**, at a height of approximately 6.5 m. Measurement Locations 1 and 2 are considered to be representative of these dwellings respectively, as the measurement locations were located at the façades of these dwellings.
- 7.1.5** Table 8 below details the derived noise level limits at the closest noise sensitive receptors, based on the noise levels measured at Measurements Locations 1 and 2.

Table 8: Noise emission limits for proposed fixed plant items and deliveries

MEASUREMENT LOCATION	RECEPTOR LOCATION	PERIOD	NOISE LEVEL LIMIT (L _{AR,Tr}) dB
1	Closest Dwellings on Friar Street	Daytime 07:00 – 23:00	50
		Night-time 23:00 – 07:00	43
2	Closest Dwellings on Greyfriars Road.	Daytime 07:00 – 23:00	49
		Night-time 23:00 – 07:00	45

- 7.1.6** The above limits are in terms of rating levels, and as such the noise levels generated by noise sources associated with the development will need to be corrected for characteristic features prior to being compared to the above limits. These limits apply to the total noise emissions from all fixed plant at the receptor location.
- 7.1.7** It should be noted that adopting a rating level limit equal to background will ensure that the specific level of the noise from sources associated with the development will be below the prevailing background levels in the area.

7.2 INTERNAL ACOUSTICS

- 7.2.1** The control of external noise breaking into the residential elements of the proposed development has been considered in outline above. Further consideration will be given during the detailed design stage to confirm exact glazing and ventilation specifications.

- 7.2.2 During the detailed design stage, consideration will also be given to the potential for noise and vibration to be generated, and transferred, within the proposed development. Good sound insulation will need to be provided between neighbouring apartments, and between the apartments and non-residential spaces, such as the retail, leisure and/or office uses, lift shafts, plant rooms and communal areas, where applicable. This will be achieved through, in particular, the adoption of the advice in Approved Document E *Resistance to the passage of sound* of The Building Regulations 2010.
- 7.2.3 In terms of the buildings services plant and associated pipes and ductwork, these will need to be installed (with the use of anti-vibration mounts and hangers, where necessary) so as to avoid the transfer of noise or vibration into neighbouring structures and spaces.

8 SUMMARY

- 8.1.1 WSP | Parsons Brinckerhoff has been appointed by CIP Property (AIPT) Limited to undertake a noise impact assessment for a proposed residential led mixed use development on land at 52 – 55 Friar Street and 12 Greyfriars Road, Reading.
- 8.1.2 The assessment has been based upon the results of a baseline noise survey. Acoustic modelling has also been carried out to establish the prevailing noise levels at the proposed development, including contributions from the local road network.
- 8.1.3 It has been identified that with windows open the predicted noise levels inside the worst affected proposed habitable rooms would exceed the relevant criteria from BS 8233 and the WHO *Guidelines for Community Noise*. Consideration has, therefore, been given to appropriate mitigation measures.
- 8.1.4 It has been identified that, through the selection of appropriate glazing and ventilation units, the applicable internal criteria can be achieved. The final specifications of the glazing and ventilation units would be confirmed during the detailed design stage.
- 8.1.5 Based on the results of the baseline survey, the guidance in BS 4142 and consultation with RBC, external noise emission limits have been determined that would be applicable to any external fixed plant associated with the proposed development.
- 8.1.6 Additional considerations beyond the scope of this report have been identified, in the form of delivery activities and the control of noise and vibration within the development itself. Example control measures have been given for consideration in order to keep noise during deliveries to a practicable minimum, whilst all other issues will be addressed during the detailed design stage.
- 8.1.7 Given the existing mixed nature of the surrounding area, including residential and commercial uses, and assuming the adoption of mitigation measures and noise emission limits in keeping with those described in this report, it is considered that the site is suitable for the proposed development with respect to noise.
- 8.1.8 Limitations to this report can be found in **Appendix D**.

Appendix A

GLOSSARY OF ACOUSTIC TERMINOLOGY

NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

ACOUSTIC TERMINOLOGY

dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

Appendix B

**REDLINE SITE BOUNDARY, ILLUSTRATIVE SCHEME LAYOUT
DRAWINGS AND MEASUREMENT LOCATIONS**

THIS DRAWING IS BASED UPON:
 - PROMAP - ORDNANCE SURVEY (C) CROWN
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 NUMBER 100022432



0 10 20 30 40 50 M

KEY

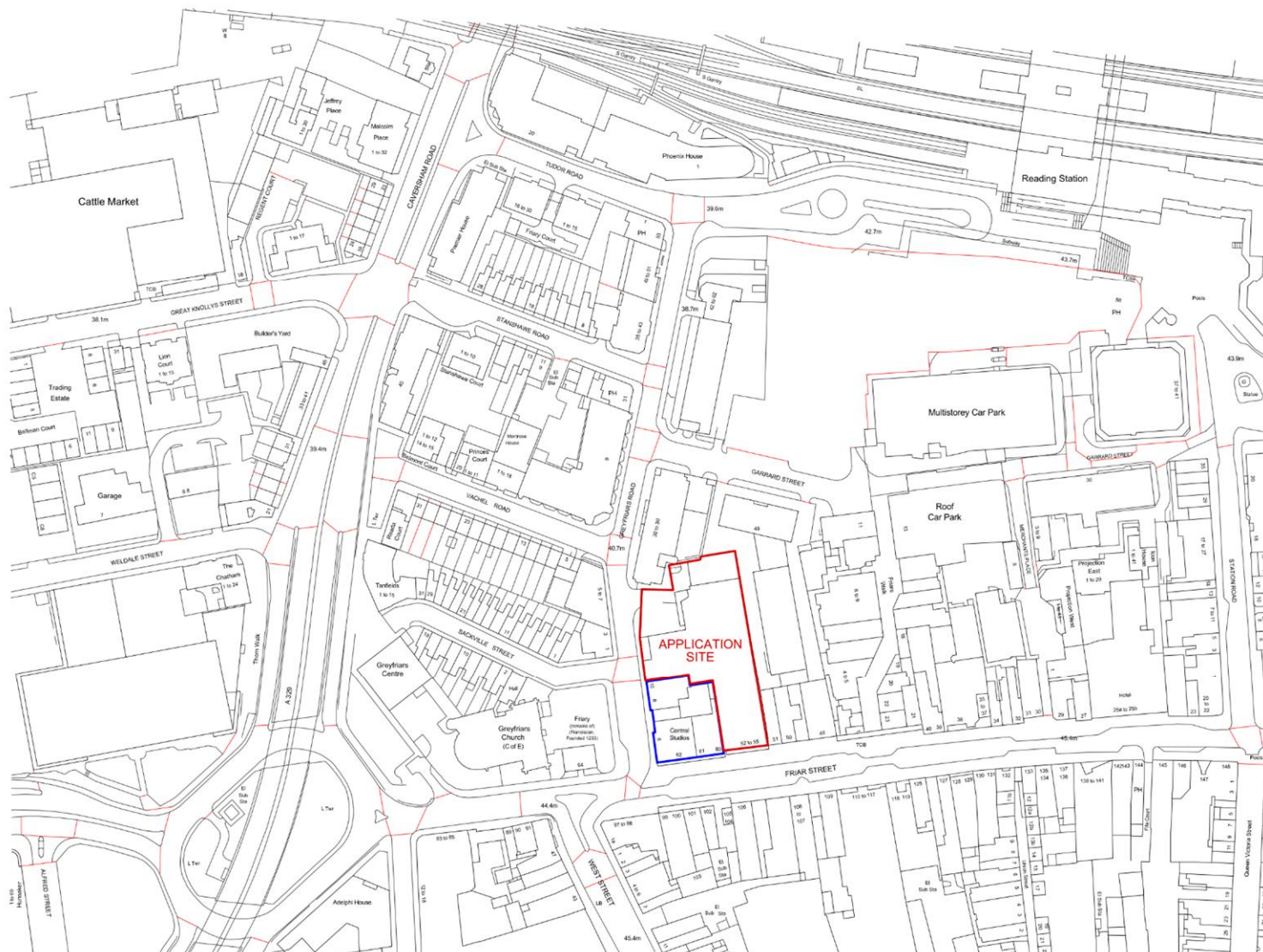
- APPLICATION BOUNDARY
AREA 0.25ha
- OTHER LAND IN APPLICANT'S CONTROL

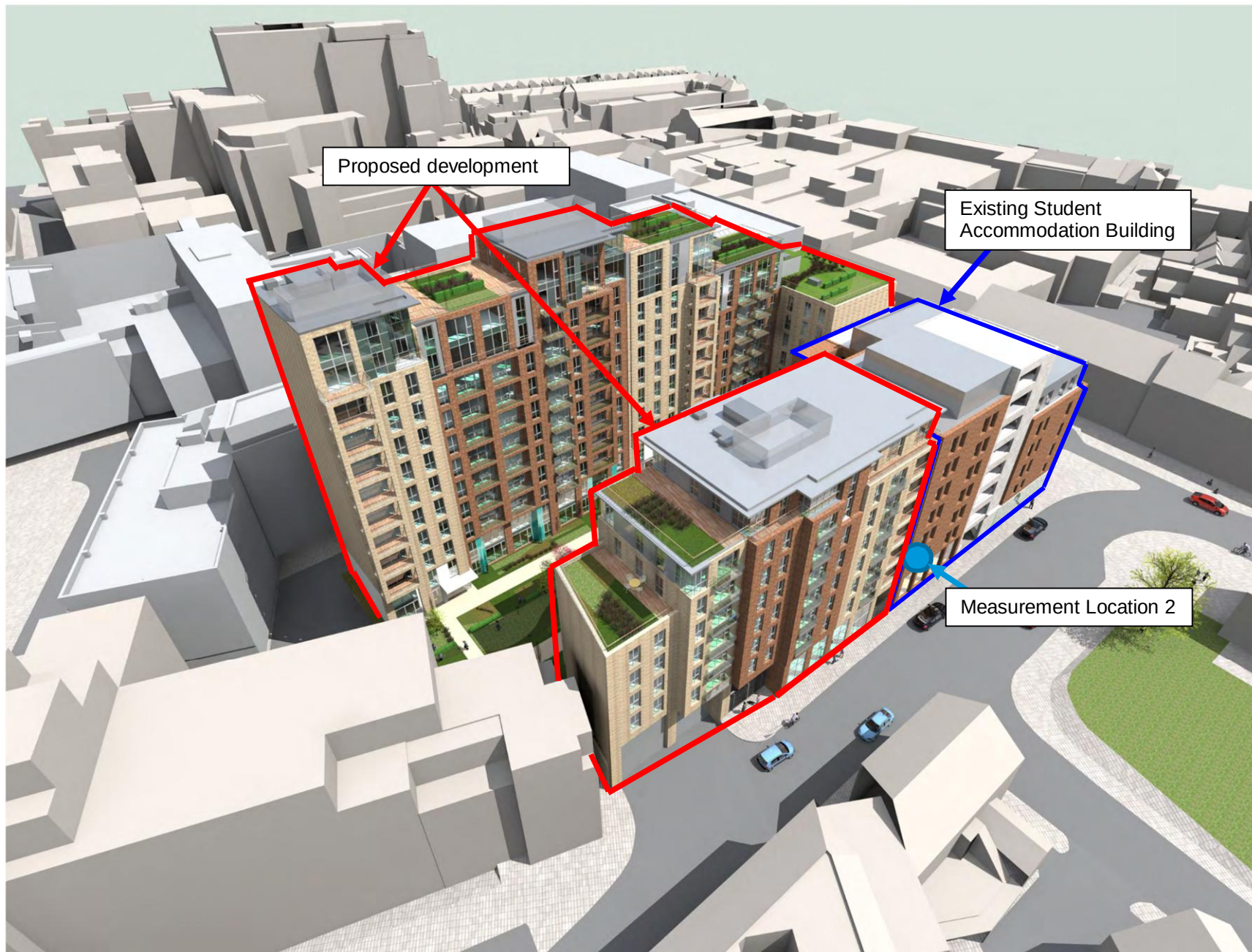
PRELIMINARY PLANNING

REV.	DATE	DESCRIPTION
PROJECT		
52-55 FRIAR STREET & 12 GREYFRIARS ROAD READING		
DRAWING		
SITE LOCATION PLAN		
CLIENT		
CIP PROPERTY (AIP) LTD		
SCALE	DRAWN	
1:1250 @ A2	FM	
DATE	CHECK	
March 2016	PW	
DRAWING No.	REVISION	
1509-PL3-01		
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Reference plan

PLANNING

REV.	DATE	DESCRIPTION
PROJECT 52-55 FRIAR STREET & 12 GREYFRIARS ROAD READING		
DRAWING: 3D AERIAL VIEW 1		
CLIENT CIP PROPERTY (AIP) LTD		
SCALE NTS @ A1	DRAWN	
DATE November 2016	CHECK.	
DRAWING No. 1509- PL3 /40	REVISION A	
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Aerial 3D View 1 - From North West



Aerial 3D view 2 - From South West



Reference plan

PLANNING

REV	DATE	DESCRIPTION
PROJECT		
52-55 FRIAR STREET & 12 GREYFRIARS ROAD READING		
DRAWING		
3D AERIAL VIEW 2		
CLIENT		
CIP PROPERTY (AIPT) LTD		
SCALE		DRAWN
NTS @ A1		CHECK
DATE		REVISION
November 2018		
DRAWING No.		
1509- PL3 /41		A
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CENTRAL STUDIOS

Level 7x (A)

Level 6 (A)

Level 5 (A)

Level 4 (A)

Level 3 (A)

Level 2 (A)

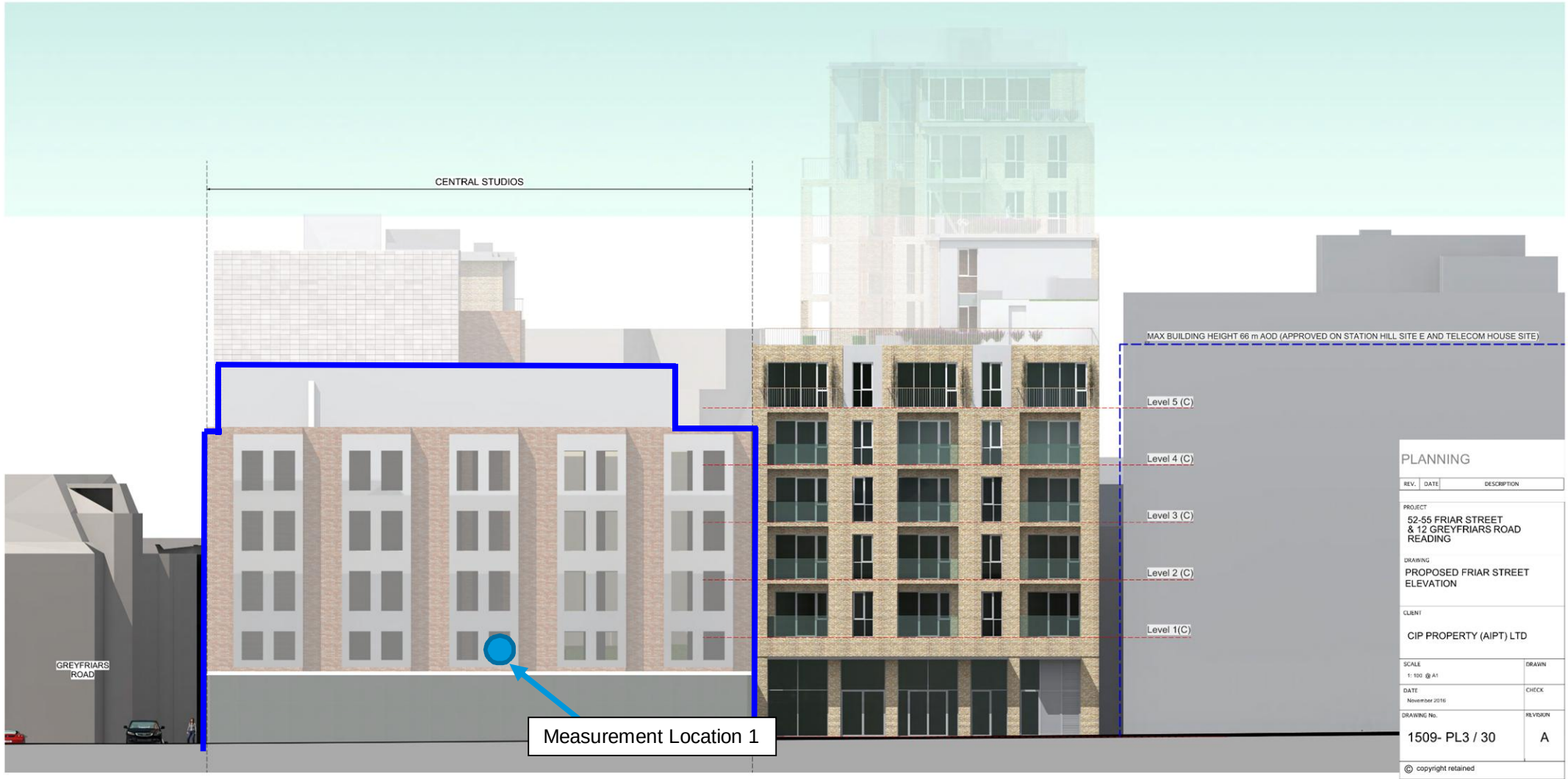
Level 1 (A)

PLANNING

REV.	DATE	DESCRIPTION
PROJECT		
52-55 FRIAR STREET & 12 GREYFRIARS ROAD READING		
DRAWING		
GREYFRIARS ROAD ELEVATION		
CLIENT		
CIP PROPERTY (AIP) LTD		
SCALE		DRAWN
1:100 @ A1		
DATE		CHECK
November 2018		
DRAWING No.		REVISION
1509- PL3 / 31		A
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Measurement Location 2





PROPOSED FRIAR STREET ELEVATION

0 5 10 M

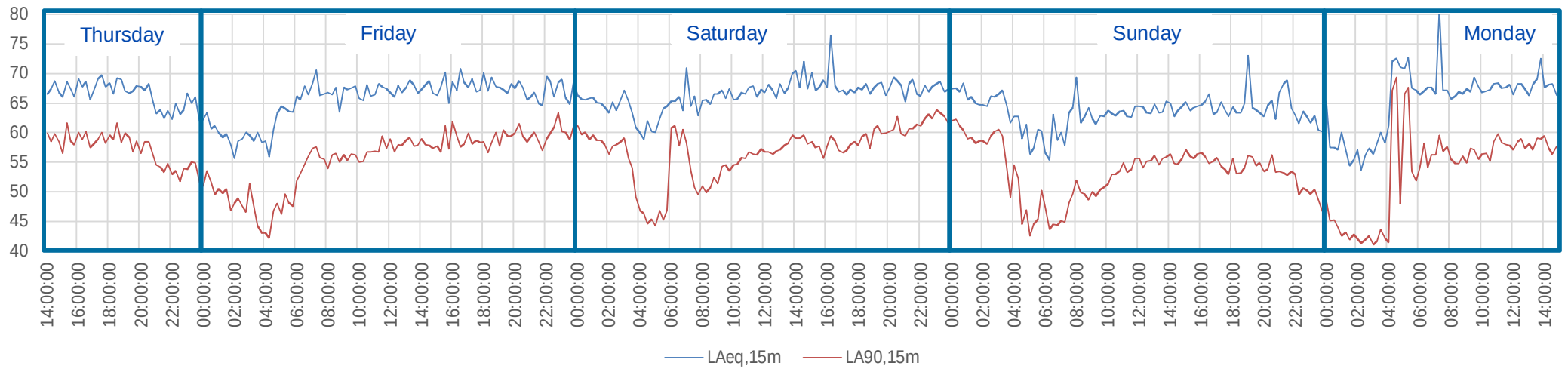
PLANNING

REV.	DATE	DESCRIPTION
PROJECT		
52-55 FRIAR STREET & 12 GREYFRIARS ROAD READING		
DRAWING		
PROPOSED FRIAR STREET ELEVATION		
CLIENT		
CIP PROPERTY (AIP) LTD		
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DATE		CHECK
November 2016		
DRAWING No.		REVISION
1509- PL3 / 30		A
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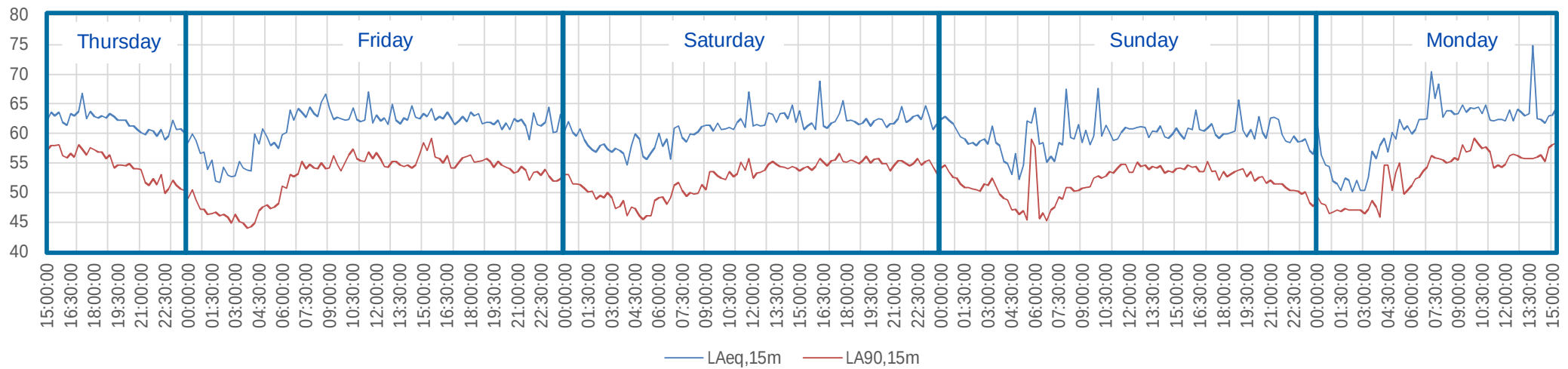
Appendix C

TIME HISTORY TRACE

Time History Trace, Measurement Location 1

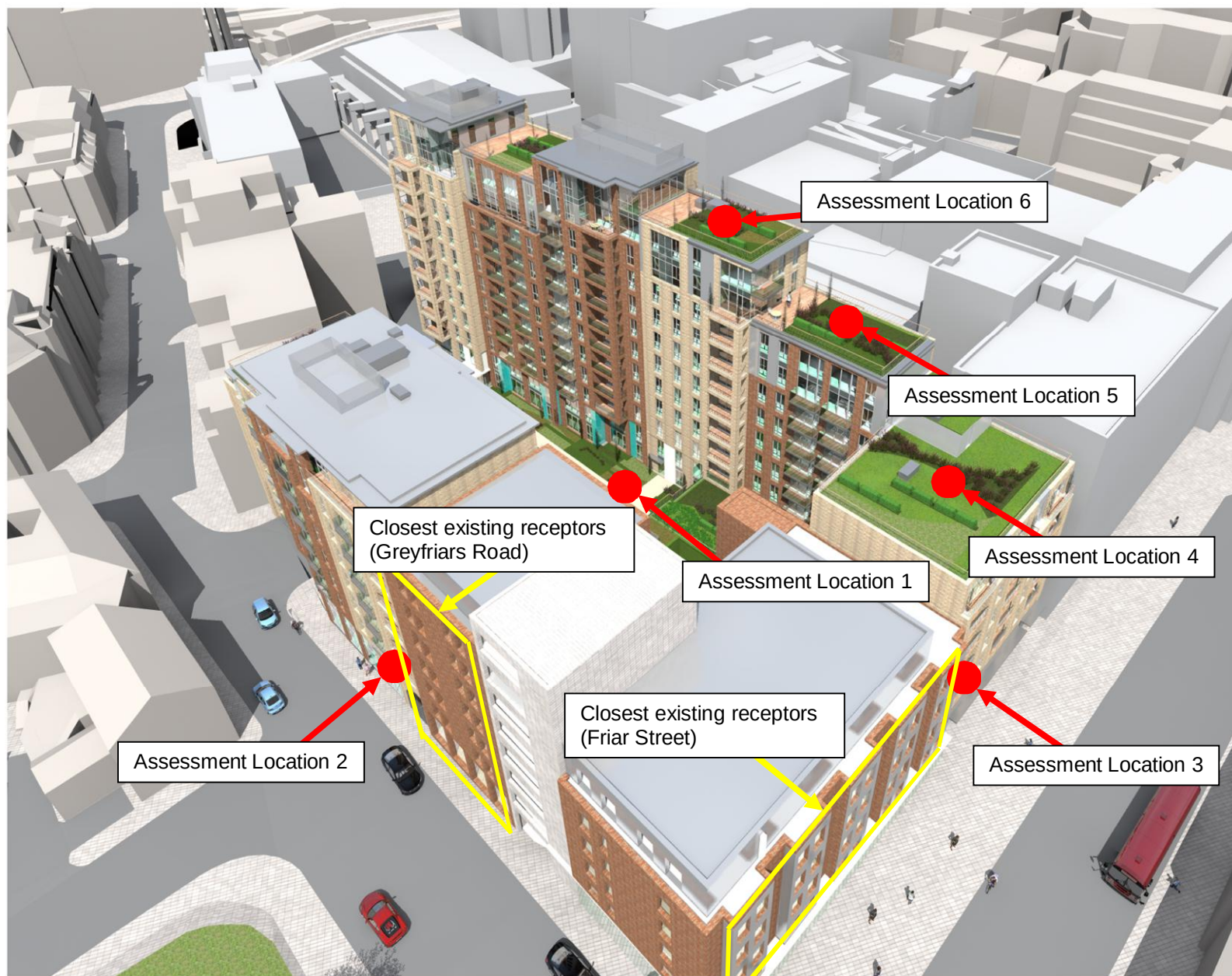


Time History Trace, Measurement Location 2



Appendix D

ASSESSMENT LOCATIONS



Aerial 3D view 2 - From South West



Reference plan

PLANNING

REV	DATE	DESCRIPTION
PROJECT		
52-55 FRIAR STREET & 12 GREYFRIARS ROAD READING		
DRAWING		
3D AERIAL VIEW 2		
CLIENT		
CIP PROPERTY (AIP) LTD		
SCALE		
NTS @ A1		
DATE		
November 2018		
DRAWING No.		
1509- PL3 /41		
REVISION		
A		
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Appendix E

LIMITATIONS

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