Twickenham Riverside
Noise Assessment

LONDON BOROUGH OF
RICHMOND UPON THAMES

August 2021

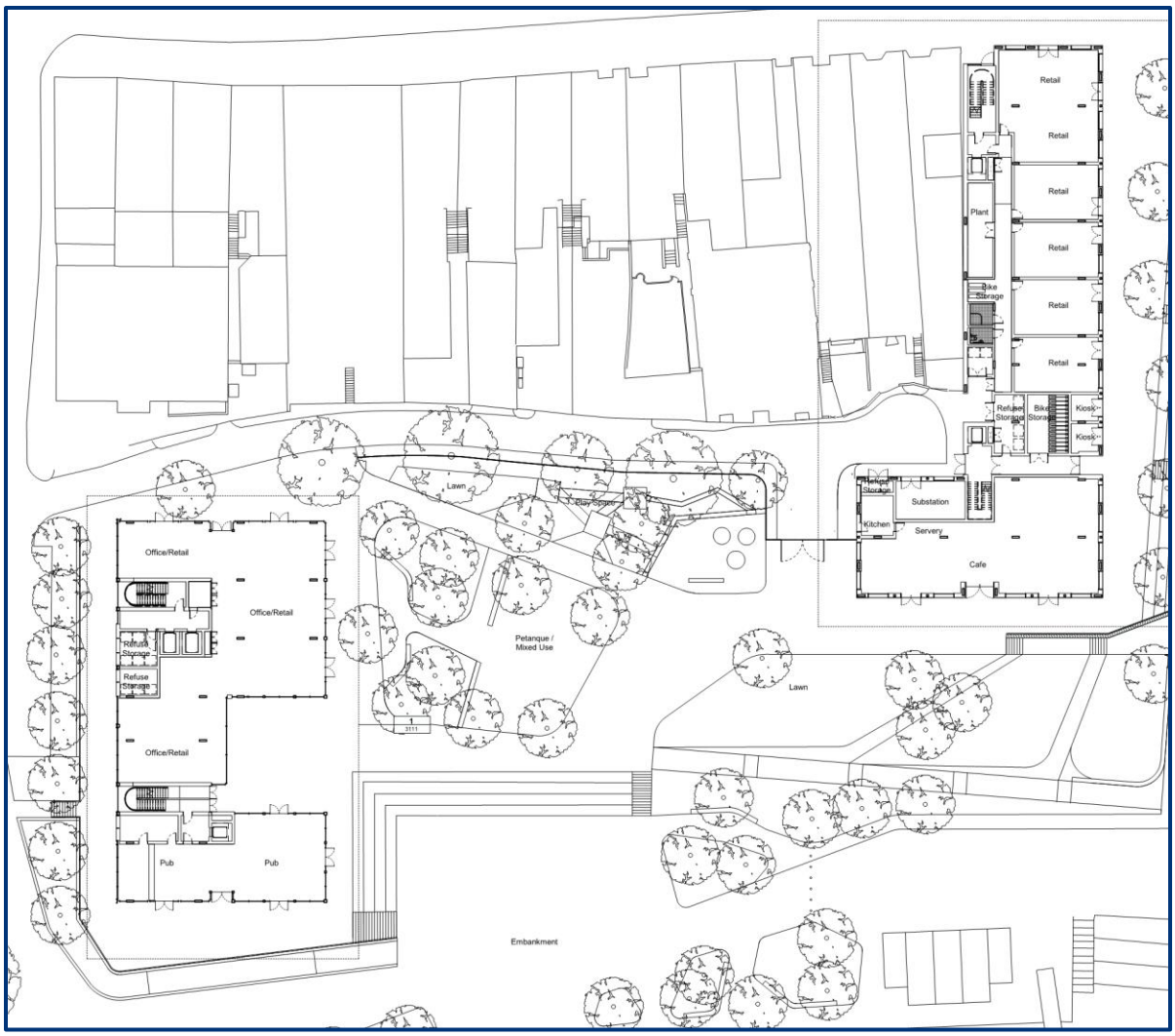
Design Team

Applicant	London Borough of Richmond upon Thames
Project Manager	Arcadis
Architect	Hopkins Architects
Landscape Architect	LDA Design
Structural Engineer	Webb Yates Engineers
Mechanical & Electrical Engineer	Skelly & Couch
Transport Consultant	WSP
Quantity Surveyor	Arcadis
Planning Consultant	Savills
Townscape & Heritage Consultant	Iceni Projects
Sustainability Consultant	Method Consulting
Accessibility Consultant	Lord Consultants
Fire Consultant	FDS Consult UK
Ecology Consultant	BSG Ecology
Arboricultural Consultant	Thomson Environmental Consultants
Daylight & Sunlight Consultant	GIA Chartered Surveyors
Acoustic Consultant	TetraTech
Air Quality Consultant	Entran
Land Contamination Consultant	Geosphere Environmental
Archaeological Consultant	AOC Archaeology Group
Viability Consultant	Lambert Smith Hampton
Principal Designer	Nick Perry Associates
BIM Consultant	BIM Technologies

Twickenham Riverside

Noise Assessment

784-B023999



Noise Assessment for Proposed Residential Development

Prepared on behalf of London Borough of Richmond upon Thames

August 2021

tetratecheurope.com

Tetra Tech Leicester, Executive Park, Avalon Way, Anstey, Leicester, United Kingdom, LE7 7GR
Tetra Tech Limited. Registered in England number: 01959704
Registered Office: 3 Sovereign Square, Sovereign Street, Leeds, United Kingdom, LS1 4ER

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CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

This report presents the findings of a noise assessment in support of a planning application for the following description of development:

Demolition of existing buildings and structures and redevelopment of the site comprising residential (Use Class C3), ground floor commercial/retail/cafe (Use Class E), and public house (Sui Generis), boathouse locker storage and floating pontoon with associated landscaping, restoration of Diamond Jubilee Gardens and other relevant works.'

A description of the existing noise environment in and around the site is provided. Noise surveys have been undertaken and the results used to verify predictions of the effects of noise. The noise levels across the site have been predicted at proposed receptors using CADNA noise modelling software, which incorporates ISO 9613 and CRTN methodologies and calculations.

A list of acoustic terminology and abbreviations used in this report is provided in Appendix A and a set of location plans, noise contour plots relevant to the assessment are presented throughout the document.

1.2 LEGISLATIVE CONTEXT

This report is intended to provide information relevant to the local planning authority and their consultees in support of a planning application for the above proposed development. Policy guidance with respect to noise is found in NPPF, published on 21st July 2021. Section 15, *Conserving and enhancing the natural environment* of the National Planning Policy Framework (NPPF) provides the following guidance in relation to noise impacts, which contains the following statement at paragraph 174:

"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans…"

A further 2 short statements are presented at paragraph 185, which state:

"185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) *"mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*

b) *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason…"*

Furthermore, paragraphs 187 and 188 state:

> *"187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*
>
> *188. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."*

Planning Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England, is to, *'identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'*

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated as follows:

Table 1.1 NPPG Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No Specific Measures Required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No Specific Measures Required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

The NPPF, NPSE and NPPG do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the Proposed Development, national planning policy and appropriate guidance documents, Section 2.0 presents the noise level criteria used as a basis of this assessment.

The NPPG also states that *neither the NPSE nor the NPPF (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the proposed development.*

1.3 PROPG PLANNING AND NOISE - NEW RESIDENTIAL DEVELOPMENT

Professional Practice Guidance on Planning and Noise for new residential development (ProPG) was launched on 22nd June 2017 by the Chartered Institute of Environmental Health (CIEH), the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA). The publication provides practitioners with guidance on the management of noise within the planning system in England.

The guidance is specifically for 'new residential development that would be exposed predominantly to noise from existing transport sources' and reflects the Government's overarching Noise Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF), and Planning Practice Guidance (including PPG-Noise), as well as other authoritative sources of guidance.

The guidance provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, aims to:

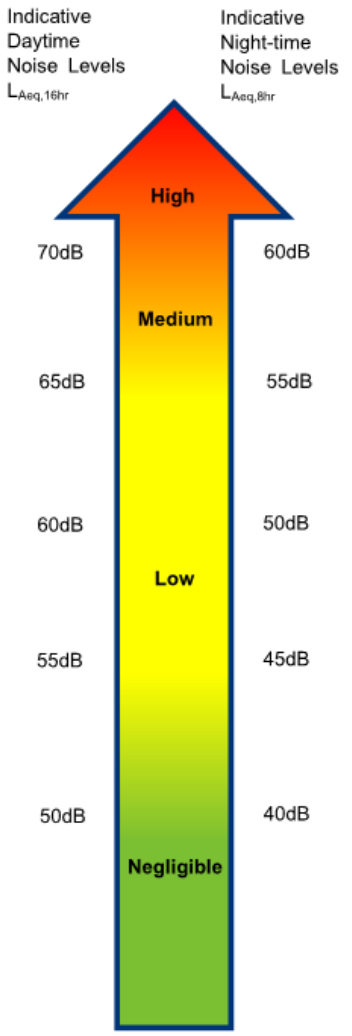
- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- Encourage the process of good acoustic design in and around new residential developments;
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- Promote appropriate noise exposure standards; and
- Assist the delivery of sustainable development.

There are two stages of the overall approach outlined in the ProPG:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of 4 key elements which is underpinned by an Acoustic Design Statement.

With regards to Stage 1, ProPG provides guidance to produce an initial site risk assessment, pre-mitigation, with regards to noise based on the prevailing daytime and night time noise levels across the site, from which the site (or areas thereof) can be allocated a Noise Risk as shown in Figure 1.1 below, together with their corresponding sound levels as referred to in the ProPG.

Figure 1.1 ProPG Stage 1, Noise Risk Assessment

Noise Risk Assessment	Potential Effect Without Noise Mitigation	Pre-Planning Application Advice
	 Increasing risk of adverse effect	High noise levels indicate that there is an increase risk that development may be refused on noise grounds. The risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice. As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is follow and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrates that a significant adverse noise impact will be avoided in the finished development. At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustics design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in he finished development.
	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective and the application need not normally be delayed on noise grounds.

An Acoustic Design Statement is then produced which addresses issues found in Stages 1 & 2 of the ProPG approach including recommendations for mitigation.

1.4 LONDON BOROUGH OF RICHMOND UPON THAMES: DEVELOPMENT CONTROL FOR NOISE GENERATING AND NOISE SENSITIVE DEVELOPMENT

Building Service Plant Noise

Consideration has been given to building service plant noise from the proposed development in relation the London Borough of Richmond Upon Thames Supplementary Planning Document *'Development Control for Noise Generating and Noise Sensitive Development'* (September 2018). The following Table has been taken from this guidance and identifies what noise level is required.

Table 1.2 New Industrial and Commercial Development

Noise Significance Risk	BS4142 Outcome	Planning Advice
Minimal	L_{A90} < -5dB	Where the rating level of noise is below the background noise level by at least 5dB, this indicates that the proposed NGD is likely to be acceptable from a noise perspective. The Borough will seek this level of compliance in most noise sensitive areas and/or where there is a requirement to mitigate creeping background effects.
Low	L_{A90} >-5dB & < 0dB	Where the rating level of noise is equal to, or below the background noise level by up to 5dB, this indicates that the proposed NGD may be acceptable from a noise perspective but will be more context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally). Compliance within this range is more applicable to less sensitive sites or where there is no requirement to mitigate creeping background effects.
Medium	L_{A90} >0dB & < +5dB	Where the rating level of noise is equal to, or above the background noise level by up to 5dB, this indicates that the proposed NGD is less likely to be acceptable from a noise perspective and will be context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally). Compliance within this range is typically only applicable to non-sensitive sites or where there are overriding other reasons why development should be considered. It will typically be necessary for the applicant to confirm how adverse impacts from the NGD will be mitigated and minimised. It is less likely that planning consent will be granted.
High	L_{A90} >+5dB	Where the rating level of noise is above the background noise level by more than 5dB, this indicates that the proposed NGD is unlikely to be acceptable from a noise perspective and planning consent is likely to be refused on noise grounds.

Entertainment noise

Consideration has been given to noise from the proposed development in relation the London Borough of Richmond Upon Thames Supplementary Planning Document *'Development Control for Noise Generating and Noise Sensitive Development'* (September 2018), however this document does not identify any specific requirements in relation to drinking establishments or restaurants.

Noise Intrusion

Consideration to the internal ambient noise levels detailed within the London Borough of Richmond Upon Thames Supplementary Planning Document *'Development Control for Noise Generating and Noise Sensitive Development'* (September 2018), are given within this assessment.

1.5 ACOUSTIC CONSULTANTS' QUALIFICATIONS, PROFESSIONAL MEMBERSHIPS

The lead acoustic consultant for this assessment is Samantha Lewis. The report has been verified by Nigel Mann. Relevant qualifications, membership and experience are summarised below.

Table 1.3 Acoustic Consultants' Qualifications & Experience

Name	Education	Institute of Acoustics Post Graduate Diploma in Acoustic and Noise Control (Pass Date)	Experience in Undertaking Noise Assessments (Start date of working in noise & acoustics)	Attained Associate Membership of the Institute of Acoustics (date)	Attained Membership of the Institute of Acoustics (date)
Samantha Lewis	BSc (2015)	Dec (2019)	Sep (2015)	Jan (2020)	-
Ashley Shepherd	BSc 2013	-	Feb 2014	Feb 2014	Nov 2017
Nigel Mann	BSc (1997) Msc (1999)	Nov (2001)	Nov (1998)	Nov (2001)	Jul (2005)

2.0 ASSESSMENT CRITERIA

2.1 NOISE ASSESSMENT CRITERIA

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Table 2.1 presents equivalent noise levels and associated actions with the target noise level criteria identified. The noise level criteria detailed below have been derived from the following standards and design guidance:

BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

World Health Organisation (1999): *Guidelines on Community Noise*

BS 4142:2014 + A1 2019 *'Methods for rating and assessing industrial and commercial sound'*

Building Bulletin 93 2004 '*Acoustic Design of Schools'*

Table 2.1 Noise Level Criteria and Actions

Effect Level	Assessment	Noise Level Criteria	Action / Justification
No Observed Adverse Effect Level	Noise Intrusion within Proposed Dwellings	Noise levels below: Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms – 35 dB $L_{Aeq,16hours}$ External Amenity Space – 50 dB $L_{Aeq,16hours}$	No Action Required Within BS8233 Criteria
	Proposed Building Service Plant	BS4142 Score of zero or lower	No Action Required Score of zero or lower is an indication of the sound source having a low impact
	Assessment of Overall Change in Noise Levels	Up to 3.0 dB Change or a Reduction in Noise Levels	No Action Required – Change in noise levels unlikely to be perceptible
Lowest Observed Adverse Effect Level	Noise Intrusion within Proposed Dwellings	Noise levels exceed: Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms – 35 dB $L_{Aeq,16hours}$ External Amenity Space – 50 dB $L_{Aeq,16hours}$	Mitigate to achieve: *Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax}* *Living Rooms – 35 dB $L_{Aeq,16hours}$* *External Amenity Space – 55 dB $L_{Aeq,16hours}$*
	Proposed Building Service Plant	BS4142 Score of +5 or lower	Difference of +5 dB likely to be an indication of an adverse effect Mitigate to achieve: BS4142 Score of plus 5 or lower
	Assessment of Overall Change in Noise Levels	Up to 4.9 dB Increase in Noise Levels	No Action Required Slight Impact at Receptor of Some Sensitivity

Effect Level	Assessment	Noise Level Criteria	Action / Justification
Significant Observed Adverse Effect	Noise Intrusion within Proposed Dwellings	Noise levels exceed: Bedrooms – 35 dB $L_{Aeq,8hours}$ Living Rooms – 40 dB $L_{Aeq,16hours}$ External Amenity Space – 55 dB $L_{Aeq,16hours}$	Mitigate to achieve: *Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms – 35 dB $L_{Aeq,16hours}$ External Amenity Space – 55 dB $L_{Aeq,16hours}$*
	Proposed Building Service Plant	BS4142 Score between +5 and +10	Difference of +10 dB likely to be an indication of a significant adverse effect Mitigate to achieve as low as practicable
	Assessment of Overall Change in Noise Levels	3.0 to 5.0 dB Change in Noise Levels at receptor of high sensitivity or Greater than 5.0 dB Increase in Noise Levels	Mitigate to achieve: Increase in Noise Levels of less than 3.0 dB (high sensitivity) or Increase in Noise Levels of less than 5.0 dB (receptor of some sensitivity)
Unacceptable Observed Adverse Effect	Noise Intrusion within Proposed Dwellings	Noise levels with mitigation exceed: Bedrooms – 35 dB $L_{Aeq,8hours}$ Living Rooms – 40 dB $L_{Aeq,16hours}$ External Amenity Space – 60 dB $L_{Aeq,16hours}$	Prevent
	Proposed Building Service Plant	BS4142 Score of +10 or higher	Prevent Mitigate to achieve as low as practicable
	Assessment of Overall Change in Noise Levels	Greater than 5.0 dB Increase in Noise Levels	Mitigate to achieve: Increase in Noise Levels of less than 5.0 dB

2.2 SOUND INSULATION REGULATIONS

The Building Regulations 2010

Requirements E1, E2 and E3 of the Building Regulations 2010 are in regard to the propagation of noise within residential buildings. The requirements are reproduced below:

Protection against sound from other parts of the building and adjoining buildings

E1. *Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.*

Protection against sound within a dwelling-house etc.

E2. *Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that:*

(a) Internal walls between a bedroom or a room containing a water closet, and other room: and

(b) Internal floors

Provide reasonable resistance to sound

Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes

E3. *The common internal parts of buildings which contain flats or rooms for residential purposes shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable*

Requirement E2 does not apply to:

(a) an internal wall which contains a door

(b) an internal wall which separates an en-suite toilet from the associated bedrooms

(c) existing walls and floors in a building which is subject to a material change of use

Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which give access to the flat or room for residential purposes.

Approved Document E 2003 (2015)

In residential properties, the normal way of satisfying requirements E1, E2 and E3 of the Building Regulations 2010 is to use the guidance provided by Approved Document E to the building regulations 2010.

Table 0.1a of The Building Regulations Approved Document E (AD-E) presents minimum sound insulation requirements for separating walls between ‘Dwelling-houses and flats’ and are presented in

Table 2.1

Table 2.1 AD-E Sound Insulation Requirements for Separating Walls

Table 0.1a **Dwelling-houses and flats – performance standards for separating walls, separating floors, and stairs that have a separating function**		
	Airborne sound insulation sound insulation $D_{nT,w} + C_{tr}$ dB (Minimum values)	**Impact sound insulation $L'_{nT,w}$ dB (Maximum values)**
Purpose built dwelling-houses and flats		
Walls	45	-
Floors and stairs	45	62
Dwelling-houses and flats formed by material change of use		
Walls	43	-
Floors and stairs	43	64

The above rules do not apply to walls containing doors, en suite bathroom walls between bathroom and access bedroom and existing floors in building which is subject to a change of use.
For internal walls that do not separate different residential properties the requirements are different, as shown in Table 2.3.

Table 2.3 AD-E Sound Insulation Requirements for Internal Walls

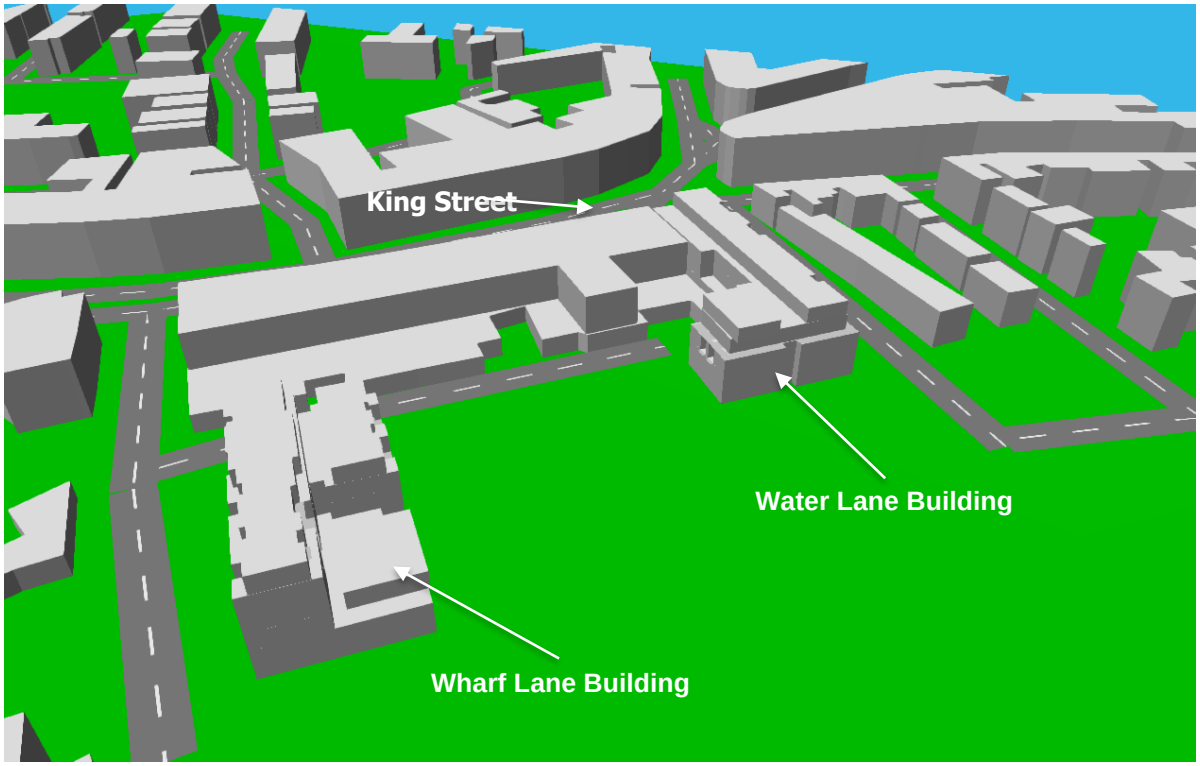
Table 0.2 **Laboratory values for new internal walls and floors within dwelling-houses, flats and rooms for residential purposes, whether purpose built or formed by material change of use**	
	Airborne sound insulation R_w dB (Minimum values)
Walls	40
Floors	40

3.0 ASSESSMENT METHODOLOGY

3.1 NOISE MODELLING METHODOLOGY

Three-dimensional noise modelling has been undertaken based on the monitoring data to predict noise levels at a number of locations both horizontally and vertically. CADNA noise modelling software has been used. This model is based on ISO 9613 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios both horizontally and vertically.

Figure 3.1 CADNA Noise Model



The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data and model settings as given in the table below have been used.

Table 3.1 Modelling Parameters Sources and Input Data

Parameter	Source	Details
Horizontal distances – around site	Ordnance Survey	Ordnance Survey
Ground levels – around site	Ordnance Survey	Ordnance Survey
Ground levels – other areas	Site Observations and Ordnance Survey	OS 1:25,000 contours and OS 1:10,000 spot heights.
Building heights – around site	Tetra Tech Observations	8 m height for two storey residential properties, and 4 m for Bungalows. 3m per storey for multi-storey developments.
Barrier heights	Tetra Tech Observations	All existing barriers at 1.8 m with the exception of hedges and trees which are considered to offer no noise protection. Proposed garden fences are considered to be 1.8m.
Receptor positions	Tetra Tech	1 m from façade, height of 1.5 m for ground floor, 4 m for first floor properties. 1.5 m height for model grid and monitoring locations for validation.
Plans	Hopkins IT	Drawing Title: Existing Site Plan Dated: 11/06/2021

It is acknowledged that a number of the values of parameters chosen will affect the overall noise levels presented in this report. However, it should be noted that the values used, as identified above, are worst case.

3.2 MODEL INPUT DATA

3.1.1 Model Verification

The model was verified by modelling the monitoring locations for the 'existing' weekday scenario. Daytime and night-time L_{Aeq} and night-time L_{Amax} scenarios have been verified. The comparison between the monitoring and modelling results are shown in the tables below.

Table 3.2 Modelled vs. Monitored Results $L_{Aeq;\ daytime\ 07:00 – 23:00}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
MP1	66.8	67.3	0.5
MP2	55.8	56.4	0.6
MP3	57.9	55.0	-2.9
MP4	63.2	63.2	0.0
MP5	60.5	60.0	-0.5

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa

Table 3.3 Modelled vs. Monitored Results $L_{Aeq;\ night\text{-}time\ 23:00– 07:00}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
MP1	61.4	60.6	-0.8
MP2	41.5	41.9	0.4

MP3	38.3	41.2	2.9
MP4	44.4	43.5	-0.9
MP5	49.9	48.5	-1.4

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

Table 3.4 Modelled vs. Monitored Results $L_{Amax;\ night\text{-}time\ 23:00–\ 07:00}$

Location	Monitored L_{Amax}	Modelled L_{Amax}	Difference between Monitored and Modelled Results
MP1	82.8	81.6	-1.2
MP2	63.0	62.7	-0.3
MP3	53.0	55.7	2.7
MP4	57.0	59.0	2.0
MP5	68.0	69.6	1.6

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

The verification points show a divergence between monitored and modelled results of no more than +/- 2.9 dB. Therefore, the models are considered to be suitably verified.

3.1.2 Entertainment Noise

To represent noise from patrons within the proposed outdoor seating areas, noise measurements were taken from a similar establishment, known as Bar and Beyond in Sheffield. Measurements at Bar and Beyond were taken on a Saturday night as a worst-case scenario. To represent full use of the proposed terrace, the L_{Aeq} levels have been modelled as an area source across the entirety area the terrace. This noise level has been used for both commercial properties.

Potential Music breakout associated with the façade of the proposed commercial unit has been included within the model. As such, the noise levels presented in Table 3.5 are considered to represent a worst-case scenario, as is not intended that the establishment will create such scenarios, as the proposed future used is to be a gastro pub / restaurant. The noise level data and calculations below have been used in the model to assess noise from this source at nearby noise sensitive properties.

Table 3.5 External Seating Area Noise Data

Description	Octave Band Sound Pressure Levels (Hz)									Single Figure (dB)
	31.5	63	125	250	500	1K	2K	4K	8K	
Existing Smoking Area $L_{Aeq,\ 10mins}$ @ 1.5m height	71.7	67.8	61.3	62.1	63.2	61.4	56.4	51.1	42.6	65.3
Music Breakout $L_{Aeq,\ 10mins}$ @ 5m	66.9	76.0	68.7	58.6	61.2	57.3	53.2	47.0	46.6	63.0

3.1.3 Proposed Building Service Plant

Point sources have been used in the model to represent potential plant associated with the Development, located on the roof of the building. The maximum sound pressure levels of the point sources at 1 and 3 metres were estimated in the model as a conditional maximum level that the noise levels at nearby receptors were predicted to meet the BS 4142 assessment criteria. Noise emission limits have been specified to ensure that plant noise rating levels (including a + 3 dB correction for potential tonal aspects of the noise source) are at least 5 dB below existing daytime and night-time background noise levels.

3.2 SENSITIVE RECEPTORS

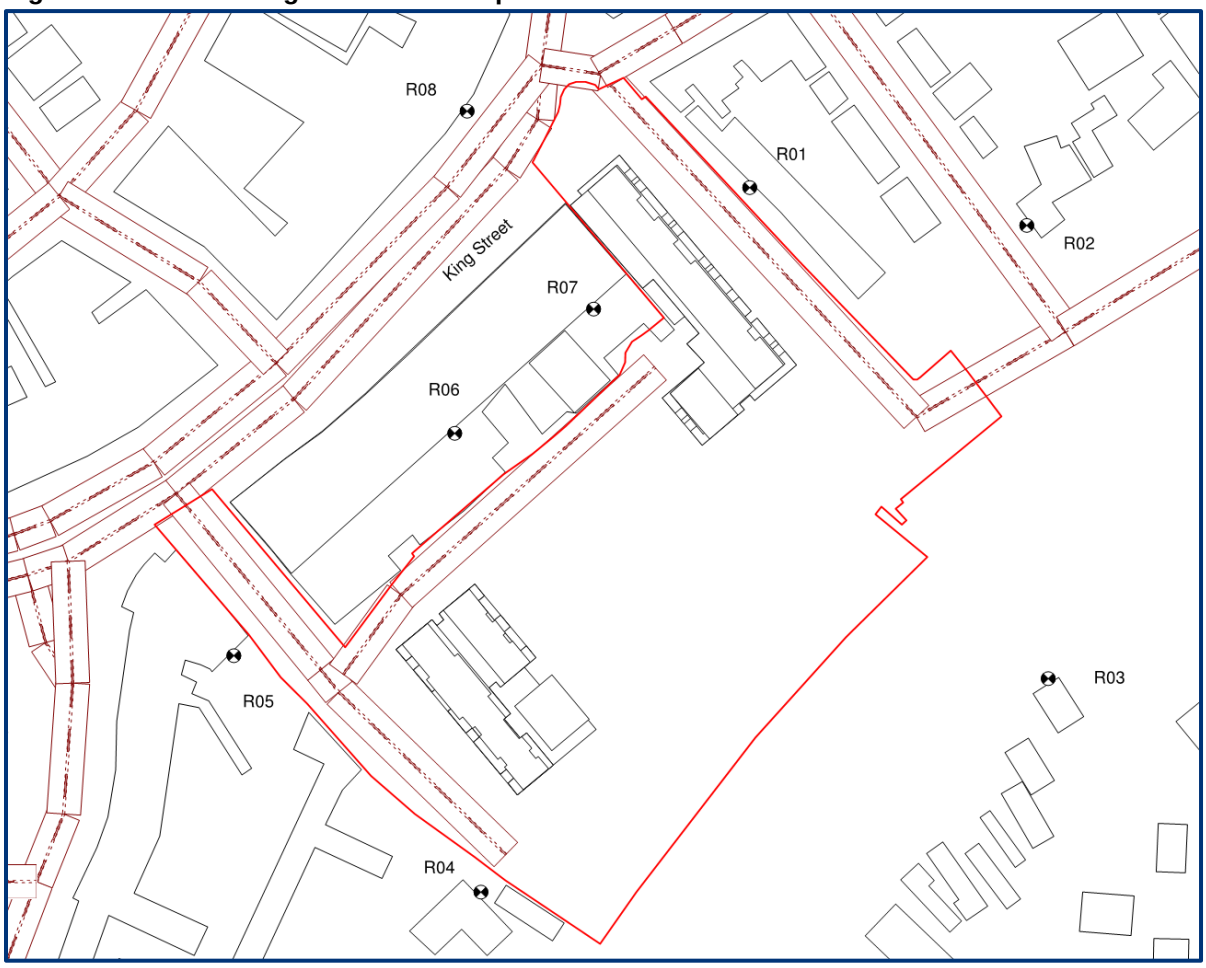
Existing noise levels have been assessed at all floors of the proposed development, on all facades, for each phase of the proposed development. The locations of the proposed receptors are shown in SK01 - SK05 of Appendix B. Sensitive external amenity area receptors are in SK06 – SK09 of Appendix B.

Table 3.6 summarises the existing receptor locations selected for the assessment of plant associated with the Development; the locations of the receptors are shown in Figure 3.2 below.

Table 3.6 Receptor Locations (Building Service Plant)

Ref.	Description	Height (m)
R01	Eris Garden, 3 Water Lane	1.5/4.0
R02	2 The Embankment	1.5/4.0
R03	The Nook, Eel Pie Island	1.5
R04	Flat 6, Eyot Lodge	4.0
R05	37-39 King Street Parade	1.5/4.0
R06	13 King Street	4.0
R07	3 King Street	4.0
R08	Flat 2, 10a King Street	4.0

Figure 3.2 Existing Sensitive Receptor Locations



4.0 NOISE SURVEY

4.1 PARAGON NOISE SURVEY

Paragon Acoustic Consultant undertook an environmental noise survey for the proposed development site in July 2017. Due to Covid-19 restriction in place in 2020 and 2021, it was deemed that using this noise survey provided representative noise levels for the surrounding environment.

Paragon acoustic undertook monitoring in five location which are shown in Figure 4.1 below.

A baseline monitoring survey was undertaken by Paragon Acoustics at five locations (as specified in the following table and shown on Figure 4.1) from 12th July to 14th July 2017. Attended short term measurements were undertaken at four locations during daytime and night-time periods with one additional location being measured unattended over a 48-hour period.

Table 4.1 Noise Monitoring Locations

Ref	Description
MP1	In the Rood of 1C King Street on the King Street Elevation
MP2	South End Residential on of Water Lane
MP3	Eel Pie Island
MP4	Back of properties with their frontage on King Street
MP5	Outside Number 15 Water Lane

Figure 4.1 Noise Monitoring Locations

4.2 NOISE SURVEY RESULTS

Table 4.2 Results of Baseline Noise Monitoring Survey (Average Levels)

Period	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	L_{AmaxT} (dB)	$L_{A90,T}$ (dB)
Daytime 07:00 – 23:00	12/07/2017-14/07/2017	MP1	66.8	-	54
	14/07/2017	MP2	55.8	-	43
	14/07/2017	MP3	57.9	-	33
	14/07/2017	MP4	63.2	-	48
	14/07/2017	MP5	60.5	-	47
Night-time 23:00 - 07:00	12/07/2017-14/07/2017	MP1	61.4	82.8	34
	17/07/2017	MP2	41.5	63.0	34
	17/07/2017	MP3	38.3	53.0	33
	17/07/2017	MP4	44.4	57.0	36
	17/07/2017	MP5	49.9	68.0	35

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

5.0 ASSESSMENT OF KEY EFFECTS

5.1 BS4142 ASSESSMENT: PROPOSED BUILDING SERVICE PLANT

This assessment has been undertaken in order to establish indicative maximum external noise levels from the proposed building services plant rooms located at the top of each building, and the maximum noise level for the building service plant. The assessment compares the predicted noise levels from proposed plant with the existing measured average background noise L_{A90} at the closest existing residential receptors.

Predictions were made by defining a sound power level (assuming hemi-spherical propagation) as a point source in the central part of the proposed plant area. When the sound pressure levels are set as shown in Table 5.1, the noise levels at all the existing receptors are predicted to be at least 10 dB below existing background levels during the daytime and night-time as shown in Table 5.2.

Table 5.1 Proposed Emission Limits for BSP as Modelled

BSP Location	Noise Emission Limit - Sound Pressure Level (Cumulative)	
	Daytime	Night-time
Plant Room Louvres	57.5 dB(A) at 1m OR 52.6 dB(A) at 3m	57.5 dB(A) at 1m OR 42.5 dB(A) at 3m
Outdoor Area	63.5 dB(A) at 1m OR 53.9 dB(A) at 3m	-

Table 5.2 BS 4142 Assessment for Proposed Roof Mounted Plant

Ref	Existing Measured Average Background L_{A90}		Noise rating level from plant (with +3 dB Correction)		BS 4142 Score	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	47	34	39	29	-8	-5
R02	43	34	31	21	-12	-13
R03	33	33	28	19	-5	-14
R04	48	36	38	28	-10	-8
R05	48	36	35	25	-13	-11
R06	48	36	33	22	-15	-14
R07	48	36	41	31	-7	-5
R08	54	34	29	19	-25	-15

5.2 NOISE INTRUSION ASSESSMENT

ProPG Stage 1 Risk Assessment

Based on the measured and verified L_{Aeq} noise models, noise levels across the open site are between 38 – 72 dB $L_{Aeq,16hours}$ during the daytime and between 31 – 63 dB $L_{Aeq,8hours}$ during the night-time. Therefore, the application site falls within the 'Medium' to 'High' Noise Risk Categories during both the daytime and night-time periods. As such, these noise levels indicate the proposed development application site requires a good acoustic design process to be followed.

The development proposals incorporate design measures including the use of building shapes to maximise the screening provided to sensitive internal and external areas of the proposed development application site. In particular, the building layout will create sheltered communal external amenity areas where noticeable and intrusive transportation noise sources will be reduced as far as practicable and is considered in greater detail below.

ProPG Element 2: Noise Intrusion Assessment (Proposed Residential Units)

Internal noise levels within all sensitive spaces (bedrooms/living rooms) of the proposed development have been assessed both with windows open, where a reduction from a partially open window of 10 dB has been used, and with windows closed where glazing with a sound reduction of R_w+C_{tr} 30 dB has been used unless stated otherwise.

Where the relevant internal ambient noise level criteria are not met with standard double glazing (example specification R_w + Ctr 30 dB - 6mm/16mm/6mm) then higher glazing specifications have been provided in Appendix C.

The glazing strategy has been designed to achieve WHO/BS 8233 internal L_{Aeq} daytime noise level criteria of 35 dB, an internal night-time L_{Aeq} noise level criteria of 30 dB with windows closed within residential spaces. The glazing specifications would also meet the L_{Amax} criteria within bedrooms of 45 dB with windows closed.

The glazing strategy highlights which areas would require enhanced glazing in order to meet internal ambient noise criteria.

It is understood that all dwellings will feature mixed mode mechanical ventilation as standard, as such the ventilation specifications are suitable in respect to acoustics.

Enhanced glazing with a minimum sound reduction R_w + C_{tr} 39 dB will featured in sensitive spaces (living room and bedrooms) on facades directly adjacent to King Street.

In all other areas, standard double glazing with a minimum sound reduction of R_w + C_{tr} 30 dB will be featured on the facades of sensitive spaces.

The glazing strategy has been shown illustratively on SK01 – SK05 within Appendix B and the full assessment tables with all units and glazing levels have been presented within Table C1-C3 in Appendix C. Figure 5.1 and 5.2 illustratively show the daytime and night-time L_{Aeq} noise levels across the development site.

Figure 5.1 Proposed Daytime $L_{Aeq,16hr}$ Noise Contour Plot (Grid Height: 1.5m)

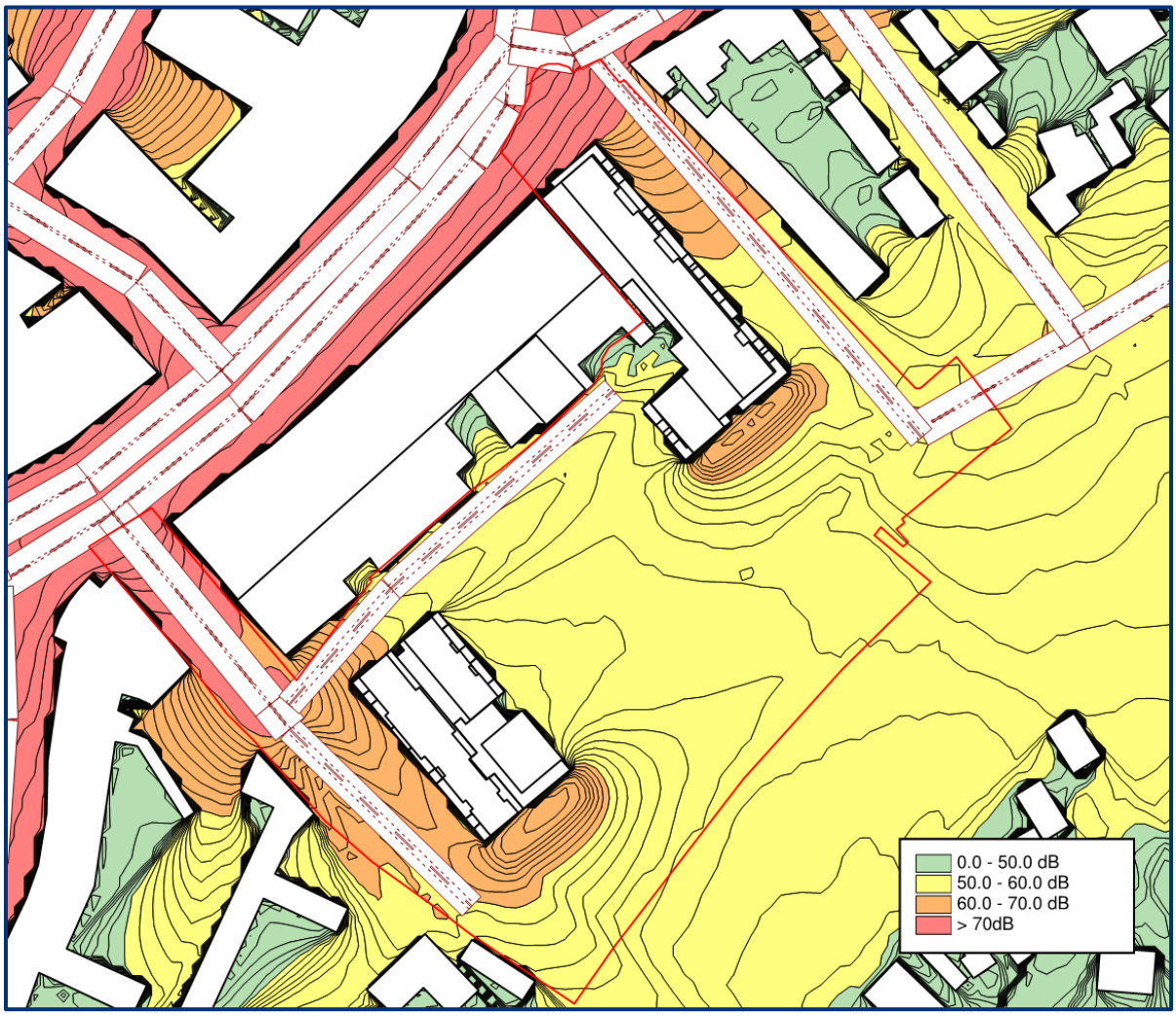
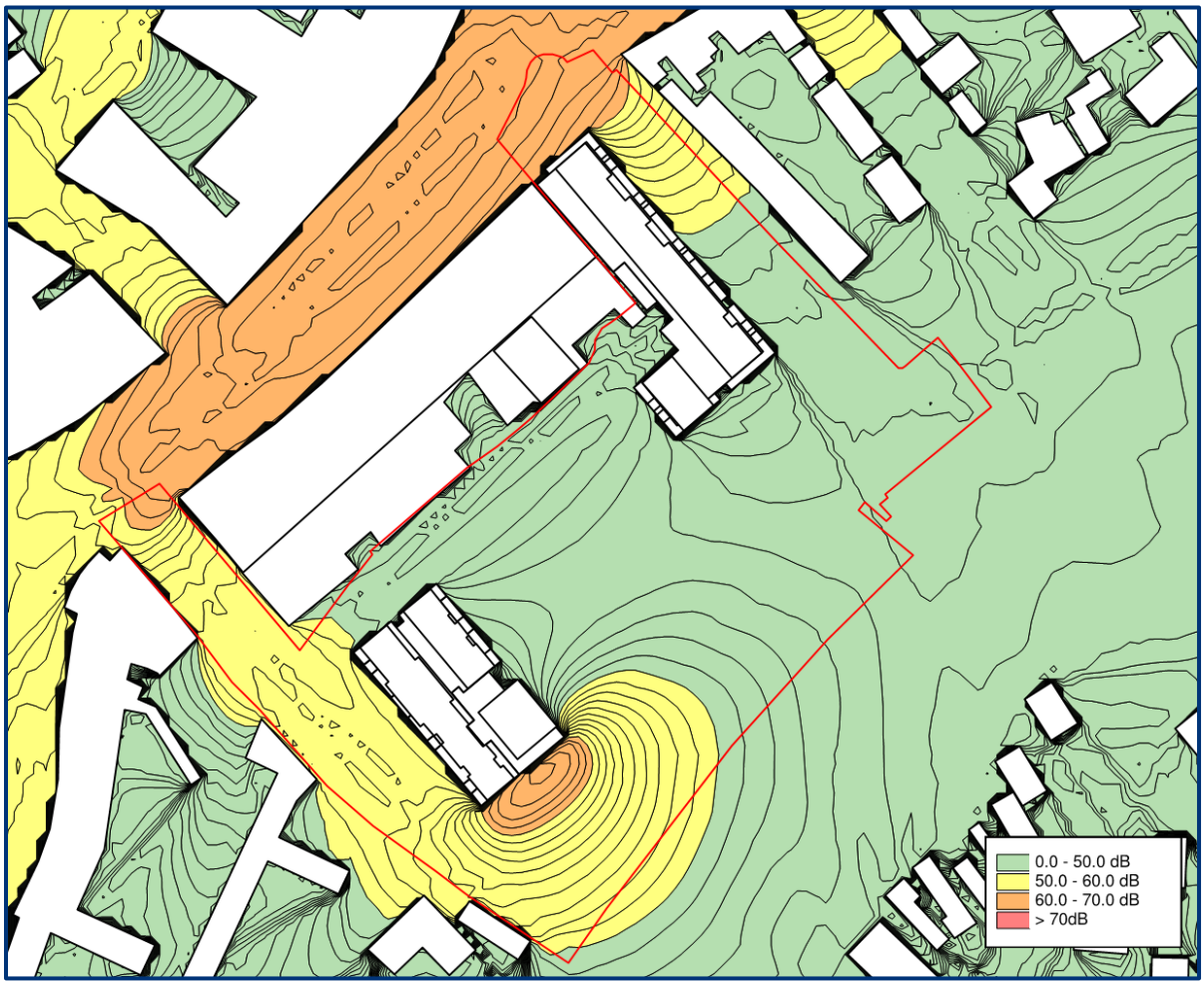


Figure 5.2 Proposed Night-time $L_{Aeq,8hr}$ Noise Contour Plot (Grid Height: 4.0m)



In order to achieve the recommended internal noise criteria, a range of mitigation measures are outlined in Section 6.1 of this report.

ProPG Element 3: External Amenity Areas Assessment

Daytime noise levels in purposed built external spaces associated with the development have been assessed and, the results of which are shown in Table C4 in Appendix C below. The locations of these receptors are illustrated in SK06-SK09 of Appendix B.

The results show that daytime L_{Aeq} noise levels within a number of private external amenity areas are predicted to exceed the BS 8233 upper guideline value (55 dB) at some receptor locations overlooking King Street and other surrounding residential roads, in the absence of any mitigation. However, the predicted noise levels are not considered likely to prohibit the use of these spaces.

Furthermore, section 7.7.3.2 of BS 8233:2014 states that the guideline values are not achievable in all circumstances where development might be desirable. It is considered that as this development is adjoining the strategic road network in the form of the King Street, a compromise should be made between the elevated noise levels and the convenience of a property in this location. Furthermore,

development should not be prohibited on the basis of predicted external noise levels in the private external amenity areas.

Although a number of the balconies exceed the external amenity criteria, within the central landscaped space forming a public space these areas meet the criteria of 55dB.

5.3 TRANQUILLITY RATING

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most). The Development is situated in a CPRE Zone 1 area of tranquillity it is not considered to be an area of tranquillity and given the application site is already used as a car park, therefore the Development is expected have a negligible impact on the tranquillity of the area.

Indeed, as noted above, the introduction of communal public spaces as part of the development will provide addition sheltered green spaces that will help to improve the tranquillity of the area.

5.4 THE ACOUSTIC, VENTILATION AND OVERHEATING GUIDE (AVOG) 2020

The Acoustic, Ventilation and Overheating Guide (AVOG) 2020 provides guidance for acoustic assessments, in particular, residential developments, providing clarity on the relationship between acoustics, overheating and appropriate ventilation requirements. With regards to overheating, AVOG states that as overheating is a temporary condition, during this period “occupants may accept a trade-off between acoustic and thermal conditions, given that they have some control over their environment,” and that occupants may “be more willing to accept higher short-term noise levels in order to achieve better thermal comfort.”

Additionally, further practical measures can be included to prevent overheating whilst maintaining a suitable internal acoustic environment, including but not restricted to: mechanical extract ventilation systems suitable consideration to the internal layout, with sensitive spaces placed away from noise sources and on northern facing facades to minimise exposure to direct sunlight and the inclusion of dual-aspect plenum windows to provide appropriate cooling ventilation measures whilst meeting internal noise level criteria.

It is considered that a good acoustic design process has been followed, with mitigation in the form mechanical ventilation being provide for all residential dwellings. As such, the proposed development will facilitate the regulation of a suitable acoustic and thermal environment within proposed dwellings.

5.2 COMMERCIAL PROPERTIES

It is understood the proposed commercial units on the ground floor on both building is to a café (Water Lane Building) and a bistro restaurant (Wharf Lane Building). Both units have areas for outdoor

seating, as such a worst-case assessment associated with the noise levels detailed in Section 3.1.2 have been used.

This assessment compares the noise from the existing ambient noise climate (based on existing measured ambient L_{Aeq} noise levels). The difference between the lowest 'existing' and the 'worst-case proposed' scenarios during the daytime is presented in Table 5.3, with the difference between the lowest 'existing' and the 'worst-case proposed' scenarios during the night-time presented in Table 5.4.

Table 5.3 Difference between Baseline and Proposed Scenario (Daytime)

Ref.	Daytime		
	Measured Baseline $L_{Aeq, 16\ hour}$	Measured Baseline Combined with Contribution from the Proposed Scenario	Contribution from Proposed Scenario L_{Aeq}
R1	60.5	60.5	0.0
R2	55.8	56.2	0.4
R3	57.9	57.9	0.0
R4	63.2	63.7	0.5
R5	63.2	63.2	0.0
R6	63.2	63.2	0.0
R7	63.2	63.2	0.0
R8	66.8	66.8	0.0

Table 5.4 Difference between Baseline and Proposed Scenario (Night-time)

Ref.	Daytime		
	Measured Baseline $L_{Aeq, 16\ hour}$	Measured Baseline Combined with Contribution from the Proposed Scenario	Contribution from Proposed Scenario L_{Aeq}
R1	49.9	49.9	0.0
R2	41.5	42.9	1.4
R3	38.3	39.8	1.5
R4	44.4	48.6	4.2
R5	44.4	45.0	0.6
R6	44.4	44.5	0.1
R7	44.4	44.5	0.1
R8	61.4	61.4	0.0

The results presented in the tables above show the change in noise levels between the existing measured L_{Aeq} noise levels and the contribution from the external seating area. When the differences between the 'existing' and 'proposed' scenario are compared with the noise change criteria given in Table 2.1 of this report, the contribution from the proposed seating area falls within the Lowest Observed Adverse Effect Level. It is unknown the future occupier of the proposed pub/restaurant and these noise changes present a worst-case assumption. Therefore, the proposed worst-case scenario is expected to have a negligible impact at surrounding residential locations and the change in ambient L_{Aeq} noise levels is not considered to be significant.

6.0 SOUND INSULATION

6.1 CRITERIA

The minimum sound insulation criteria are specified in Sections 2. This is in terms of the weighted standardised level difference, $D_{nT,w}$ where *T* is the reverberation time in seconds. This parameter describes the on-site performance that must be achieved. Consequently, wall and floor partition specifications are provided in terms of the weighted sound insulation index, R_w, the calculation for which considers an allowance for construction defects, flanking noise transmission, room geometry, and room acoustics.

6.2 ASSESSMENT OF FLOOR CONSTRUCTION

Noise Criteria

Noise levels from the proposed ground floor commercial use in the proposed 1st floor apartments are proposed to $L_{Aeq,1hour} \leq 30$ dB during the daytime and $L_{Aeq.1hour} \leq 25$ dB during the night-time which would result in a negligible contribution when compared to break-in through the façade from external noise sources.

Source Noise Levels

Example source noise levels for a retail and restaurant scenario is presented in Table 6.1 below to determine suitable floor constructions to achieve the noise criteria.

Table 6.2 Proposed Noise Levels for Ground Floor Retail Use

Description	Octave-band (Hz) Equivalent Sound Pressure Level, L_{Aeq} (dB)							L_{Aeq} (dB)
	63	125	250	500	1000	2000	4000	
Retail/Office	30.8	49.9	53.4	60.8	59.0	58.2	52.0	**65.0**
Restaurant	32.5	56.1	66.4	71.4	76.1	76.7	70.0	**80.6**

Required Separating Floor Performance

The minimum required sound reduction (in terms of apparent sound reduction index, R'_w which describes the in-situ performance) to meet the target criteria has been calculated for daytime and night-time operation.

Calculations are based on a typical ceiling height of 2900 mm and standard reverberation time of 0.5 seconds. The minimum required sound insulation performance includes a 5 dB allowance for construction defects and calculation precision.

Table 6.2 Minimum Required Separating Floor Sound Insulation

Period	Ground Floor Use	Criteria	Minimum Required Reduction R'_w(dB)
Daytime Use			
Daytime (07:00 – 23:00)	Retail/Office	$L_{Aeq,16hours} \leq 30$ dB	41
	Restaurant		57

Night-time Use			
Night-time (23:00 – 07:00)	Retail/Office	$L_{Aeq,8hours}$ ≤ 25 dB	46
	Restaurant		62

It should be noted that the proposed pub/restaurant in the Wharf Lane Building is to be shell and core, as such will not contain a ceiling. The installation to the ceiling to increase the sound insulation is subject to the future occupier of the unit.

Proposed Constructions

A typical floor construction between proposed ground floor and 1st floor apartments, as presented in from Approved Document E, has been used as a basis for the assessment of noise transfer between the separating floor construction. In addition to the example floor constructions it will be necessary to control indirect noise transmission (flanking noise).

Table 6.3 Proposed Separating Floor Construction between Ground Floor commercial and 1st Floor Residential

Scenario	Required Reduction R'_w (dB)*	Predicted Sound Reduction R'_w (dB)	Construction Description	Mitigation Measures Required
Retail/Office (daytime)	41	61	225mm Concrete plus 100mm dry screed	None Required
Restaurant (daytime)	57	61	225mm Concrete plus 100mm dry screed	None Required
Retail/Office (night-time)	46	61	225mm Concrete plus 100mm dry screed	None Required
Restaurant (night-time)	62	61	225mm Concrete plus 100mm dry screed	Suspended Ceiling with 150mm void plus 1x layer 12.5mm soundbloc

**Including Flanking Noise*

Flanking noise is noise transmitted via indirect noise paths, such as through the cavity of an external wall, through concrete floors, along structural members, and through elements of curtain walling, for example. It is required to minimise flanking noise as it is likely to limit the sound insulation between spaces.

Floor Coverings

For impact sound reduction between dwellings, the criteria would not be achieved with the proposed build-up in Table 6.3. Either soft coverings such as carpets or a resilient layer under any vinyl, tile floor coverings and timber flooring will be required in kitchens and living spaces for market dwellings to achieve the impact performance.

6.3 PROPOSED INTERNAL PARTITIONS

The proposed internal wall performances will require to be designed to achieve the requirements of AD. For separating walls between dwelling, walls are required to achieve a minimum sound reduction of $D_{nT'w}+C_{tr,}$ which is an on-site acoustic performance measure. To achieve this sound reduction,

separating walls need to achieve a minimum sound insulation value shown in SK10 – SK13 In Appendix B.

Internal partitions that do not separate dwellings are required to perform at 40 dB R_w, as shown in Section 2.2.

Example construction are presented in Appendix D.

Any separating wall will be required to be isolated from any structural columns that is located between two separate residential dwellings. The wall surrounding the column is required to achieve the same sound reduction as the remaining area of the wall to ensure continued acoustic reduction is achieved.

6.4 LIFT SHAFTS

It is good practice to ensure that noise sensitive areas are not placed adjacent to risers or lift shafts. However, bearing in mind the nature of the development, this may not be practicable due to constraints in the design. Where service risers and lift shafts abut sensitive areas the noise limits in Table 6.4 should be adhered to.

Table 6.4 Noise Criteria for Lifts

Room Space (Measurement Location)	Limit of Noise Intrusion
In Lift Car	55dB L_{AFmax}
In Lift lobby	55dB L_{AFmax}
Into offices without lift lobbies	50dB L_{AFmax}

It is recommended that adjoining walls provide a minimum sound insulation performance of 55dB R_w.

As a matter of good practice, lift tracks should be resiliently mounted and on remote walls to internal spaces to mitigate risk of structure-borne noise. It is expected that the supplier/sub-contractor of the lifts will be responsible for its isolation from the primary building structure.

It is understood that a 200mm thick concrete wall will be located around the lift shafts which achieves a sound reduction of approximately 59dB R_w.

6.5 PLANT ROOMS

Noise from plant rooms must be designed to suit the adjacent occupied areas and to comply with Noise at Work Regulations [Ref 5].

Noise levels within plant rooms must meet the requirements of the Noise at Work Regulations to protect occupants/employees from noise. It is recommended that noise levels do not exceed the Lower Exposure Action Value of 80 dBA for daily personal exposure, $L_{EP,d}$, or weekly personal exposure, $L_{EP,w}$. Hearing protection is not required to be offered by the employer below these noise levels. Peak sound pressure levels must not exceed 137 dBC.

It is acceptable for noise levels to exceed 80 dBA if the exposure time is less than the daily reference period of 8 hours. Table 6.5 presents the daily personal exposure limits for shortened time periods.

Table 6.5 Daily Personal Exposure Limits for Shortened Time Periods

Exposure Period, *T* (hours)	Exposure Limit, $L_{EP,T}$ (dBA)	Personal Daily Exposure, $L_{EP,d}$ (dBA)
1	89	80
2	86	80
3	84	80
4	83	80
5	82	80
6	81	80
7	81	80
8	80	80

A risk assessment must be undertaken in accordance with the Noise Regulations to assess the risks associated with noise exposure to employees.

If the any of the following apply it is likely that measures to control the noise risk to occupants/employees will be required:

- Noise is intrusive – for example, as noisy as a busy road, a vacuum cleaner or a crowded restaurant – or worse than intrusive, for most of the working day.
- Occupants/employees have to raise their voices to carry out a normal conversation when about 2 m apart for at least part of the day.
- Occupants/employees use noisy equipment, such as loud sound systems for music playback, for more than half an hour during the day.

Where plant poses a risk of transmitting noise and/vibration to the structure of the building, the plant must incorporate anti-vibration/noise measures, such as resilient fixings, anti-vibration springs, mounts, mats or an inertia base, for example, and physical connections to the plant must include flexible connectors.

To avoid the transmission of duct-borne noise to the structure of the building, services should include resilient fixings.

Separating walls and floors between plant room and adjacent spaces should provide a minimum acoustic performance of 60dB $R_{w.}$

6.6 CONSTRUCTION & DETAILING

Partitions/Walls

Walls should be constructed from slab to soffit and as specified in the manufacturer's instructions. All gaps must be filled appropriately and sealed with acoustic mastic.

Services should not penetrate through separating partitions between noise-sensitive rooms. Where possible, services should ideally be routed along circulation areas from where they may penetrate into the room. Where services must penetrate a separating partition between noise-sensitive rooms then the penetration should be appropriately treated and is likely to require a cross-talk attenuator.

Services, such as electrical outlets, network sockets and AV connectors, should ideally be surface mounted in suitable trunking to avoid incorporating recessed back-boxes in a partition. Where

recessed back boxes must be used, they should not be located back-to-back, no closer than 450 mm and treated with the same plasterboard lining as is being penetrated. Prefabricated socket boxes and intumescent putty liners are available.

Doors

A partition containing a door is limited by the acoustic performance of the door-set. To achieve the optimum sound insulation performance, acoustically rated door-sets must be well fitting, with compression or wipe seals around the perimeter and a drop-down threshold seal.

Where entrance doors to apartments are required to be close to each other the doors should be as far apart as reasonably practicable to reduce the risk of noise travelling between apartments through doorways and circumventing the separating acoustically rated partitions.

Services Downpipes

Services pipes likely to produce noise, such as internal rainwater and waste downpipes, must be encased in 2 no. layers of dense plasterboard with 50 mm absorbent acoustic partition roll in the cavity. Any gaps around services at wall or floor penetrations must be appropriately filled and sealed.

Crosstalk Attenuators

It is recommended that any services ductwork does not pass through acoustically sensitive partitions. Ideally, services should run along circulation routes and break into noise-sensitive spaces from there. Cross-talk attenuators may be required where service ductwork passes through an acoustically rated partition.

Junctions between Walls and Floors

Where the floor and partition intersect this should be adequately sealed to reduce any potential flanking paths.

Junctions between Internal Walls and Ceilings

Internal walls should continue past suspended ceilings and up to the soffit. It is unlikely that the required sound insulation will be achieved if the wall terminates at, or just above, a suspended ceiling.

Junctions between Partitions and the Soffit

Non-load-bearing partitions are likely to require a deflection head to allow movement in structural elements. Manufacturer's construction details should be followed for any particular product and it must be ensured that any gaps between the head of the partition and the soffit are filled with a flexible acoustic sealant.

For soffits with a complicated geometry, such as profiled steel decking, it can be difficult to ensure all air gaps are filled. However, all gaps must be filled and then sealed with a flexible acoustic sealant.

Curtain Walling

Curtain walling presents the potential for a number of flanking transmission paths, including via the frame, vertically and horizontally through transoms and mullions, and via gaps between the slab and the frame. All gaps between the slab and curtain walling must be suitably filled and then sealed with

flexible acoustic mastic. Cavity stops are required to limit flanking noise transmission between adjacent spaces through the frame.

7.0 CONCLUSIONS

This report presents the findings of a noise assessment in support of a planning application for a proposed residential development along with associated commercial properties at Twickenham Riverside, London Borough of Richmond Upon Thames.

In considering paragraphs 174 185 of the NPPF, the Proposed Development is not expected to generate significant volumes of traffic or other noticeable or intrusive noise sources and there will not have an 'adverse impact' on health or quality of life. Similarly, it is considered that all 'adverse impacts' on health and quality of life' (relating to noise) are mitigated by the use of the following mitigation:

A glazing strategy has been provided which achieves both ventilation and internal ambient noise level requirements of $L_{Aeq\ daytime}$ 35 dB, $L_{Aeq\ night\text{-}time}$ of 30 dB and $L_{Amax\ night\text{-}time}$ of 45 dB in all residential bedroom/spaces of the Proposed Development. For sensitive bedrooms and living rooms with facades adjacent to the King Street will feature enhanced glazing with a sound reduction up to $R_w + C_{tr}$ 39 dB. At all other locations and facades will feature a standard double glazing with a minimum sound reduction of $R_w + C_{tr}$ 30 dB. It is understood as standard all dwellings will feature mechanical ventilation.

Maximum noise level limits have been set for proposed building services plant. Noise Levels are predicted to result in the plant noise rating levels being at least 5 dB below the existing background noise levels during both the daytime and night-time. Accordingly, the proposed plant is predicted to have a low impact at the closest sensitive receptors.

With respect to NPPF paragraphs 185 (b), 187 & 188, an assessment of the existing tranquillity level of the application site has been undertaken and identified that the application site is not highly prized for its tranquillity and recreational value in terms of noise. The Development is unlikely to reduce the tranquillity value of the area and will increase local access to areas of relative tranquillity.

Therefore, it is considered that the mitigation measures outlined within this report and suitable to reduce any noticeable and intrusive noise from the surrounding environment within proposed dwellings and it is considered that existing businesses would not be restricted by the Proposed Development.

Internal design advice has been provided regarding internal noise transmission between the commercial units and the residential dwellings along with the required sound insulation between each residential dwelling.

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APPENDICES

APPENDIX A – ACOUSTIC TERMINOLOGY AND ABBREVIATIONS

Acoustic Terminology

dB — Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.

dB(A) — Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.

L_{Aeq} — Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq,\ 07:00\ –\ 23:00}$ for example, describes the equivalent continuous noise level over the 12 hour period between 7 am and 11 pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower that the $L_{Aeq,\ 07:00\ –\ 23:00}$.

L_{Amin} — The L_{Amin} is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.

L_{Amax} — The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.

L_n — Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say. 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the $L_{A10,\ 1\ hr}$ = x dB.

The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90}, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L_{A1} and L_{Amax} are common descriptors of construction noise.

R_w — The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

Abbreviations

CADNA – Computer Aided Noise Abatement

DMRB – Design Manual for Roads and Bridges

HGV – Heavy Goods Vehicle

PPG – Planning Practice Guidance

UDP – Unitary Development Plan

UKAS – United Kingdom Accreditation Service

APPENDIX B – SKETCHES

SK01 Ground Floor Receptor Locations and Glazing Strategy

SK02 First Floor Receptor Locations and Glazing Strategy

SK03 Second Floor Receptor Locations and Glazing Strategy

SK04 Third Floor Receptor Locations and Glazing Strategy

SK05 Fourth Floor Receptor Locations and Glazing Strategy

SK06 First Floor External Amenity Receptor Locations

SK07 Second Floor External Amenity Receptor Locations

SK08 Third Floor External Amenity Receptor Locations

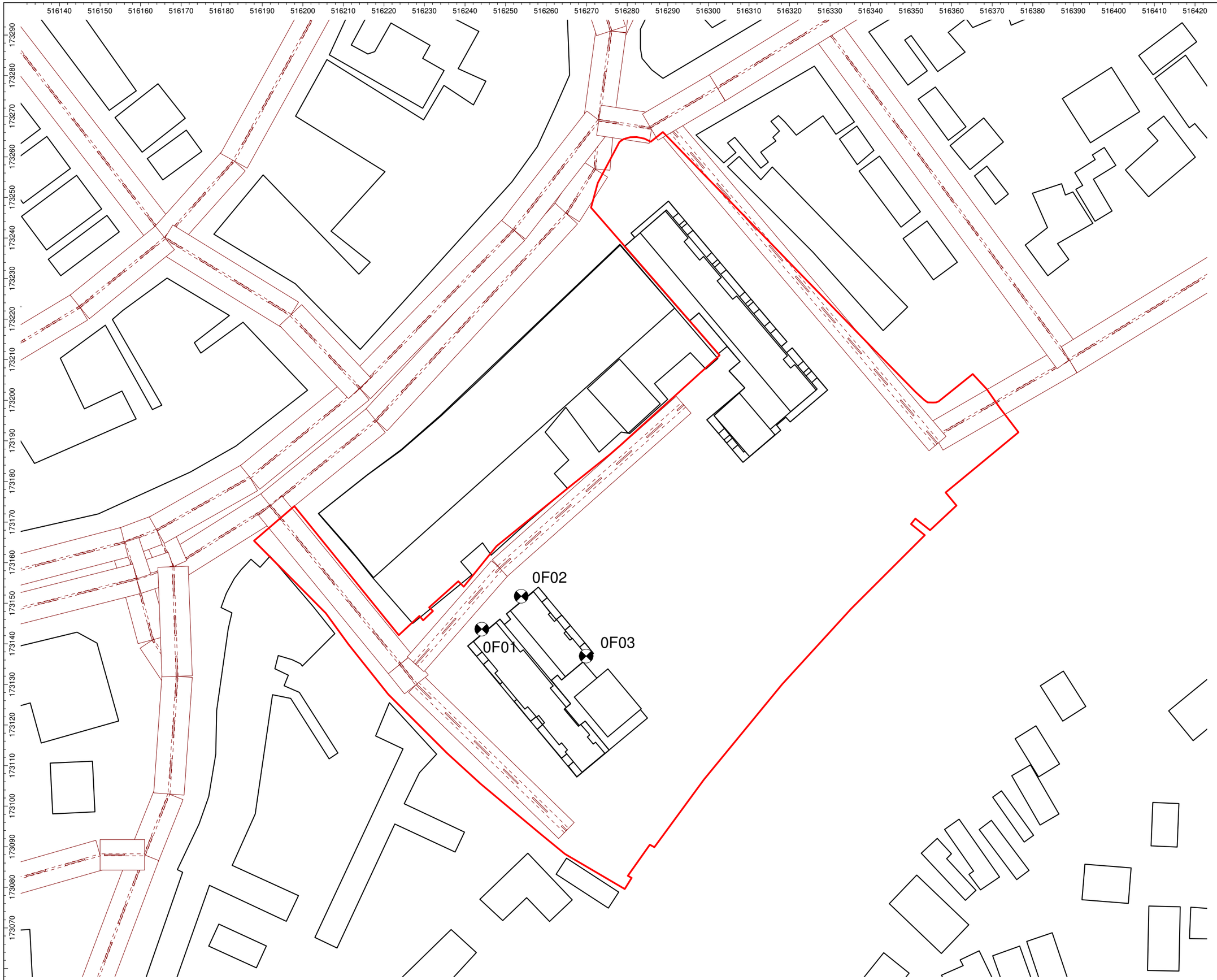
SK09 Fourth Floor External Amenity Receptor Locations

SK10 First Floor Sound Insulation Mark-Up

SK11 Second Floor Sound Insulation Mark-Up

SK12 Third Floor Sound Insulation Mark-Up

SK13 Fourth Floor Sound Insulation Mark-Up



Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Ground Floor: Sensitive Receptor Location Plan & Glazing Requirements

Drawing Number:
SK01

Key:

Site Boundary:

Receptor Locations:

Enhance Glazing:

39dB Rw+Ctr:

All other facades will features glazing achieving 30 dB Rw +Ctr.

Scale: Not to scale

Tetra Tech 21.05.21

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
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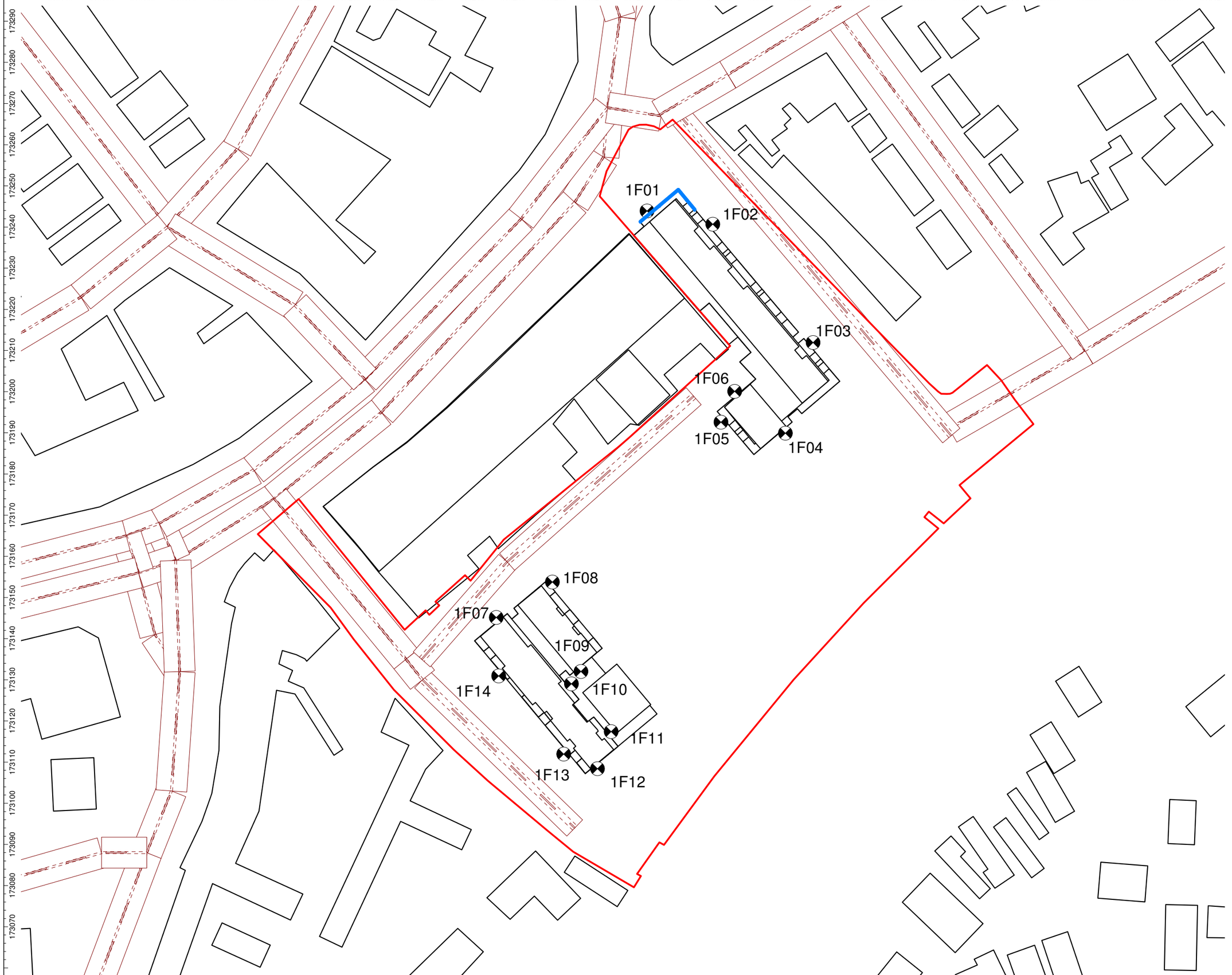

Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
First Floor:
Sensitive Receptor Location Plan & Glazing Requirements

Drawing Number:
SK02

Key:

Site Boundary:

Receptor Locations:

Enhance Glazing:

39dB Rw+Ctr:

All other facades will features glazing achieving 30 dB Rw +Ctr.

Scale: Not to scale

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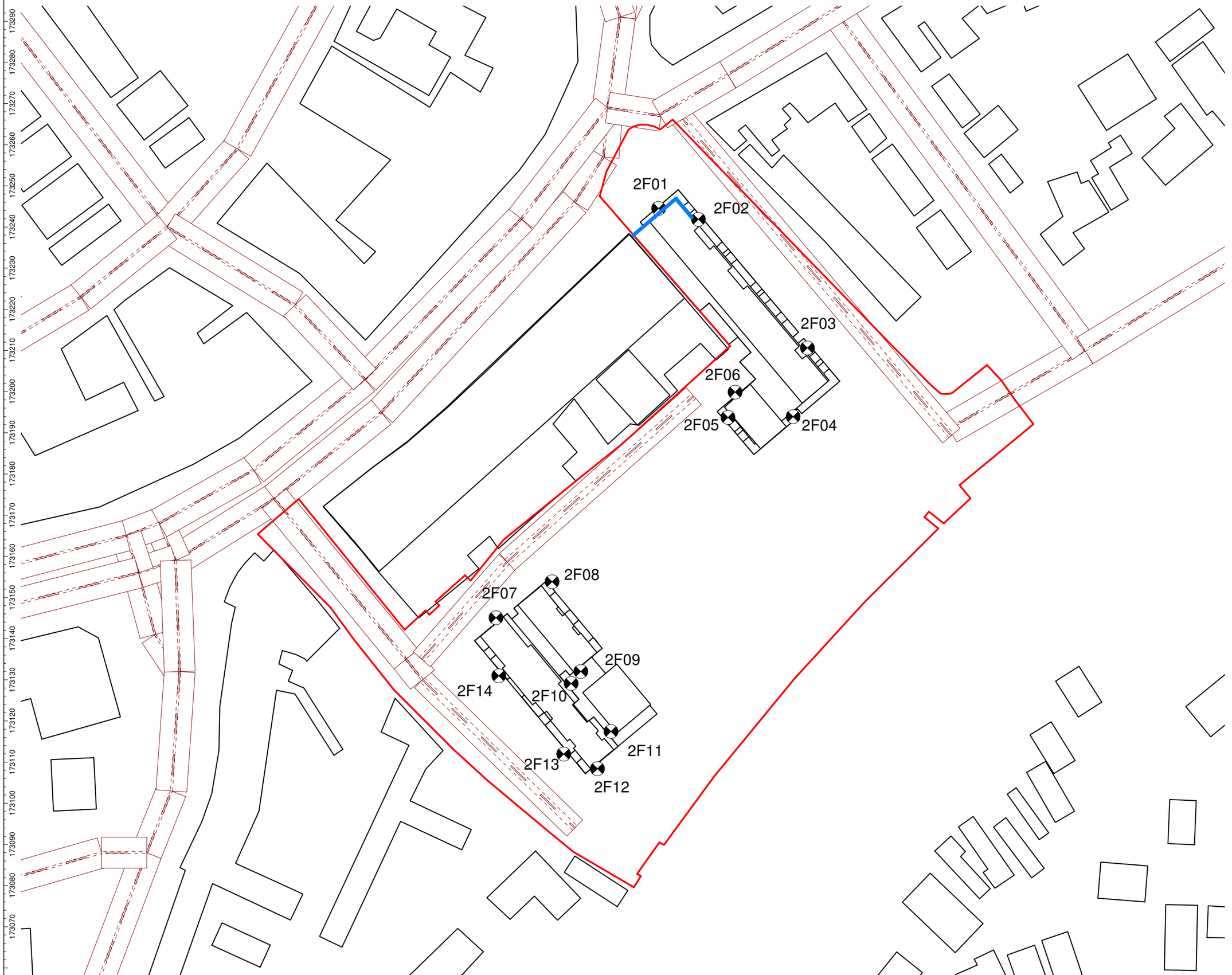

Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Second Floor: Sensitive Receptor Location Plan & Glazing Requirements

Drawing Number:
SK03

Key:

Site Boundary:

Receptor Locations:

Enhance Glazing:

39dB Rw+Ctr:

All other facades will features glazing achieving 30 dB Rw +Ctr.

Scale: Not to scale

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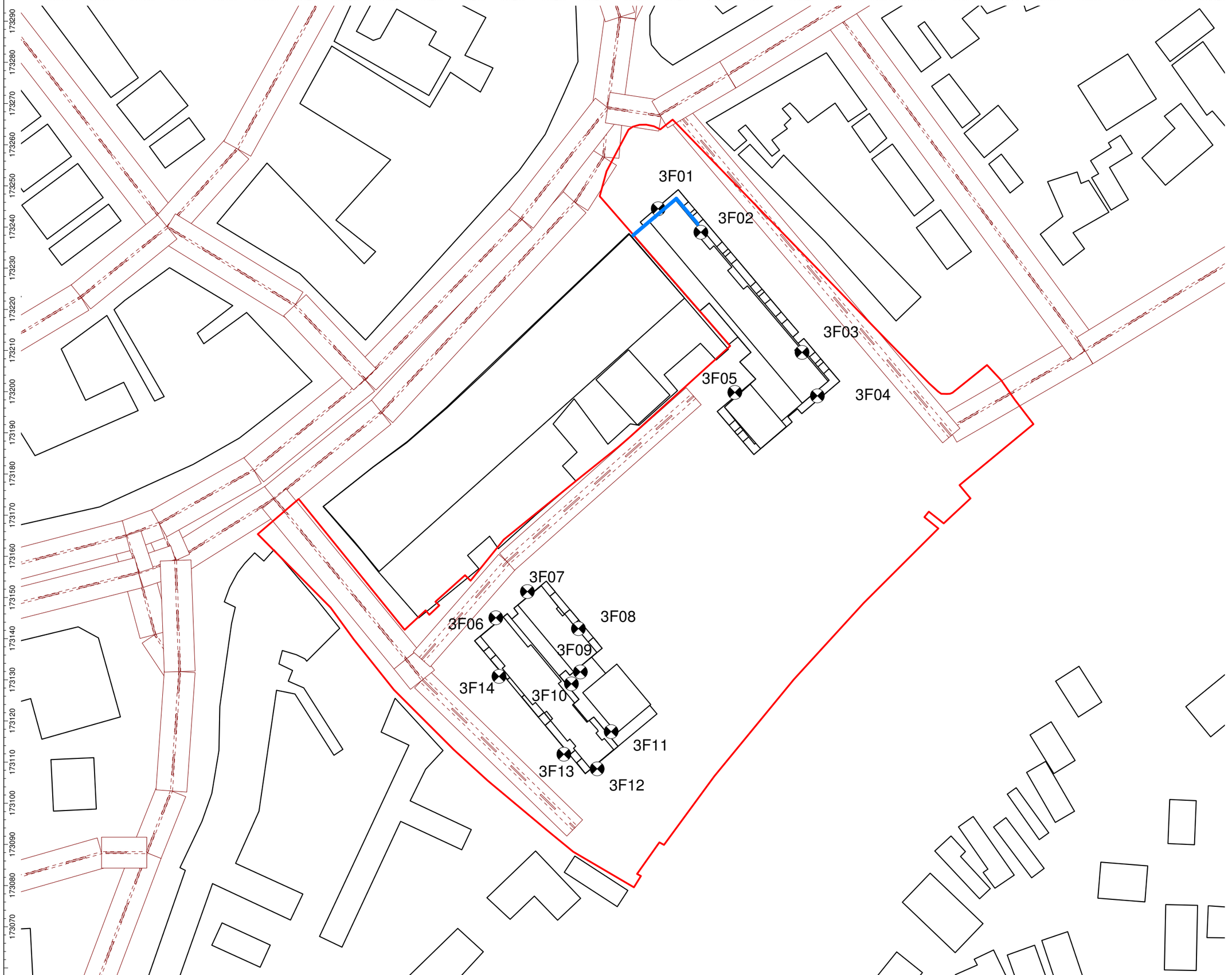

Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Third Floor:
Sensitive Receptor Location Plan & Glazing Requirements

Drawing Number:
SK04

Key:

Site Boundary:

Receptor Locations:

Enhance Glazing:

39dB Rw+Ctr:

All other facades will features glazing achieving 30 dB Rw +Ctr.

Scale: Not to scale

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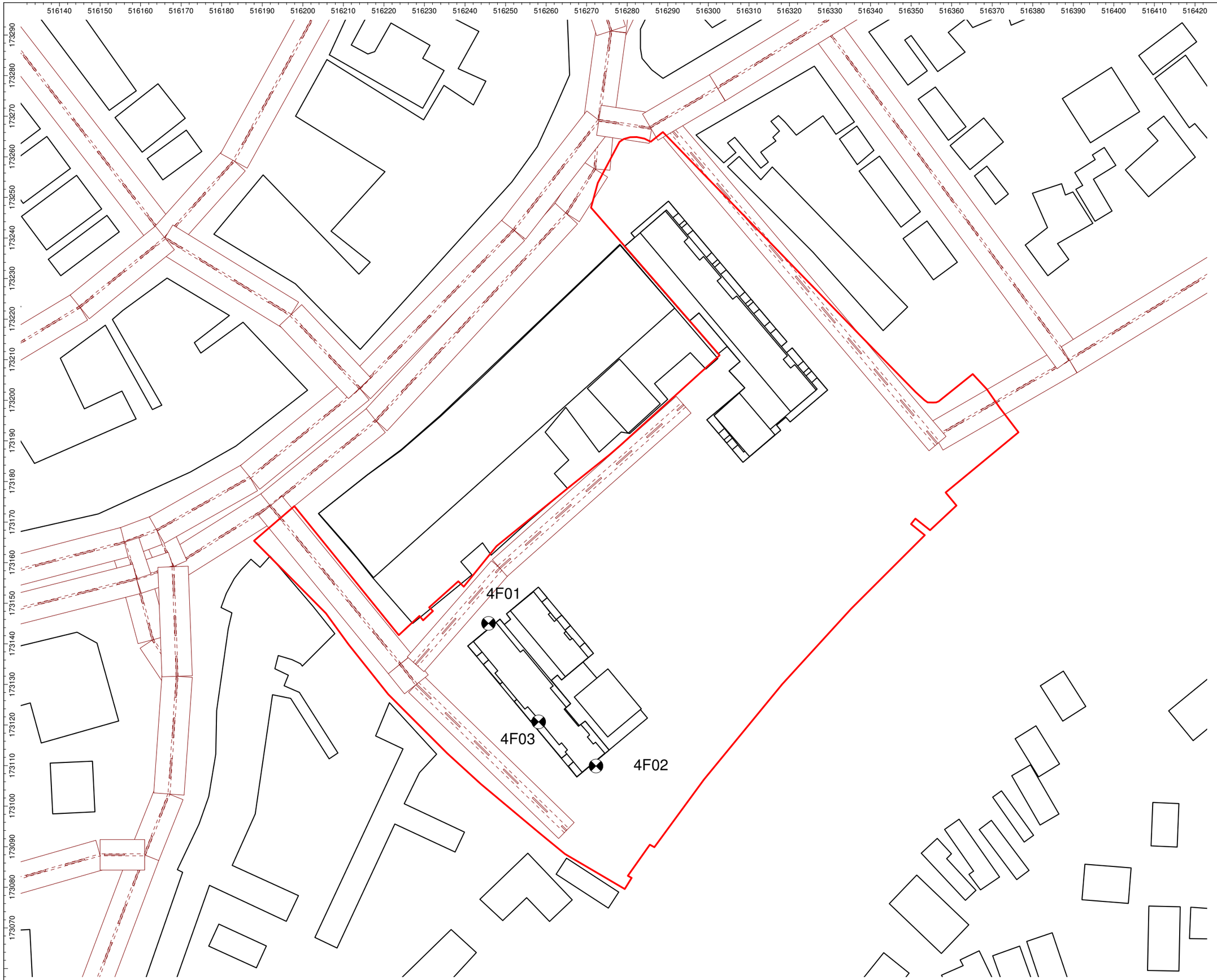
Licence Number AL 553611



Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Fourth Floor: Sensitive Receptor Location Plan & Glazing Requirements

Drawing Number:
SK05

Key:

Site Boundary:

Receptor Locations:

Enhance Glazing:

39dB Rw+Ctr:

All other facades will features glazing achieving 30 dB Rw +Ctr.

Scale: Not to scale

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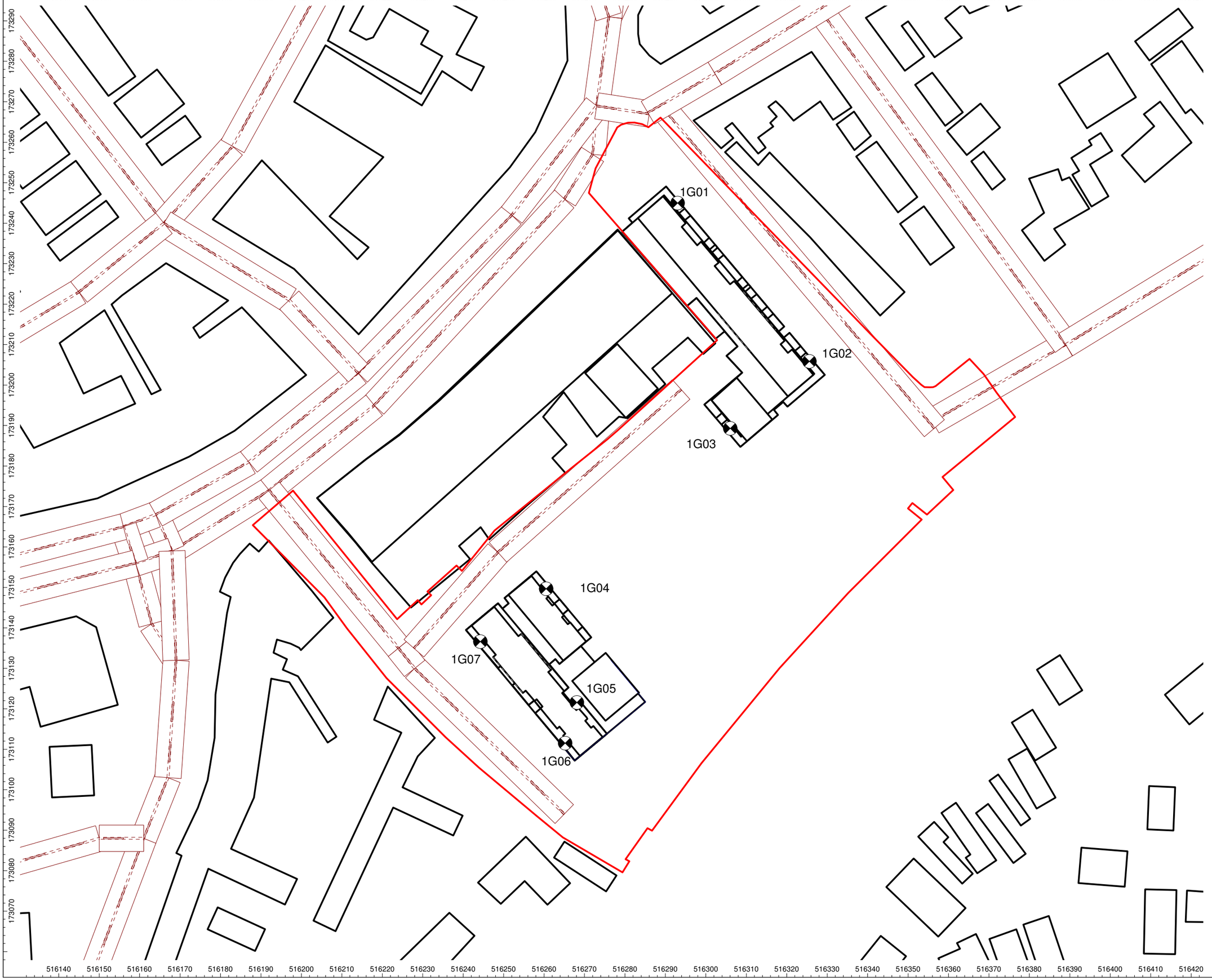

Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
First Floor:
External Amenity Sensitive Receptor Locations

Drawing Number:
SK06

Key:

Site Boundary:

Receptor Locations:

Scale: Not to scale

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LE7 7GR
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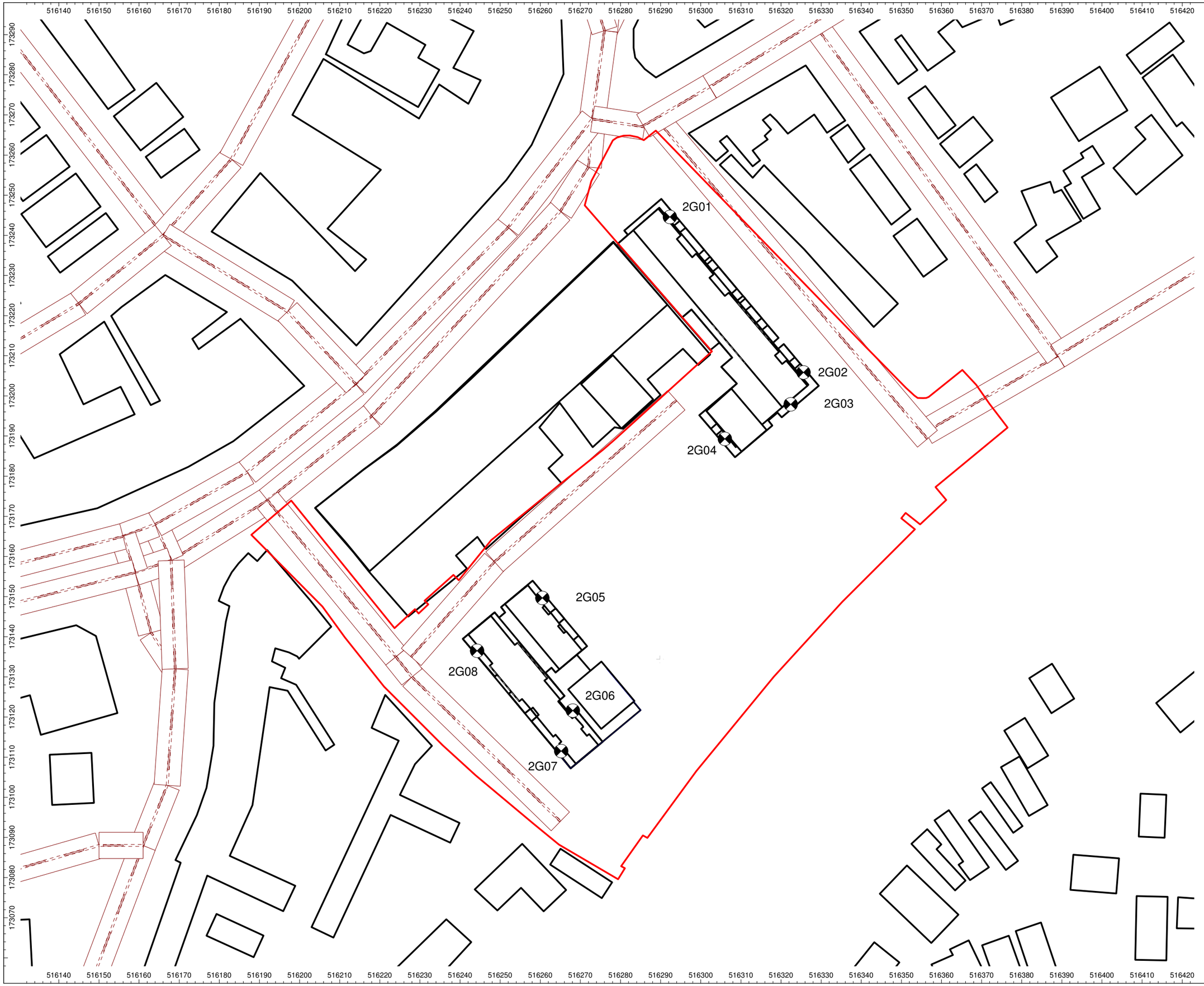
Licence Number AL 553611



Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Second Floor: External Amenity Sensitive Receptor Locations

Drawing Number:
SK07

Key:

Site Boundary:

Receptor Locations:

Scale: Not to scale

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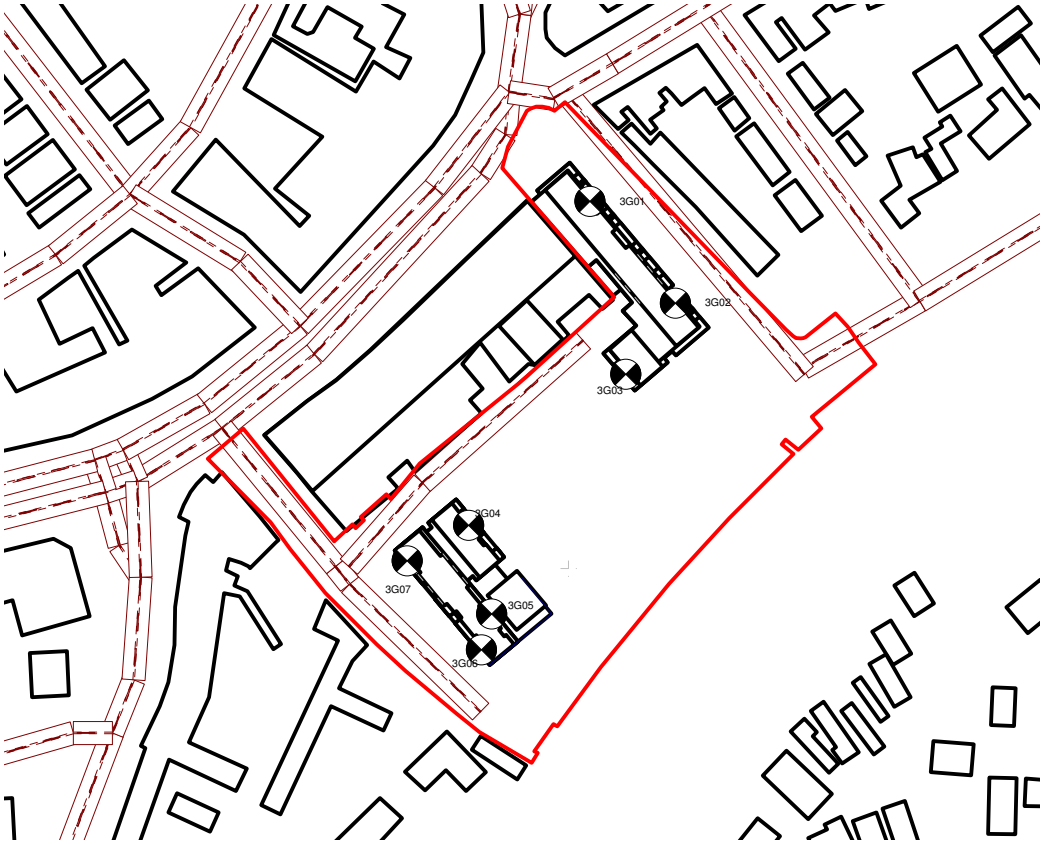
Licence Number AL 553611



Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Third Floor:
External Amenity
Sensitive Receptor
Locations

Drawing Number:
SK08

Key:

Site Boundary:

Receptor Locations:

Scale: Not to scale

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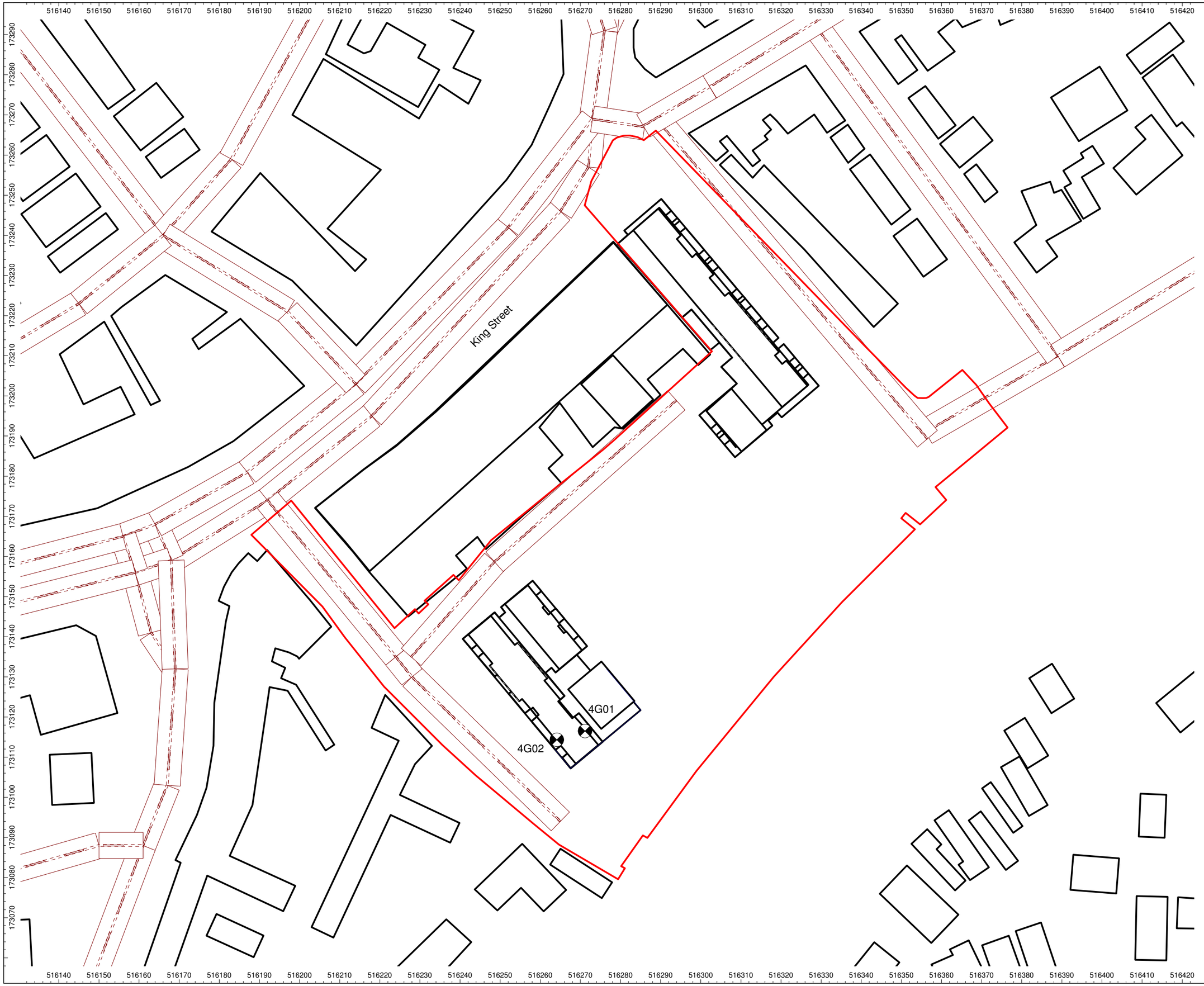
Leicestershire
LE7 7GR
Tel 0116 234 8000

TETRA TECH

Licence Number AL 553611



Client:
London Borough of Richmond upon Thames

Project:
Twickenham Riverside

Drawing Title / Scenario:
Fourth Floor: External Amenity Sensitive Receptor Locations

Drawing Number:
SK09

Key:

Site Boundary:

Receptor Locations:

Scale: Not to scale

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Leicestershire
LE7 7GR
Tel 0116 234 8000

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Licence Number AL 553611

Project:
Twickenham Riverside

Client:
London Borough of Richmon Upon Thames

Drawing Title:
MINIMUM INTERNAL SOUND INSULATION REQUIREMENTS (01)
Minimum Internal Sound Insulation Requirements

First Floor

Key:

Minimum Partition Performance

- 45 dB
- 51 dB
- 53 dB
- 56 dB
- 59 dB
- 60 dB

Project no.	784-B023999
Drawing no.	
Revision:	A
Date:	
Scale:	NTS
Drawn by:	SL
Checked by:	GD
Approved by:	NM

Tetra Tech
Executive Park
Avalon Way
Anstey
Leicester
LE7 7GR

Tel: 0116 234 8000
Email: NALO.UK@Tetratech.com

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Project:
Twickenham Riverside

Client:
London Borough of Richmon Upon Thames

Drawing Title:
MINIMUM INTERNAL SOUND INSULATION REQUIREMENTS (01)
Minimum Internal Sound Insulation Requirements

Second Floor

Key:

Minimum Partition Performance

- 45 dB
- 51 dB
- 53 dB
- 56 dB
- 59 dB
- 60 dB

Project no.	784-B023999
Drawing no.	
Revision:	A
Date:	
Scale:	NTS
Drawn by:	SL
Checked by:	GD
Approved by:	NM

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Avalon Way
Anstey
Leicester
LE7 7GR

Tel: 0116 234 8000
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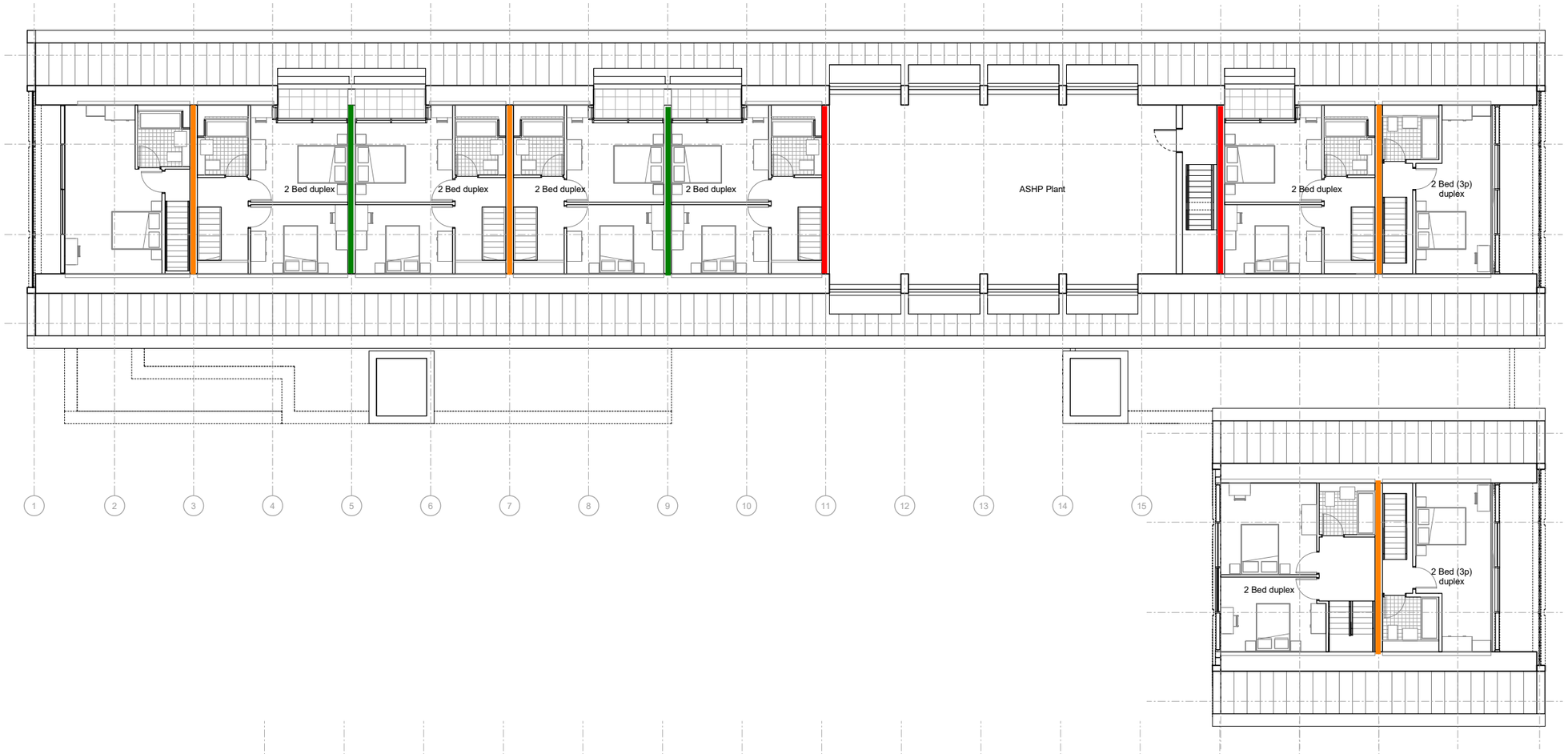

Project:
Twickenham Riverside

Client:
London Borough of Richmon Upon Thames

Drawing Title:
MINIMUM INTERNAL SOUND INSULATION REQUIREMENTS (01)
Minimum Internal Sound Insulation Requirements

Third Floor

Key:

Minimum Partition Performance

- 45 dB
- 51 dB
- 53 dB
- 56 dB
- 59 dB
- 60 dB

Project no.	784-B023999
Drawing no.	
Revision:	A
Date:	
Scale:	NTS
Drawn by:	SL
Checked by:	GD
Approved by:	NM

Tetra Tech
Executive Park
Avalon Way
Anstey
Leicester
LE7 7GR

Tel: 0116 234 8000
Email: NALO.UK@Tetratech.com

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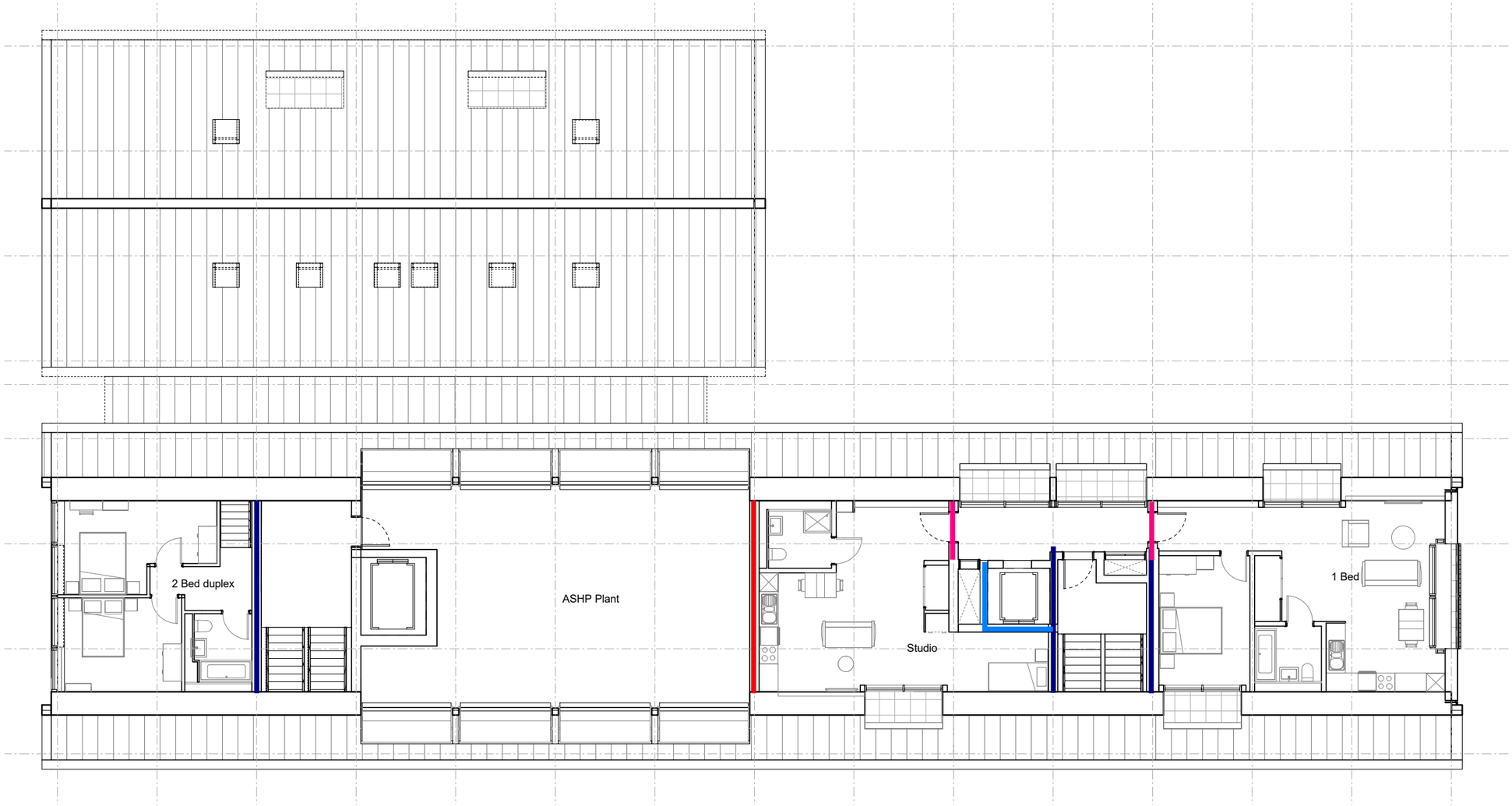

Project:
Twickenham Riverside

Client:
London Borough of Richmon Upon Thames

Drawing Title:
MINIMUM INTERNAL SOUND INSULATION REQUIREMENTS (01)
Minimum Internal Sound Insulation Requirements

Fourth Floor

Key:

Minimum Partition Performance

- 45 dB
- 51 dB
- 53 dB
- 56 dB
- 59 dB
- 60 dB

Project no.	784-B023999
Drawing no.	
Revision:	A
Date:	
Scale:	NTS
Drawn by:	SL
Checked by:	GD
Approved by:	NM

Tetra Tech
Executive Park
Avalon Way
Anstey
Leicester
LE7 7GR

Tel: 0116 234 8000
Email: NALO.UK@Tetratech.com

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APPENDIX C – NOISE INTRUSION ASSESSMENT TABLES

Table C1 Daytime Noise Intrusion Levels $L_{Aeq16hour}$

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
0F01	61.5	51.5	31.5	35
0F02	58.4	48.4	28.4	35
0F03	39.0	29.0	9.0	35
1F01	71.5	61.5	41.5	35
1F02	63.4	53.4	33.4	35
1F03	58.2	48.2	28.2	35
1F04	49.2	39.2	19.2	35
1F05	53.4	43.4	23.4	35
1F06	52.0	42.0	22.0	35
1F07	60.8	50.8	30.8	35
1F08	53.5	43.5	23.5	35
1F09	47.9	37.9	17.9	35
1F10	47.9	37.9	17.9	35
1F11	44.5	34.5	14.5	35
1F12	60.9	50.9	30.9	35
1F13	59.9	49.9	29.9	35
1F14	62.9	52.9	32.9	35
2F01	70.7	60.7	40.7	35
2F02	62.4	52.4	32.4	35
2F03	56.8	46.8	26.8	35
2F04	48.6	38.6	18.6	35
2F05	52.4	42.4	22.4	35
2F06	52.2	42.2	22.2	35
2F07	61.1	51.1	31.1	35
2F08	53.8	43.8	23.8	35
2F09	48.5	38.5	18.5	35
2F10	48.8	38.8	18.8	35
2F11	51.5	41.5	21.5	35
2F12	59.2	49.2	29.2	35
2F13	59.9	49.9	29.9	35
2F14	62.9	52.9	32.9	35
3F01	70.5	60.5	40.5	35
3F02	60.8	50.8	30.8	35
3F03	55.4	45.4	25.4	35
3F04	50.2	40.2	20.2	35
3F05	52.6	42.6	22.6	35
3F06	61.4	51.4	31.4	35
3F07	58.7	48.7	28.7	35
3F08	51.2	41.2	21.2	35
3F09	49.7	39.7	19.7	35
3F10	49.9	39.9	19.9	35

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
3F11	52.7	42.7	22.7	35
3F12	58.4	48.4	28.4	35
3F13	59.9	49.9	29.9	35
3F14	62.7	52.7	32.7	35
4F01	61.5	51.5	31.5	35
4F02	57.3	47.3	27.3	35
4F03	56.3	46.3	26.3	35

Table C2 Night-time Noise Intrusion Levels $L_{Aeq\ 8\ hour}$

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
0F01	49.3	39.3	19.3	30
0F02	48.8	38.8	18.8	30
0F03	28.3	18.3	0.0	30
1F01	62.0	52.0	32.0	30
1F02	53.3	43.3	23.3	30
1F03	47.4	37.4	17.4	30
1F04	39.3	29.3	9.3	30
1F05	46.9	36.9	16.9	30
1F06	44.5	34.5	14.5	30
1F07	48.9	38.9	18.9	30
1F08	46.4	36.4	16.4	30
1F09	33.7	23.7	3.7	30
1F10	33.8	23.8	3.8	30
1F11	41.1	31.1	11.1	30
1F12	60.3	50.3	30.3	30
1F13	50.5	40.5	20.5	30
1F14	50.1	40.1	20.1	30
2F01	61.2	51.2	31.2	30
2F02	52.4	42.4	22.4	30
2F03	46.3	36.3	16.3	30
2F04	36.2	26.2	6.2	30
2F05	43.9	33.9	13.9	30
2F06	44.5	34.5	14.5	30
2F07	48.6	38.6	18.6	30
2F08	46.2	36.2	16.2	30
2F09	35.2	25.2	5.2	30
2F10	35.5	25.5	5.5	30
2F11	48.5	38.5	18.5	30
2F12	58.0	48.0	28.0	30
2F13	50.1	40.1	20.1	30
2F14	49.9	39.9	19.9	30
3F01	61.0	51.0	31.0	30
3F02	50.8	40.8	20.8	30
3F03	45.5	35.5	15.5	30

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
3F04	38.5	28.5	8.5	30
3F05	44.4	34.4	14.4	30
3F06	48.4	38.4	18.4	30
3F07	47.7	37.7	17.7	30
3F08	41.1	31.1	11.1	30
3F09	37.1	27.1	7.1	30
3F10	37.3	27.3	7.3	30
3F11	49.5	39.5	19.5	30
3F12	56.8	46.8	26.8	30
3F13	49.6	39.6	19.6	30
3F14	49.8	39.8	19.8	30
4F01	48.2	38.2	18.2	30
4F02	55.0	45.0	25.0	30
4F03	45.9	35.9	15.9	30

Table C3 Night-time Noise Intrusion Levels L_{Amax}

Location	External L_{Amax} at 1m from facade	Internal L_{Amax} with windows open	Internal L_{Amax} with windows closed	Criteria Internal L_{Amax}
0F01	61.2	51.2	31.2	45
0F02	59.2	49.2	29.2	45
0F03	47.4	37.4	17.4	45
1F01	84.2	74.2	54.2	45
1F02	71.1	61.1	41.1	45
1F03	66.1	56.1	36.1	45
1F04	54.7	44.7	24.7	45
1F05	58.2	48.2	28.2	45
1F06	57.8	47.8	27.8	45
1F07	61.8	51.8	31.8	45
1F08	58.2	48.2	28.2	45
1F09	50.6	40.6	20.6	45
1F10	51.6	41.6	21.6	45
1F11	52.9	42.9	22.9	45
1F12	66.5	56.5	36.5	45
1F13	66.9	56.9	36.9	45
1F14	66.6	56.6	36.6	45
2F01	83.2	73.2	53.2	45
2F02	69.1	59.1	39.1	45
2F03	64.0	54.0	34.0	45
2F04	54.8	44.8	24.8	45
2F05	59.3	49.3	29.3	45
2F06	59.0	49.0	29.0	45
2F07	63.2	53.2	33.2	45
2F08	59.0	49.0	29.0	45
2F09	52.5	42.5	22.5	45

Location	External L_{Amax} at 1m from facade	Internal L_{Amax} with windows open	Internal L_{Amax} with windows closed	Criteria Internal L_{Amax}
2F10	53.8	43.8	23.8	45
2F11	56.9	46.9	26.9	45
2F12	64.2	54.2	34.2	45
2F13	66.4	56.4	36.4	45
2F14	66.9	56.9	36.9	45
3F01	83.0	73.0	53.0	45
3F02	66.7	56.7	36.7	45
3F03	62.9	52.9	32.9	45
3F04	56.1	46.1	26.1	45
3F05	60.2	50.2	30.2	45
3F06	63.8	53.8	33.8	45
3F07	61.2	51.2	31.2	45
3F08	57.7	47.7	27.7	45
3F09	55.6	45.6	25.6	45
3F10	56.1	46.1	26.1	45
3F11	57.9	47.9	27.9	45
3F12	63.1	53.1	33.1	45
3F13	66.1	56.1	36.1	45
3F14	67.0	57.0	37.0	45
4F01	64.3	54.3	34.3	45
4F02	61.5	51.5	31.5	45
4F03	62.6	52.6	32.6	45

All values are sound pressure levels in dB re: 2x 10^{-5} Pa

Table C4 Private External Amenity Area Noise Levels $L_{Aeq,16hr}$

Ref	External $L_{Aeq,16hr}$ (dB) Daytime	Upper BS 8233 Guideline Value Criteria L_{Aeq}
1G01	61.3	55
1G02	51.4	55
1G03	51.0	55
1G04	50.2	55
1G05	41.2	55
1G06	54.2	55
1G07	61.1	55
2G01	63.1	55
2G02	56.5	55
2G03	51.3	55
2G04	52.0	55
2G05	50.9	55
2G06	47.9	55
2G07	54.7	55
2G08	61.4	55
3G01	60.0	55
3G02	51.5	55

Ref	External $L_{Aeq,16hr}$ (dB) Daytime	Upper BS 8233 Guideline Value Criteria L_{Aeq}
3G03	52.9	55
3G04	51.5	55
3G05	50.0	55
3G06	54.9	55
3G07	60.9	55
4G01	50.7	55
4G02	55.1	55

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa

APPENDIX D – EXAMPLE CONSTRUCTIONS

Table D1 Example Partition Constructions

Sound Insulation Performance, R_w (dB)		Construction
	40	70 mm 'C' studs with 1 no. layer 12.5 mm SoundBloc to both sides.
	42	70 mm 'C' studs with 1 no. layer 12.5 mm WallBoard to both sides, and 50 mm APR in cavity
	45	70 mm 'C' studs with 1 no. layer 12.5 mm SoundBloc to both sides, and 25 mm APR in cavity
	48	70 mm AcouStuds with 1 no. layer 12.5 mm SoundBloc to both sides, and 25 mm APR in cavity
	49	92 mm 'C' studs with 1 no. layer 15 mm SoundBloc to both sides, and 25 mm APR in cavity
	50	92 mm 'C' studs with 1 no. layer 15 mm SoundBloc to both sides, and 50 mm APR in cavity
	50	70 mm 'C' studs with 2 no. layer 12.5 mm WallBoard to both sides, and 25 mm APR in cavity
	52	92 mm AcouStuds with 1 no. layer 15 mm SoundBloc to both sides, and 50 mm APR in cavity. Plaster skim.
	52	70 mm 'C' studs with 2 no. layer 12.5 mm SoundBloc to both sides, and 25 mm APR in cavity
	54	70 mm 'C' studs with 2 no. layer 15 mm SoundBloc to both sides, and 25 mm APR in cavity
	56	70 mm 'C' studs with 2 no. layer 15 mm SoundBloc to both sides, and 50 mm APR in cavity

APPENDIX E – REPORT CONDITIONS

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The report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections'. Environmental conditions can vary, and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times. No investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather-related conditions. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions. The “shelf life” of the Report will be determined by a number of factors including; its original purpose, the Client’s instructions, passage of time, advances in technology and techniques, changes in legislation etc. and therefore may require future re-assessment.

The whole of the report must be read as other sections of the report may contain information which puts into context the findings in any executive summary.

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