9. Noise & Vibration

Appendix 9.1

NOISE & VIBRATION IMPACT ASSESSMENT

Everton Stadium Development Ltd

Goodison Park Legacy Project, Merseyside

Noise and Vibration Assessment December 2020

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Contents Page

1.0 Introduction....1

2.0 Planning Policy and Legislation....3

3.0 Assessment Criteria....8

4.0 Assessment Methodology....13

5.0 Noise Survey....22

6.0 Assessment of Key Effects....31

7.0 Acoustic Design Statement (Mitigation)....42

8.0 Conclusions of Noise and Vibration Assessment....43

Appendix Contents

Appendix A – Acoustic Terminology and Abbreviations

Appendix B – Sketches

Appendix C – Construction and Environmental Management Plan (CEMP)

Appendix D – Acoustic Consultants' Qualifications, Professional Memberships

Appendix E – Liverpool City Council Consultation Response

Appendix F – Report Conditions

1.0 Introduction

1.1 Purpose of this Report

This report presents the findings of a noise and vibration assessment undertaken to support an outline planning application for a mixed-use development at Goodison Park, Goodison Road, Liverpool, on behalf of Everton Stadium Development Ltd (hereafter 'Everton'). The proposal includes demolition of the existing stadium and the construction of residential, retail, commercial units and community uses and forms part of The People's Project.

'The People's Project' comprises:

1. The development of a new 52,888 seated capacity stadium predominantly for football use (with the ability to host other events) at Bramley-Moore Dock with associated facilities and infrastructure; and
2. Demolition of the existing Goodison Park stadium (post relocation) and redevelopment of the site for a mixed-use development, including housing, commercial space, community use and open space, referred to as the 'Goodison Park Legacy Project' (GPLP).

The description of development is as follows:

"Application for Outline Planning Permission for the demolition of existing buildings and redevelopment of the site for a mix of uses, comprising residential units (Use Class C3); residential institution (Use Class C2); shops (Use Class A1); financial & professional services (Use Class A2); food and drink use (Use Class A3); drinking establishments (Use Class A4); hot food takeaways (Use Class A5); business use (Use Class B1); non-residential institutions (Use Class D1); and open space, with associated access, servicing, parking and landscaping. All matters (Access, Appearance, Landscaping, Layout and Scale) are reserved for future determination."

Following correspondence with Liverpool City Council, the applicant has progressed design-led changes to the submitted application (reference 20O/0997) which requires the noise and vibration assessment to be updated; this version of the report includes the following updates in relation to Noise and Vibration:

- New assemblage of buildings proposed;
- Previous locations of each building use amended; and
- Maximum building heights amended.

This ES technical appendix relating to noise and vibration has been reviewed against the following aspects and for each it has been confirmed that there are no amendments required to the content of the appendix:

- Baseline data validity: there have been no relevant changes to the baseline data, and the results of the noise survey presented in Section 5.0 remain valid; and
- Operational traffic data: no relevant changes have been made to operational traffic data as confirmed by Highways consultant Mott MacDonald.

Further information on the changes to the operational traffic trip figures and distribution brought about by the December 2020 scheme changes is provided in Section 7.1.4 in Chapter 7 Transport in Volume II of the Environmental Statement. The results demonstrate that the revised application quanta will generate 25 fewer traffic trips in the morning peak and 67 fewer trips in the evening peak hour than the March 2020 scheme, while the traffic distribution is expected to remain broadly the same. On this basis, it is considered that the previous March 2020 traffic data represents a robust, worst case scenario, and has therefore been retained for use in this revised report.

In accordance with the methodology outlined in Chapter 2, ES Volume II, a Level 2 update has been undertaken. Due to:

- The relevance and scale of the proposed development amendments (including amendments to the building locations and uses and, consequently, the proposed receptor locations).

The relevant assessment information is presented/discussed within this appendix and therefore this report has been revised to reflect these updates.

The sections that have been updated are detailed below:

- Section 1.1 – Description of changes considered for the noise and vibration assessment;
- Section 4.1 – Figure 4.1 updated to include design changes;
- Section 4.4 – Revised proposed receptor locations to include the design changes;
- Section 6.4 – Updated building services plant assessment to include design changes;
- Section 6.5 – Updated noise intrusion assessment to include design changes;
- Section 6.6 – Updated amenity area assessment to include design changes;
- Section 6.6 – Updated mitigation measures to include design changes; and
- Appendix B – Sketches updated to include design changes.

The noise levels from the proposed development have been predicted at local representative 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 and noise contour plots relevant to the assessment are presented in Appendix B.

1.2 March 2020 Planning Application Consultation Response – Liverpool City Council (LCC)

LCC provided a consultation response to the submitted full application (dated 3rd August 2020) regarding the previously submitted noise and vibration assessment. Within this document, a number of conditions relating to noise are proposed, shown in Appendix E of this document. These conditions are considered to be achievable, subject to the proposed clarification detailed in Appendix E.

2.0 Planning Policy and Legislation

Section 38(6) of the Planning and Compulsory Purchase Act 2004 and Section 70(2) of the Town & Country Planning Act 1990 require planning applications to be determined in accordance with the statutory development plan, unless material considerations indicate otherwise. The statutory development plan for the City of Liverpool currently comprises the Unitary Development Plan (adopted 2002).

The statutory development plan policies relevant to the application proposal are summarised below. The following policies and guidance are material considerations which also inform the assessment:

- Emerging Liverpool Local Plan (Submission Draft, May 2018);
- National Planning Policy Framework (February 2019);
- Planning Practice Guidance (updated July 2019); and
- Supplementary Planning Documents (where relevant).

2.1 Local Planning Policy

Chapter 13 of the Liverpool Unitary Development Plan (UDP): A Plan for Liverpool (2002) contains the relevant policies with respect to noise:

Pollution – Policy EP11

"1. Planning permission will not be granted for development which has the potential to create unacceptable air, water, noise or other pollution or nuisance.

2. Where existing uses adversely affect the environment through noise, vibration, soot, grit, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems, the City Council will:

i. seek to reduce the problem on site;

ii. refuse planning permission for development which would result in a consolidation or expansion of uses giving rise to environmental problems;

iii. impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such permission, in order to regulate uses;

iv. take enforcement action where appropriate; and

v. in appropriate circumstances, compulsorily acquire the premises whilst endeavouring to assist in the relocation of the firm, where resources permit.

3. In the case of new development close to existing uses which are authorised or licensed under pollution control legislation, and which are a potential nuisance to the proposed development, planning

permission will not be granted unless the City Council is satisfied that sufficient measures can and will be taken to protect amenity and environmental health.

Paragraph 13.103 also states:

"In determining whether a development is likely to cause unacceptable levels of pollution, the City Council will consider:

- *national and international standards and regulations;*
- *the advice of the pollution and control authorities;*
- *Government guidance;*
- *neighbouring land uses; and*
- *the cumulative effect that may result i.e. where emissions, noise, discharge or nuisance from the development would combine with those already existing to reach unacceptable levels."*

The emerging Liverpool City Council Local Plan 2013-2033 (submission version May 2018) also contains the relevant policies with respect to noise from the proposed development:

Policy SP4 (Food and Drink Uses and Hot Food Take-aways)

"5. Proposals for all food and drink uses including hot food take-aways both within and outside designated centres should demonstrate that:

(a) There would be no adverse impact on residential amenity in terms of noise, customer activity, vibrations, odours, traffic disturbance and litter;

(d) Appropriate fume extraction systems and/ or noise insulation are provided;"

Policy R1 Pollution

"1. Development proposals which are likely to have a pollution impact should demonstrate that:

a. Appropriate measures are incorporated to avoid pollution to air, water and soil;

b. The impact of noise, vibration and lighting will not be significant;

c. The proposal will not undermine the achievement of Air Quality Management Area (AQMA) objectives; and

d. It will not lead to a significant decline in air quality

2. Where existing uses adversely affect the environment through noise, vibration, dust, smoke, fumes, smell, vehicle obstruction or other environmental problems the City Council will:

a. Refuse planning permission for proposals which would result in a consolidation or expansion of uses giving rise to environmental problems.

b. Impose appropriate conditions on any permission which may be granted and/or obtain legal agreements in relation to such a permission in order to regulate uses.

3. New development proposals close to existing uses which are authorised or licenced under pollution control legislation, and which are a potential nuisance to the proposed development, will not be permitted unless the City Council is satisfied that sufficient measures will be taken by the developer to protect amenity and environmental health.

4. Where appropriate Major developments should incorporate measures to reduce and minimise air pollution."

2.2 National Planning Policy

National policy guidance with respect to noise is found in National Planning Policy Framework (NPPF), published on 19th February 2019. With regard to noise and planning, NPPF contains the following statement at paragraph 170:

"170. 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

Two further statements are presented at paragraph 180, which state:

"180. 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 182 and 183 state:

"182. 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.

183. 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, published in March 2014 and last updated in July 2019, 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 paragraph 2.20 of the Explanatory Note of the Noise Policy Statement for England (NPSE) March 2010 is to identify *'whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) 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 2.1 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

Perception	Examples of Outcomes	Increasing Effect Level	Action
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

3.0 Assessment Criteria

3.1 PPG Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Tables 3.1 – 3.4 presents equivalent noise levels and associated actions with the target noise level criteria identified. The noise level criteria detailed below have been derived from standards and design guidance:

- BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings – Code of practice'*
- BS 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'*
- Building Bulletin 93 *'Acoustic Design for Schools'* (February 2015)
- IEMA (Institute for Environmental Management and Assessment) *'Guidelines for Environmental Noise Impact Assessment October 2014'*
- BS 5228-1: 2009 + A1:2014 *'Code of Practice for Noise and vibration control on construction and open sites'*
- Tables 3.54a and 3.54b of LA 111 published in November 2019 (Design Manual for Roads and Bridges)

Table 3.1 Noise Level Criteria and Actions

Effect Level	Assessment	Noise Level Criteria	Action / Justification
No Observed Adverse Effect Level (NOAEL)	Building Services 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
	Proposed Residential Units	Noise levels less than: Bedrooms (night-time) – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms (daytime) – 35 dB $L_{Aeq,16hours}$ Classroom (daytime) – 35 dB $L_{Aeq,16hours}$ Open Plan Office (daytime) – 45 dB $L_{Aeq,T}$ External Amenity Space (daytime) – 50 dB $L_{Aeq,16hours}$	No Action Required Within BS8233 / WHO / BB93
Lowest Observed Adverse Effect Level (LOAEL)	Building Services Plant	*BS4142 Score of +5 or lower*	No Action Required Difference of +5db likely to be an indication of an adverse effect BS4142 Score of plus 5 or lower
	Proposed Residential Units	Noise levels exceed: Bedrooms (night-time) – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms (daytime) – 35 dB $L_{Aeq,16hours}$ Classroom (daytime) – 35 dB $L_{Aeq,16hours}$ Open Plan Office (daytime) – 45 dB $L_{Aeq,T}$ External Amenity Space (daytime) – 55 dB $L_{Aeq,16hours}$	Mitigate to achieve: *Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms – 35 dB $L_{Aeq,16hours}$* Within BS8233 / WHO / BB93

Effect Level	Assessment	Noise Level Criteria	Action / Justification
Significant Observed Adverse Effect Level (SOAEL)	Building Services Plant	BS4142 Score greater than +5	Difference of up to +10dB likely to be an indication of a significant adverse effect Mitigate to achieve: BS4142 Score of + 5 or lower
	Proposed Residential Units	Noise levels exceed: Bedrooms (night-time)– 35 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms (daytime)– 45* dB $L_{Aeq,16hours}$ Classroom (daytime) – 35 dB $L_{Aeq,16hours}$ Open Plan Office (daytime) – 50 dB$L_{Aeq,T}$ Depending on context, external noise levels exceed: External Amenity Space (daytime) – 55 dB $L_{Aeq,16hours}$	Mitigate to achieve: *Bedrooms – 30 dB $L_{Aeq,8hours}$ / 45 dB L_{Amax} Living Rooms – 35 dB$L_{Aeq,16hours}$* Classroom (daytime) – 35 dB $L_{Aeq,16hours}$ Within BS8233 / WHO / BB93 * Values correspond with PPG24 Category B (15 dB open window reduction) Depending on context, Mitigate and reduce noise levels to a minimum within external amenity spaces
Unacceptable Observed Adverse Effect Level (UOAEL)	Building Services Plant	BS4142 Score of + 10 or higher	Avoid Mitigate to achieve: BS4142 Score of 5 dB or lower
	Proposed Residential Units	Noise levels exceed: Bedrooms (night-time) – 51 dB $L_{Aeq,8hours}$ / 67 dB L_{Amax} Living Rooms (daytime) – 57 dB Classroom (daytime) – 45 dB $L_{Aeq,16hours}$ Open Plan Office (daytime) – 50 dB $L_{Aeq,T}$ External Amenity Space – 65 dB$L_{Aeq,16hours}$	Avoid Values correspond with PPG24 Category D (mixed sources), planning permission should normally be refused. L_{Amax} noise levels based on PPG24 regular exceedance of 82 dB L_{Amax} less 15 dB for an open window.

Table 3.2 Noise Level Criteria (Traffic Noise Assessment)

Short-term Change in Noise Levels $L_{A10,18hr}$ (dB)	Category (Short-term)	Long-term Change in Noise Levels $L_{A10,18hr}$ (dB)	Category (Long-term)
0.0	No Change	0.0	No Change
0.1 – 0.9	Negligible Adverse	0.1 – 2.9	Negligible Adverse
1.0 – 2.9	Minor Adverse (LOAEL)	3.0 – 4.9	Minor Adverse (LOAEL)
3.0 – 4.9	Moderate Adverse (SOAEL)	5 – 9.9	Moderate Adverse (SOAEL)
> 5.0	Major Adverse	> 10.0	Major Adverse

Table 3.3 Noise Level Criteria and Actions (Construction Noise Assessment)

Effect Level	Assessment	Noise Level Criteria	Action / Justification
No Observed Adverse Effect Level	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 50dB In urban areas noise levels exceed 55dB	No Action Required Complaints Relating to Construction Noise Unlikely
Lowest Observed Adverse Effect Level	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 60dB In urban areas noise levels exceed 65dB	Mitigate to achieve total noise levels below relevant category threshold
Significant Observed Adverse Effect	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 70dB In urban areas noise levels exceed 75dB	Mitigate to achieve total noise levels below relevant category threshold
Unacceptable Observed Adverse Effect	Construction Noise Assessment	Fixed Limits In rural areas noise levels exceed 80dB In urban areas noise levels exceed 85dB	Mitigate to achieve total noise levels below relevant category threshold

3.3 Vibration Assessment Criteria

BS5228-2:2009 +A1:2014, 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' provides the guidance for construction assessment.

Reference is also made to the potential for building damage that could occur as a result of the construction phases of the development. Guidance levels on acceptable values of transient vibration from BS 7385-2:1993 *'Evaluation and Measurement for Vibration in Buildings'* are referred to in the assessment.

3.3.1 Construction Assessment Criteria

BS 5228-2:2009 +A1:2014, "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration" provides a methodology for assessment and guidance with regard to mitigation of construction related vibration.

Vibration levels from potential piling activities associated with the proposed development of the application site have been assessed in accordance with the criteria to enable determination of whether a significant effect is likely to occur at noise sensitive properties.

The calculation methodology set out in Annex E of BS 5228-2 for percussive piling has been used to determine the propagation of vibration.

$$v_{res} \leq k_p \left[\frac{\sqrt{W}}{r^{1.3}}\right]$$

Where

- v_{res} is the resultant PPV, in mms^{-1}
- k_p is the scaling factor of 3
- W is the nominal hammer energy, in joules
- r is the slope distance from the pile toe or tunnel crown, in meters

Table 3.4 below outlines the guidance with regard to the effect of human exposure to construction vibration.

Table 3.4 Guidance on effects of vibration levels

Vibration Level [A), B), C)]	Effect
0.14 mms^{-1}	Vibration may be just perceptible in the most sensitive situations for most vibration frequencies associates with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mms^{-1}	Vibration might just be perceptible in residential environments
1.0 mms^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated and explanation has been given to residents.
10 mms^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

a) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.
b) A transfer function (which relates to an external level to an internal level) needs to be applied if only external measurements are available
c) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.

3.3.2 Building Damage

BS 7385-2:1993 *Evaluation and Measurement for Vibration in Buildings* provides guidance on acceptable values of transient vibration for avoidance of cosmetic damage to buildings as follows.

Table 3.5 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Component Particle Velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential of Light Commercial Type Buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 50 Hz and above

Table 3.5 above shows the limits for transient vibration, above which cosmetic damage could occur. Minor damage is possible at vibration magnitudes which are greater than twice those given above and major damage to a building structure may occur at values greater than four times the tabulated values. PPV values of below 15 mm/s are unlikely to results in any damage to buildings.

Damage is classified into the following categories:

Table 3.6 Vibration Damage Classification

Damage	Description
Cosmetic	The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.
Minor	The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks.
Major	Damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

4.0 Assessment Methodology

4.1 Noise Modelling Methodology

The proposed development has been assessed, using three-dimensional noise modelling of source noise levels at a large number of locations both horizontally and vertically using CADNA noise modelling software (as shown in Figure 4.1). 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. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in the table below have been used.

Figure 4.1 CADNA Noise Model

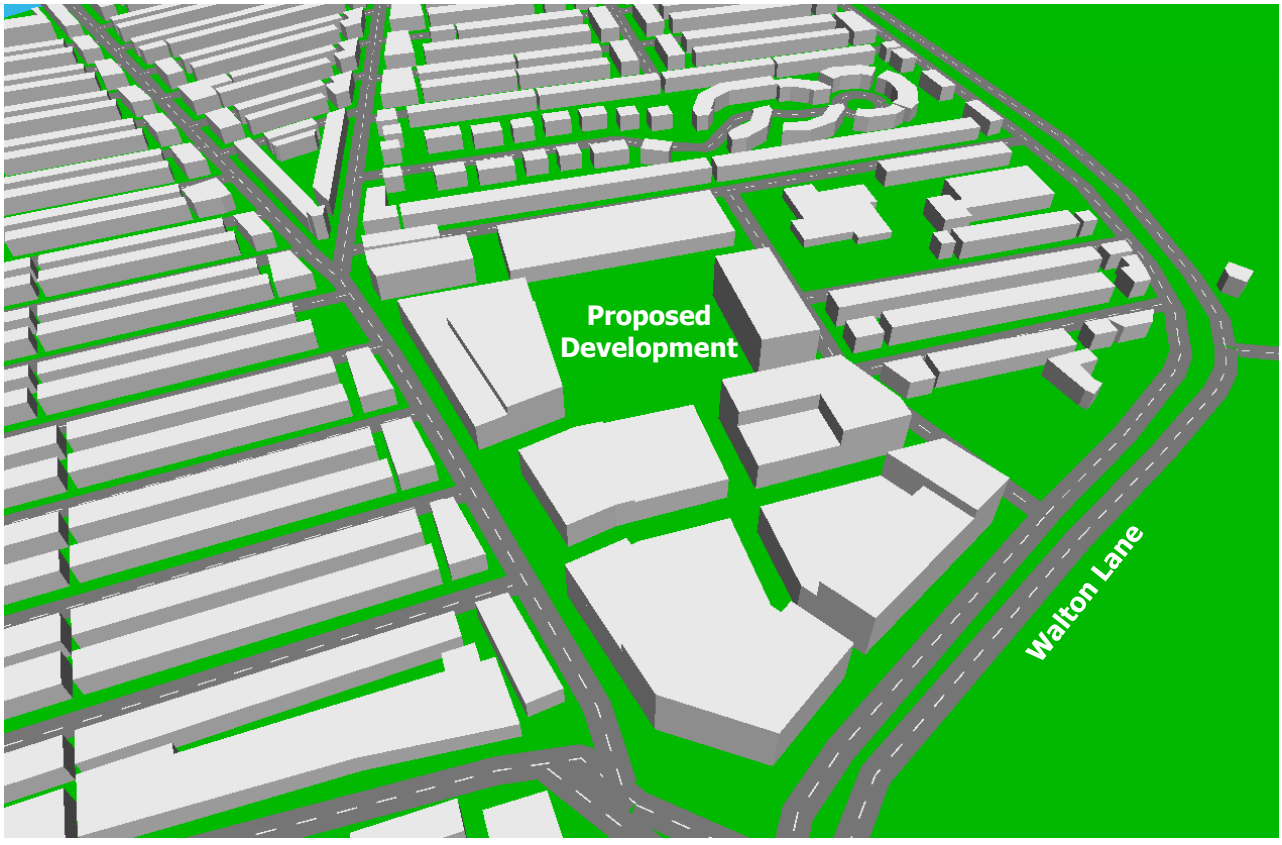


Table 4.1 Modelling Parameters Sources and Input Data

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.
Traffic data – main surrounding roads	Mott MacDonald	Provided by Mott MacDonald transport consultants
Building heights – outside the site	WYG Observations	8m height for two storey and 3m per storey thereafter and 4 m for bungalows
Receptor positions	WYG	1 m from façade, height of 1.5 m for ground floor, 4 m for first floor properties with ground floor or bungalow dormer windows, 3 m increments per storey. 1.5 m height for model grid and monitoring locations for validation.
Proposed Development Parameter Plans	Planit I.E Limited	Drawing Title: Maximum Development Heights Parameter Plan 02 Drawing Number: 2579-PLA-XX-XX-DR-U-0009 Rev P01 Drawing Title: Ground Floor Uses Parameter Plan 03 Drawing Number: 2579-PLA-XX-XX-DR-U-0010 Rev P01 Drawing Title: Upper Floor Uses Parameter Plan 04 Drawing Number: 2579-PLA-XX-XX-DR-U-0011 Rev P01

It is acknowledged that a number of these parameters will affect the overall noise levels presented in this report. However, it should be noted that certain assumptions made, as identified above, are worst-case, ensuring that a robust approach has been taken to the assessment.

4.2 Model Input Data

4.2.1 Existing Ambient Noise Climate

Noise sources affecting the site observed to make a significant contribution to the ambient noise have been included within this assessment; noise emissions from existing road traffic flows have been derived from verification of the measured noise levels, along with observations made during the site survey and/or WYG Environment experience of similar road systems.

4.2.2 Model Verification

The model was verified by modelling the monitoring locations for the 'existing' 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 for the monitoring locations shown on SK01 of Appendix B.

Table 4.2 Modelled vs. Monitored Results $L_{Aeq;\ daytime\ 07:00 – 23:00}$

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
LT1	69.9	69.9	0.0
ST1	74.4	72.1	-2.3
ST2	59.0	59.0	0.0

Location	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between Monitored and Modelled Results
ST3	58.7	58.7	0.0
ST4	68.3	68.3	0.0
ST5	65.7	65.7	0.0
ST6	66.3	68.8	2.5
ST7	69.1	69.3	0.2
ST8	70.1	70.1	0.0
ST9	75.5	71.6	-3.9
ST10	66.4	66.4	0.0
ST11	55.2	57.9	2.7
ST12	56.8	57.4	0.6

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

Table 4.3 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
LT1	64.8	64.8	0.0
ST1	63.1	65.8	2.7
ST2	48.4	51.0	2.6
ST3	46.1	46.1	0.0
ST4	53.2	54.0	0.8
ST5	56.0	56.0	0.0
ST6	54.5	57.0	2.5
ST7	62.5	64.2	1.7
ST8	62.0	62.0	0.0
ST9	64.1	66.5	2.4
ST10	57.9	57.9	0.0

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

Table 4.4 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
LT1	81.0	81.0	0.0
ST1	82.7	83.2	0.5
ST2	65.2	67.2	2.0
ST3	71.4	68.8	-2.6
ST4	72.6	73.5	0.9
ST5	76.4	75.6	-0.8
ST6	73.3	73.3	0.0
ST7	82.4	80.5	-1.9
ST8	78.6	78.6	0.0
ST9	87.5	82.7	-4.8
ST10	76.3	76.3	0.0

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

The verification points show no divergence between monitored and modelled results at the long-term monitoring location. The greatest weight has been given to the long-term monitoring due to the longer exposure time and dominance from Walton Lane. Following analysis of sound files recorded during the baseline survey, the measured night-time L_{Amax} noise level at LT1 presented above represents the 95% percentile of measured L_{Amax} noise levels over the entire monitoring period and is not expected to be exceeded more than 10 times per night. Therefore, the models are considered to be suitably verified.

4.2.3 Building Services Plant Noise Data

Point sources have been used in the model to represent the proposed building services plant (BSP) associated with the scheme. The maximum sound pressure levels of 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 are at least 10 dB below existing daytime and night-time background noise levels. The worst-case assessment presented below considers the effects of 8 no. externally located items/areas of likely roof-mounted building services plant, placed in worst-case locations facing sensitive receptors, the locations of which are shown illustratively on SK02c of Appendix B.

4.2.4 Road Traffic Noise Data

All roads expected to make a significant contribution to overall noise levels have been included within this assessment. Traffic flows and HGV percentages have been provided by Mott MacDonald transport consultants. Estimates of the vehicle speeds have been made based upon the speed restrictions currently in force in the area. The scenarios detailed below have been considered for this assessment, with the future years incorporating the proposed development and other cumulative developments, so as to represent a worst-case scenario.

1. 2028 "Do Minimum (DM)" – without development opening year
2. 2028 "Do Something (DS)" – with development opening year (Base + Cumulative Development + Proposed Development)
3. 2032 "Do Minimum (DM)" – without development future year
4. 2032 "Do Something (DS)" – with development future year (Base + Cumulative Development + Proposed Development)

Table 4.5 Traffic Data

Road Link	Do Minimum 2028	HGV %	Do Something 2028	HGV %	Do Minimum 2032	HGV %	Do Something 2032	HGV %
Walton Lane Cem	24894	3	26343	3	25872	3	27322	3
Walton Lane E Park	29586	3	31218	3	30748	3	32380	3
Walton Lane W Park	29055	3	29881	3	30196	3	31022	3

Road Link	Do Minimum 2028	HGV %	Do Something 2028	HGV %	Do Minimum 2032	HGV %	Do Something 2032	HGV %
Walton Lane S Park	24538	3	25850	3	25502	3	26813	3
Priory Road	9114	2	9297	2	9473	2	9655	2
Langham Street	3673	1	3673	1	3819	1	3819	1
Spellow Lane (Dixie Dean)	10687	2	12706	2	11106	2	13125	2
Spellow Lane W	8385	2	8795	2	8713	2	9123	2
Goodison Road S	4156	0	5656	0	4319	0	5819	0
Goodison Road N	914	0	1013	0	950	0	1049	0
Andrew Street	1009	1	1009	1	1049	1	1049	1
Nimrod Street	580	1	958	1	602	1	980	1
City Road	2851	0	3039	0	2963	0	3151	0
Gwladys Street W	1704	0	2782	0	1771	0	2849	0
Gwladys Street E	1142	0	2251	0	1187	0	2296	0
Bullens Road	707	1	1984	1	735	1	2012	1

4.3 Construction Data

Information regarding noise emissions from equipment used during the construction phase has been obtained from Annex C of BS 5228-1:2009 + A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. This annex presents a range of current sound level data on typical site equipment and common site activities.

This data is obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in the database are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant. The results are presented as un-weighted octave band activity L_{eq} levels, and overall A-weighted activity L_{eq} levels in dB. All sound pressure levels are standardized to 10 metres from the plant.

The items of plant and associated noise levels shown in Table 4.6 below has been used for the purposes of this assessment and consider the range of typical activities likely to be employed during the construction phase of the proposed development. These have been determined in conjunction with the Construction Management Plan produced by CBRE. Items of mobile plant have been positioned in the areas on the development site that are close to existing sensitive receptors.

Table 4.6 Mobile Plant Demolition & Construction Phases

Mobile Plant	BS 5228-1:2009 Annex C Ref.	Octave Band Sound Pressure Levels (Hz)								Model Input $L_{Aeq,1hour}$ at 10 m
		63	125	250	500	1K	2K	4K	8K	
Generator	Table C.4 No. 76	80	74	57	54	53	48	45	37	61 dB

Mobile Plant	BS 5228-1:2009 Annex C Ref.	Octave Band Sound Pressure Levels (Hz)								Model Input $L_{Aeq,1hour}$ at 10 m
		63	125	250	500	1K	2K	4K	8K	
Compressor - Tractor Mounted	Table D.8 No. 18	-	-	-	-	-	-	-	-	89 dB
Water Bowser	Table C.6 No. 37	80	81	75	79	73	74	70	65	81 dB
Tracked Excavator	Table C.2 No. 19	95	84	79	73	70	68	64	57	77 dB
Diesel Front End Loader	Table D.11 No. 29	-	-	-	-	-	-	-	-	83 dB
Diesel Hydraulic Shovel	Table D.10 No. 41	-	-	-	-	-	-	-	-	89 dB
Tipper Lorry	Table C.5 No. 31	72	77	74	72	71	70	67	60	77 dB
Lorry (Unloading)	Table D.7 No. 122	-	-	-	-	-	-	-	-	84 dB
Site Fork Lift Truck	Table D.7 No. 93	-	-	-	-	-	-	-	-	76 dB
Tracked Excavator- loading truck	Table C.1 No. 10	82	78	82	81	81	78	72	64	85 dB
Pneumatic Circular Saw	Table D.7 No. 79	-	-	-	-	-	-	-	-	75 dB
Lorry Mounted Road Sweeper	Table D.8 No. 31	-	-	-	-	-	-	-	-	73 dB
Tracked Crane	Table C.4 No. 48	82	77	80	76	66	66	56	50	76 dB
Articulated Dump truck	Table C.2 No. 33	85	87	77	75	76	73	69	62	81 dB
Lorry Mounted Auger	Table D.4 No. 45	-	-	-	-	-	-	-	-	81 dB
Oscillatory Boring Machine	Table D.4 No. 47	-	-	-	-	-	-	-	-	81 dB
Concrete Mixer Truck	Table C.4 No. 20	83	74	66	69	70	78	60	55	80 dB
Concrete Pumps	Table C.4 No. 28	79	80	73	72	69	68	59	53	75 dB
Poker Vibrator	Table C.4 No. 33	82	80	80	73	69	72	70	65	78 dB
Power Float	Table D.6 No. 44	-	-	-	-	-	-	-	-	72 dB
Vibratory Roller	Table C.5 No. 20	90	82	73	72	70	65	59	54	75 dB
Road Roller	Table D.3 No. 114	-	-	-	-	-	-	-	-	80 dB
Dumpers	Table C.4 No. 5	73	64	55	55	60	56	50	43	63 dB
Scaffold	Table D.7 No. 1	-	-	-	-	-	-	-	-	80 dB
Hand-held Electric Circular Saw	Table D.7 No. 77	-	-	-	-	-	-	-	-	82 dB

4.4 Sensitive Receptors

The tables below summarise receptor locations that have been selected to represent worst-case existing residential receptors with respect to demolition and construction activities, site related traffic noise and direct noise from the site. The locations of the receptors are shown on SK02a – SK02b in Appendix B.

Table 4.7 Sensitive Receptor Locations (Demolition & Construction/Operational Noise)

Ref.	Description	Approximate Distance to Source (m)	Height (m)
R01	9 Goodison Road	30.0	1.5
R02	29a Goodison Road	28.0	1.5
R03	41 Goodison Road	30.0	1.5
R04	St Lukes C of E Church, Goodison Road	25.0	1.5
R05	21 Gwladys Street	27.0	1.5
R06	63a Gwladys Street	31.0	1.5
R07	105 Gwladys Street	84.0	1.5
R08	Gwladys Street Community Primary and Nursery School	37.0	1.5
R09	2 Muriel Street	30.0	1.5

Ref.	Description	Approximate Distance to Source (m)	Height (m)
R10	1 Bullens Road	29.0	1.5
P01	Proposed Multi-Storey Flats, Walton Lane	35.0	8.0

Table 4.8 Existing Receptor Locations – Traffic Noise Assessment

Ref.	Description	Closest Source	Approximate distance to closest source (m)	Height (m)
TR01	161 Walton Lane	Walton Lane	10.0	4.0
TR02	56a Spellow Lane	Spellow Lane	5.0	4.0
TR03	Spellow Lane Church, Spellow Lane	Spellow Lane	3.0	4.0
TR04	9 Goodison Road	Goodison Road	3.0	4.0
TR05	37 Goodison Road	Goodison Road	3.0	4.0
TR06	59 Andrew Street	Andrew Street	3.0	4.0
TR07	41 Nimrod Street	Nimrod Street	3.0	4.0
TR08	71 Goodison Road	Goodison Road	4.0	4.0
TR09	1 Frodsham Street	Goodison Road	3.0	4.0
TR10	77a City Road	City Road	3.0	4.0
TR11	20 City Road	City Road	7.0	4.0
TR12	63a Gwladys Street	Gwladys Street	4.0	4.0
TR13	1 Bullens Road	Bullens Road	3.0	4.0
TR14	267 Walton Lane	Walton Lane	5.0	4.0
TR15	293 Walton Lane	Walton Lane	4.0	4.0
TR16	333 Walton Lane	Walton Lane	4.0	4.0

4.4.1 Proposed Sensitive Receptors

Noise levels have been assessed at blocks where sensitive spaces are proposed including residential and educational spaces within the development. This application is an outline application with all matters reserved for future determination. The application seeks permission for maximum floorspaces within various use classes, however the specific use and exact end user of each of the blocks is not currently known. Therefore, for the purposes of this assessment a number of assumptions have been made about the specific use of each block, as set out in Table 4.9 below.

The locations of proposed receptors are detailed in the tables below and illustrated on SK02a and SK02b of Appendix B. For the purposes of this worst-case assessment, noise levels have been predicted at a worst-case first-floor level for all blocks and noise levels extrapolated to the upper floors. These levels have been used to provide a glazing and ventilation strategy which is detailed on SK06 of Appendix B. Further to this, noise levels have also been assessed within the proposed central community amenity space. The assessment includes all buildings once the development is fully complete.

Table 4.9 Proposed Receptor Locations

Ref.	Description	Use Classification	Height (m)
PR1	Northern Façade – Plot E	C3 – Residential D1 – Community	4.0
PR2	Western Façade – Plot E		4.0
PR3	Southern Façade – Plot E		4.0
PR4	Eastern Façade – Plot E		4.0
PR5	Northern Façade – Plot C	C3 – Residential	4.0
PR6	Northern Façade – Plot C	GF: C3 – Residential & A1 / A2 / A3 / A4 / A5 – Retail UF: C3 – Residential	4.0
PR7	Western Façade – Plot C		4.0
PR8	Southern Façade– Plot C		4.0
PR9	Southern Façade– Plot C	C3 – Residential	4.0
PR10	Eastern Façade– Plot C		4.0
PR11	Northern Façade – Plot A	C3 – Residential	4.0
PR12	Northern Façade – Plot A	GF: A1 / A2 / A3 / A4 / A5 – Retail UF: B1 – Commercial	4.0
PR13	Western Façade – Plot A	GF: A1 / A2 / A3 / A4 / A5 – Retail UF: B1 – Commercial	4.0
PR14	Western Façade – Plot A	GF: A1 / A2 / A3 / A4 / A5 – Retail UF: B1 – Commercial	4.0
PR15	Southern Façade– Plot A	B1 – Commercial	4.0
PR16	Eastern Façade– Plot A	B1 – Commercial	4.0
PR17	Eastern Façade– Plot A	C3 – Residential	4.0
PR18	Western Façade – Plot B		4.0
PR19	Western Façade – Plot B		4.0
PR20	Southern Façade – Plot B		4.0
PR21	Eastern Façade – Plot B		4.0
PR22	Northern Façade – Plot B		4.0
PR23	Southern Façade – Plot D	C2 – Residential Institution	4.0
PR24	Eastern Façade – Plot D		4.0
PR25	Northern Façade – Plot D		4.0
PR26	Western Façade – Plot D		4.0
PR27	Southern Façade – Plot F	D1 – Community	4.0
PR28	Eastern Façade – Plot F		4.0
PR29	Northern Façade – Plot F		4.0
PR30	Western Façade – Plot F		4.0
PR31	Southern Façade – Plot G	C3 – Residential	4.0
PR32	Eastern Façade – Plot G		4.0
PR33	Northern Façade – Plot G		4.0
PR34	Western Façade – Plot G		4.0

Table 4.10 Proposed Central Community Amenity Space Receptor Location

Ref.	Description	Height (m)
G01	Amenity Space – Central Green Space	1.2

4.5 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). By reference to these maps the Development is assessed as falling into Zone 1.

5.0 Noise Survey

5.1 Noise Survey Methodology

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels. Equipment used during the survey included:

Norsonic 140	Building Acoustics Analyser	s/n	1402989
Rion NL-52	Environmental Noise Analyser	s/n	620858
Rion NL-52	Environmental Noise Analyser	s/n	264490
Rion NL-52	Environmental Noise Analyser	s/n	1043466
Rion NC-74	Sound Calibrator	s/n	35046823

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at thirteen locations (as specified in the following table and shown in SK01 of Appendix B) from Friday 20th April 2018 to Tuesday 1st May 2018. Attended short-term measurements were undertaken at ten locations during the day, evening, and night-time periods of Saturday 21st April 2018, Sunday 22nd April 2018 and Monday 30th April 2018, with two extra locations being measured attended during the day period only. One further location was measured unattended over a 264-hour period. The raw data collected from the long-term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 *The Description and Measurement of Environmental Noise: Guide to quantities and procedures*. Weather conditions during the survey period were observed as being dry and clear with occasional cover. Anemometer readings confirmed that wind speeds were less than 5 ms^{-1} at all times during the survey with a predominant southerly wind direction on 21st April 2018 and predominant westerly on 22nd April 2018 and 30th April 2018.

Table 5.1 Noise Monitoring Locations

Ref	Description
LT1	Northern perimeter of Stanley Park adjacent to 255 Walton Lane
ST1	Walton Lane, opposite Goodison Park
ST2	1 Bullens Road
ST3	75 Gwladys Street
ST4	St Lukes Parish Hall, City Road
ST5	Winslow Hotel, 31 Goodison Road
ST6	Salop Chapel, 62 Spellow Lane

Ref	Description
ST7	171 Walton Lane
ST8	52 County Road
ST9	Walton Lane, opposite Gwladys Street Community Primary and Nursery School
ST10	Priory Road, opposite entrance to Anfield Cemetery
ST11	Anfield Cemetery
ST12	Stanley Park

5.2 Noise Survey Results

The ambient noise climate in the area on a non-matchday consists of road traffic noise on Walton Lane, Priory Road, Spellow Lane, A59 and smaller residential roads such as City Road, Gwladys Street, Goodison Road and Bullens Road.

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period).

Table 5.2 Meteorological Conditions during the Survey

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Weekday Day						
Weekday Day ST1	30/04/2018 14:40	11.0	2-3	NW	4	Road traffic noise (Walton Lane), work on stadium, birds
Weekday Day ST2	30/04/2018 14:40	11.0	0-2	N	4	Road traffic noise (Walton Lane, Bullens Road, Diana Street), distant birdsong
Weekday Day ST3	30/04/2018 14:47	11.0	3-4	N	4	Road traffic noise (Walton Lane, Gwladys Street), school noise, plants rustling
Weekday Day ST4	30/04/2018 15:28	11.0	3-4	N	4	Road traffic noise (City Road, Gwladys Street, Goodison Road), noise from street sweeper
Weekday Day ST5	30/04/2018 15:37	11.0	1-2	NW	4	Road traffic noise (Goodison Road), people walking past, dogs barking, residential activity
Weekday Day ST6	30/04/2018 14:59	11.0	1-2	N	5	Road traffic noise (Spellow Lane, Goodison Road, Walton Lane), distant industry noise
Weekday Day ST7	30/04/2018 15:08	11.0	3-4	NW	4	Road traffic noise (A5054, Barmouth Way), distant roadworks noise
Weekday Day ST8	30/04/2018 15:18	11.0	3-4	N	3	Road traffic noise, football
Weekday Day ST9	30/04/2018 14:20	11.0	1-2	N	4	Road traffic noise (Walton Lane)
Weekday Day ST10	30/04/2018 14:21	11.0	2-3	NW	4	Road traffic noise (Priory Road), birds

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Weekday Day ST11	30/04/2018 14:24	11.0	3-4	NW	4	Road traffic noise (Walton Lane), birds
Weekday Day ST12	30/04/2018 15:01	11.0	3-4	NW	4	Road traffic noise, birds, dog walkers
Weekday Evening						
Weekday Evening ST1	30/04/2018 19:50	9.0	1-2	NW	2	Road traffic noise (Walton Lane)
Weekday Evening ST2	30/04/2018 20:08	9.0	1-2	NW	2	Road traffic noise (Walton Lane, Bullens Road, Diana Street), birds, residential activity
Weekday Evening ST3	30/04/2018 20:08	8.0	3-4	N	1	Road traffic noise (Walton Lane, Gwladys Street)
Weekday Evening ST4	30/04/2018 20:30	10.0	1-2	N	2	Road traffic noise (Goodison Road)
Weekday Evening ST5	30/04/2018 20:28	10.0	3-4	N	1	Road traffic noise (Goodison Road, Walton Lane)
Weekday Evening ST6	30/04/2018 20:36	10.0	1-2	NW	2	Road traffic noise (Spellow Lane, Walton Lane), distant sirens, birds, people walking past
Weekday Evening ST7	30/04/2018 20:09	10.0	2-4	NW	3	Road traffic noise (Walton Lane)
Weekday Evening ST8	30/04/2018 21:13	10.0	3-4	N	1	Road traffic noise (A505)
Weekday Evening ST9	30/04/2018 19:51	10.0	3-4	N	2	Road traffic noise (Walton Lane)
Weekday Evening ST10	30/04/2018 19:47	10.0	2-3	N	3	Road traffic noise (Priory Road)
Weekday Night						
Weekday Night ST1	01/05/2018 01:41	7.0	1-2	W	1	Occasional road traffic noise (Walton Lane)
Weekday Night ST2	01/05/2018 02:11	7.0	1-2	W	1	Occasional road traffic noise (Walton Lane)
Weekday Night ST3	01/05/2018 02:07	7.0	1-2	W	0	Road traffic noise (Walton Lane, City Road)
Weekday Night ST4	01/05/2018 02:19	7.0	1-3	NW	2	Occasional road traffic noise (Goodison Road)
Weekday Night ST5	01/05/2018 02:27	7.0	1-2	N	0	Road traffic noise (Walton Lane)
Weekday Night ST6	01/05/2018 02:53	7.0	1-2	W	1	Occasional road traffic noise (Walton Lane, Spellow Lane)
Weekday Night ST7	01/05/2018 01:59	7.0	0-2	NW	2	Road traffic noise (Walton Lane)
Weekday Night ST8	01/05/2018 02:51	7.0	0-1	NW	2	Road traffic noise

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Weekday Night ST9	01/05/2018 01:40	7.0	1-2	NW	0	Road traffic noise (Walton Lane)
Weekday Night ST10	01/05/2018 01:37	7.0	0-2	NW	2	Road traffic noise (Priory Road, Walton Lane)
Saturday Day						
Saturday Day ST1	21/04/2018 14:41	20.0	1-2	SE	1	Traffic noise along Walton Lane, bird noise from park, activity from people on park and walking past talking
Saturday Day ST2	21/04/2018 14:22	20.0	1-2	SE	1	Traffic noise from Walton Lane, occasional vehicle along Bullens Road, occasional people walking past talking, occasional bird noise, occasional distant plane
Saturday Day ST3	21/04/2018 14:21	20.0	0-1	SE	0	Road traffic noise (Walton Lane, Gwladys Street), aircraft, pedestrians
Saturday Day ST4	21/04/2018 14:40	20.0	1-2	SE	1	Road traffic noise (City Road), football
Saturday Day ST5	21/04/2018 14:57	20..0	1-2	SE	1	Road traffic noise (Goodison Road)
Saturday Day ST6	21/04/2018 15:13	20.0	1-2	SE	2	Road traffic noise (Spellow Lane)
Saturday Day ST7	21/04/2018 15:02	21.0	1-2	SE	2	Traffic noise from Walton Lane, bird noise, people occasionally walking past talking
Saturday Day ST8	21/04/2018 14:54	20.0	1-2	SE	1	Road traffic noise (Walton Lane, Priory Road), children in playground, pedestrians
Saturday Day ST9	21/04/2018 15:14	20.0	0-1	SE	1	Road traffic noise (Walton Lane)
Saturday Day ST10	21/04/2018 15:34	20.0	0-2	SE	2	Road traffic noise (Priory Road), birds
Saturday Day ST11	21/04/2018 14:54	21.0	1-2	SE	1	Road traffic noise (Walton, Lane, Priory Road), children in playground
Saturday Day ST12	21/04/2018 15:02	21.0	1-2	SE	2	Activity on park – people talking, children playing, bird noise, distant traffic noise
Saturday Evening						
Saturday Evening ST1	21/04/2018 21:41	18.0	0-1	SE	3	Traffic noise along Walton Lane, people occasionally walking past talking, occasional plane in distance
Saturday Evening ST2	21/04/2018 21:59	17.0	1-2	SE	3	Traffic noise from Walton Lane, occasional siren in distance, people occasionally walking past talking
Saturday Evening ST3	21/04/2018 22:00	17.0	0-1	SE	3	Road traffic noise (City Road, Gwladys Street)
Saturday Evening ST4	21/04/2018 20:39	17.0	0-1	SE	3	Traffic noise from Regent Road

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Saturday Evening ST5	21/04/2018 22:19	16.0	1-2	E	3	Road traffic noise (Walton Lane, Goodison Road), plant at stadium aircraft, noise from pub
Saturday Evening ST6	21/04/2018 22:20	17.0	1-2	SE	3	Traffic noise from Spellow Lane & Walton Lane, people occasionally walking past talking
Saturday Evening ST7	21/04/2018 22:24	17.0	0-1	E	3	Road traffic noise (Walton Lane)
Saturday Evening ST8	21/04/2018 22:39	16.0	1-2	E	3	Road traffic noise (A59)
Saturday Evening ST9	21/04/2018 21:41	16.0	0-1	SE	3	Road traffic noise (Walton Lane)
Saturday Evening ST10	21/04/2018 21:38	16.0	0-1	SE	3	Road traffic noise (Priory Road)
Saturday Night						
Saturday Night ST1	21/04/2018 23:08	16.0	1-2	E	4	Road traffic noise (Walton Lane), occasional siren
Saturday Night ST2	21/04/2018 23:26	16.0	1-2	E	4	Road traffic noise (Walton Lane), occasional siren
Saturday Night ST3	21/04/2018 23:26	16.0	1-2	E	3	Road traffic noise (Walton Lane, Gwladys Street)
Saturday Night ST4	21/04/2018 23:25	16.0	0-2	E	4	Distant road traffic noise (City Road, Goodison Road)
Saturday Night ST5	21/04/2018 23:48	16.0	1-2	E	3	Road traffic noise (Walton Lane, Goodison Road), stadium plant, pub noise
Saturday Night ST6	21/04/2018 23:50	16.0	1-2	E	4	Road traffic noise (Spellow Lane, Walton Lane), occasional person walking past
Saturday Night ST7	21/04/2018 23:52	16.0	0-1	E	4	Road traffic noise (Walton Lane)
Saturday Night ST8	22/04/2018 00:10	16.0	1-2	E	3	Road traffic noise (A59), pedestrians
Saturday Night ST9	21/04/2018 23:08	16.0	0-1	E	3	Road traffic noise (Walton Lane)
Saturday Night ST10	21/04/2018 22:24	16.0	0-1	E	3	Road traffic noise (Walton Lane)
Sunday Day						
Sunday Day ST1	22/04/2018 16:00	13.0	0-1	W	7	Road traffic noise (Walton Lane), birdsong
Sunday Day ST2	22/04/2018 16:00	13.0	0-1	W	8	Road traffic noise (Bullens Road, Walton Lane)
Sunday Day ST3	22/04/2018 15:35	13.0	0-1	W	8	Road traffic noise (Gwladys Street, Walton Lane)
Sunday Day ST4	22/04/2018 15:12	13.0	0-1	W	8	Road traffic noise (City Road, Goodison Road, Gwladys Street)
Sunday Day ST5	22/04/18 14:53	13.0	0-1	W	8	Road traffic noise (Goodison Road), distant plant

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Sunday Day ST6	22/04/2018 15:35	13.0	2-3	W	8	Road traffic noise (Spellow Lane, Walton Lane), pedestrians, noise from school
Sunday Day ST7	22/04/2018 15:16	13.0	1-2	W	8	Road traffic noise (Walton Lane), birdsong, aircraft, pedestrians
Sunday Day ST8	22/04/2018 15:56	13.0	2-3	W	7	Road traffic noise (A59), pedestrians
Sunday Day ST9	22/04/2018 15:22	13.0	1-2	W	8	Road traffic noise (Walton Lane), light rain
Sunday Day ST10	22/04/2018 15:40	13.0	1-2	W	8	Road traffic noise (Priory Road, Walton Lane), birdsong
Sunday Day ST11	22/04/2018 15:00	13.0	0-1	W	8	Road traffic noise (Walton Lane), birdsong
Sunday Day ST12	22/04/2018 14:55	13.0	2-3	W	7	Bird noise in park and traffic noise in distance
Sunday Evening						
Sunday Evening ST1	22/04/2018 21:44	12.0	0-1	SW	4	Road traffic noise (Walton Lane), aircraft, occasional siren, pedestrians
Sunday Evening ST2	22/04/2018 22:03	12.0	1-2	SW	4	Road traffic noise (Walton Lane), occasional aircraft
Sunday Evening ST3	22/04/2018 22:05	12.0	1-2	W	4	Road traffic noise (Walton Lane, Gwlady's Street), aircraft
Sunday Evening ST4	22/04/2018 22:01	12.0	2-3	SW	2	Road traffic noise (Gwladys Street, City Road, Goodison Road, Walton Lane, A59), stadium plant
Sunday Evening ST5	22/04/2018 22:24	12.0	1-2	W	4	Road traffic noise (Goodison Road, Walton Lane), distant plant noise
Sunday Evening ST6	22/04/2018 22:23	12.0	1-2	SW	4	Road traffic noise (Spellow Lane, Walton Lane), occasional aircraft, pedestrians
Sunday Evening ST7	22/04/2018 22:21	12.0	0-1	SW	4	Road traffic noise (Walton Lane)
Sunday Evening ST8	22/04/2018 22:42	12.0	1-2	SW	4	Road traffic noise (A59)
Sunday Evening ST9	22/04/2018 21:45	12.0	0-2	W	4	Road traffic noise (Walton Lane)
Sunday Evening ST10	22/04/2018 21:43	12.0	2-3	SW	3	Road traffic noise (Priory Road, Walton Lane), sporadic aircraft
Sunday Night						
Sunday Night ST1	22/04/2018 23:06	11.0	1-2	SW	6	Road traffic noise (Walton Lane), occasional aircraft
Sunday Night ST2	22/04/2018 23:23	11.0	2-3	W	7	Road traffic noise, birdsong, pedestrians, residential activity, aircraft
Sunday Night ST3	22/04/2018 23:24	11.0	0-1	W	6	Distant road traffic noise (Walton Lane, Gwladys Street)
Sunday Night ST4	22/04/2018 23:22	11.0	1-2	SW	7	Road traffic noise (Gwladys Street, Goodison Lane, City Road), stadium plant, distant road traffic noise (Walton Lane, A59)

Survey Location	Date & Time	Temperature (°C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
Sunday Night ST5	22/04/2018 23:43	11.0	1-3	W	6	Plant noise, road traffic noise (Walton Lane)
Sunday Night ST6	22/04/2018 23:49	11.0	2-3	SW	6	Occasional road traffic noise (Spellow Lane, Walton Lane), occasional siren, wind, pedestrians
Sunday Night ST7	22/04/2018 23:44	11.0	2-3	SW	7	Road traffic noise (Walton Lane), wind on trees
Sunday Night ST8	23/04/2018 00:01	11.0	1-2	W	6	Road traffic noise (A59)
Sunday Night ST9	22/04/2019 23:04	11.0	0-1	W	6	Road traffic noise on Walton Lane.
Sunday Night ST10	22/04/2018 23:02	11.0	0-1	SW	6	Road traffic noise (Priory Road, Walton Lane)

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2 x 10^{-5} Pa). For the long-term (LT) location, the presented $L_{Aeq,T}$ and $L_{A10,T}$ are average noise levels whilst the L_{A90} is the modal noise level of each 5 minute measurement over the stated survey period.

Table 5.3 Results of Baseline Noise Monitoring Survey (Average Levels)

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Weekday Day 07:00 - 23:00	112 Hours	20/04/2018 – 01/05/2018 07:00 - 23:00	LT1	69.9	97.7	41.2	72.9	61.0
Weekday Night 23:00 – 07:00	56 Hours	20/04/2018 – 01/05/2018 23:00 - 07:00		64.7	95.5	39.4	67.0	45.0
Weekend Day 07:00 - 23:00	64 Hours	20/04/2018 – 01/05/2018 07:00 - 23:00		68.8	99.2	38.4	72.3	56.0
Weekend Night 23:00 – 07:00	32 Hours	20/04/2018 – 01/05/2018 23:00 - 07:00		64.8	94.0	38.7	69.0	46.0
Weekday Day								
Weekday Day 07:00 - 19:00	15 Mins	30/04/2018 14:40	ST1	74.4	85.0	53.1	78.2	65.5
	15 Mins	30/04/2018 14:40	ST2	59.0	79.3	45.6	59.6	51.2
	15 Mins	30/04/2018 14:47	ST3	58.7	80.4	42.3	59.1	46.7
	15 Mins	30/04/2018 15:28	ST4	68.3	95.8	57.8	69.4	61.6
	15 Mins	30/04/2018 15:37	ST5	65.7	89.3	39.7	68.9	56.2
	15 Mins	30/04/2018 14:59	ST6	66.3	84.9	50.9	69.8	56.8
	15 Mins	30/04/2018 15:08	ST7	69.1	87.7	51.0	72.7	57.8
	15 Mins	30/04/2018 15:19	ST8	70.1	83.7	54.0	74.2	60.4
	15 Mins	30/04/2018 14:21	ST9	75.5	86.9	52.9	79.3	63.1
	15 Mins	30/04/2018 14:21	ST10	66.4	78.0	41.0	70.4	55.5
	15 Mins	30/04/2018 14:24	ST11	55.2	69.0	46.7	56.4	50.8

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
	15 Mins	30/04/2018 15:01	ST12	56.8	73.4	39.9	59.2	52.5
Weekday Evening 19:00-23:00	15 Mins	30/04/2018 19:50	ST1	73.1	84.6	49.1	77.1	57.4
	15 Mins	30/04/2018 20:15	ST2	55.5	74.7	43.7	59.4	46.3
	15 Mins	30/04/2018 20:08	ST3	56.8	76.8	39.2	55.5	42.2
	15 Mins	30/04/2018 20:30	ST4	61.5	77.6	42.8	66.1	46.0
	15 Mins	30/04/2018 20:28	ST5	63.4	88.7	47.5	67.2	49.4
	15 Mins	30/04/2018 20:36	ST6	62.3	77.2	43.0	66.1	49.1
	15 Mins	30/04/2018 20:09	ST7	69.1	85.8	46.3	73.0	52.9
	15 Mins	30/04/2018 20:47	ST8	70.2	87.1	50.3	74.1	56.7
	15 Mins	30/04/2018 19:51	ST9	74.6	90.1	52.5	79.0	61.5
	15 Mins	30/04/2018 19:48	ST10	66.4	88.3	46.7	70.3	53.6
Weekday Night 23.00 – 07.00	15 Mins	01/05/2018 01:41	ST1	63.1	82.7	42.6	66.3	45
	15 Mins	01/05/2018 02:11	ST2	48.4	65.2	39.4	49.2	44.2
	15 Mins	01/05/2018 01:40	ST3	46.1	71.4	32.7	42.4	34.7
	15 Mins	01/05/2018 02:29	ST4	53.2	72.6	39.5	53.0	41.4
	15 Mins	01/05/2018 02:27	ST5	56.0	76.4	46.6	56.1	48.3
	15 Mins	01/05/2018 02:53	ST6	54.5	73.3	39.0	54.8	41.7
	15 Mins	01/05/2018 01:58	ST7	62.5	82.4	37.4	66.6	40.2
	15 Mins	01/05/2018 02:51	ST8	62.0	78.6	38.7	65.9	42.9
	15 Mins	01/05/2018 02:07	ST9	64.1	87.5	35.9	64.4	40.3
	15 Mins	01/05/2018 01:37	ST10	57.9	76.3	38.1	61.4	40.5
Saturday								
Saturday Day 07:00 – 19:00	15 Mins	21/04/2018 14:41	ST1	73.2	83.6	45.9	77.3	57.9
	15 Mins	21/04/2018 14:22	ST2	57.3	75.0	44.4	59.8	49.4
	15 Mins	21/04/2018 14:21	ST3	54.9	78.3	41.1	52.1	44.8
	15 Mins	21/04/2018 14:40	ST4	60.6	75.4	43.6	64.8	49.1
	15 Mins	21/04/2018 14:57	ST5	62.5	77.6	48.4	66.5	51.8
	15 Mins	21/04/2018 15:13	ST6	64.4	78.6	48.4	68.6	54.6
	15 Mins	21/04/2018 15:02	ST7	68.5	78.0	48.5	72.4	57.5
	15 Mins	21/04/2018 14:21	ST8	69.1	82.1	53.8	72.8	59.9
	15 Mins	21/04/2018 15:14	ST9	75.4	86.6	46.5	80.1	57.9
	15 Mins	21/04/2018 15:34	ST10	63.7	78.2	43.2	68.1	48.2
	15 Mins	21/04/2018 14:54	ST11	48.4	68.0	39.8	49.6	43.6
	15 Mins	21/04/2018 15:24	ST12	55.6	80.6	42.0	53.6	45.1
Saturday Evening 19:00 – 23:00	15 Mins	21/04/2018 21:41	ST1	71.2	86.7	45.0	75.0	54
	15 Mins	21/04/2018 21:59	ST2	57.0	80.2	41.4	59.9	46.6
	15 Mins	21/04/2018 21:59	ST3	52.8	73.6	39.7	49.5	42.1
	15 Mins	21/04/2018 21:59	ST4	58.2	74.9	40.7	62.0	43.1
	15 Mins	21/04/2018 22:19	ST5	61.1	80.8	48.4	64.9	50.1
	15 Mins	21/04/2018 22:20	ST6	60.7	76.0	44.7	65.4	47.9
	15 Mins	21/04/2018 22:23	ST7	68.2	85.1	43.8	72.0	53.7
	15 Mins	21/04/2018 22:39	ST8	70.6	81.3	49.3	74.7	58.7
	15 Mins	21/04/2018 21:41	ST9	73.3	88.4	44.2	78.0	57.3
	15 Mins	21/04/2018 21:38	ST10	62.4	81.1	41.9	66.8	47.4

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{Amin,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Saturday Night 23:00-07:00	15 Mins	21/04/2018 23:08	ST1	68.9	83.8	41.3	73.5	48.8
	15 Mins	21/04/2018 23:26	ST2	55.4	72.2	41.3	58.7	45.9
	15 Mins	21/04/2018 23:26	ST3	54.2	79.3	40.2	54.7	42.7
	15 Mins	21/04/2018 23:26	ST4	58.6	80.2	41.6	61.0	44.1
	15 Mins	21/04/2018 23:48	ST5	59.9	80.4	48.2	61.7	50.2
	15 Mins	21/04/2018 23:50	ST6	61.1	76.3	39.9	65.1	47.1
	15 Mins	21/04/2018 23:51	ST7	66.0	84.8	42.1	69.8	48.6
	15 Mins	22/04/2018 00:10	ST8	69.7	80.5	49.4	73.9	59.0
	15 Mins	21/04/2018 23:08	ST9	76.3	106.0	41.2	77.0	52.6
	15 Mins	21/04/2018 23:06	ST10	61.6	77.1	39.5	66.3	43.9
Sunday								
Sunday Day 07:00 – 19:00	15 Mins	22/04/2018 16:00	ST1	76.0	88.0	47.5	80.0	61.6
	15 Mins	22/04/2018 16:00	ST2	60.6	81.3	42.8	60.7	49.1
	15 Mins	22/04/2018 15:35	ST3	57.0	76.2	40.3	55.6	44.3
	15 Mins	22/04/2018 15:12	ST4	64.2	82.0	44.4	68.5	48.7
	15 Mins	22/04/2018 14:53	ST5	66.4	80.8	48.1	71.3	51.6
	15 Mins	22/04/2018 15:35	ST6	66.5	82.4	40.3	70.4	53.5
	15 Mins	22/04/2018 15:16	ST7	69.6	81.3	40.0	73.0	56.6
	15 Mins	22/04/2018 15:56	ST8	75.0	99.8	40.4	76.7	58.1
	15 Mins	22/04/2018 15:22	ST9	77.4	96.8	55.1	81.2	64.8
	15 Mins	22/04/2018 15:40	ST10	68.6	80.0	48.7	72.9	55.2
	15 Mins	22/04/2018 15:00	ST11	52.8	67.6	44.8	54.1	48.5
	15 Mins	22/04/2018 14:55	ST12	51.6	65.8	46.5	53.2	48.9
Sunday Evening 19:00 – 23:00	15 Mins	22/04/2018 21:44	ST1	71.5	87.0	43.6	75.9	53.5
	15 Mins	22/04/2018 22:03	ST2	56.0	77.5	44.2	58.7	48.6
	15 Mins	22/04/2018 22:05	ST3	53.5	78.2	40.1	52.4	43.5
	15 Mins	22/04/2018 22:01	ST4	59.3	79.2	43.0	62.7	45.4
	15 Mins	22/04/2018 22:24	ST5	59.5	80.2	47.6	60.6	49.1
	15 Mins	22/04/2018 22:33	ST6	66.9	93.2	42.7	66.0	47.8
	15 Mins	22/04/2018 22:21	ST7	68.5	88.0	42.6	71.8	52.3
	15 Mins	22/04/2018 22:42	ST8	68.7	86.3	49.6	72.5	56.1
	15 Mins	22/04/2018 21:44	ST9	71.9	86.0	44.7	76.2	56.1
	15 Mins	22/04/2018 21:43	ST10	66.3	88.3	41.4	69.4	49.6
Sunday Night 23:00 – 07:00	15 Mins	22/04/2018 23:05	ST1	67.8	85.1	42.8	71.3	46.6
	15 Mins	22/04/2018 23:23	ST2	52.0	73.6	44.1	54.9	45.5
	15 Mins	22/04/2018 23:24	ST3	49.5	73.3	37.1	47.1	39.8
	15 Mins	22/04/2018 23:22	ST4	55.3	75.1	40.8	58.8	42.5
	15 Mins	22/04/2018 23:43	ST5	58.4	81.2	46.8	57.3	48.6
	15 Mins	22/04/2018 23:48	ST6	60.1	80.5	39.4	63.0	43.9
	15 Mins	22/04/2018 23:44	ST7	65.5	84.6	39.2	69.9	47.2
	15 Mins	23/04/2018 00:01	ST8	67.0	81.7	48.3	71.5	55.1
	15 Mins	22/04/2019 23:06	ST9	68.9	85.0	40.7	73.0	47.2
	15 Mins	22/04/2018 23:02	ST10	59.0	75.9	40.3	62.8	43.4

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

6.0 Assessment of Key Effects

6.1 Demolition & Construction Noise Assessment

Noise levels from potential construction activity associated with the proposed development of the application site have been assessed in accordance with BS 5228 criteria which indicates if a significant effect is likely to occur at noise sensitive properties.

This assessment has been undertaken in order to determine the maximum external noise levels at neighbouring properties for the proposed demolition and construction activities at the site and whether typical plant and activities and those detailed within the Construction Strategy ES chapter (Chapter 4, ES Volume II) will be within these levels. In order to present a worst-case assessment, the model assumes that all sources will be operating simultaneously across the application site. The assessment includes 2.4m solid hoarding around the site boundary, as detailed within the Construction Strategy ES chapter. The number of daily construction vehicle movements is expected to fluctuate throughout the construction phase, reaching the maximum figure during the latter half of the period. The maximum number of daily vehicle movements generated during the peak of the construction phase has been estimated by the Club to be 114 vehicle movements. To ensure a robust, worst case scenario has been considered, the relevant environmental assessments have assumed that 100 percent of the 114 maximum daily movements will be made by HGVs.

It should be noted that HGVs accessing the site during the demolition and construction phases will access the site via defined accesses off Goodison Road and Bullens Road where existing daily road traffic flows along Walton Road (which are in excess of 29,000) dominate the ambient noise climate. As such, there is expected to be a limited contribution from 114 HGV movements per day during the construction phase scenario that has been assessed.

The table below shows predicted levels of construction noise at noise sensitive properties for comparison with the BS 5228-1 recommended noise limit criteria of 75 dBA.

Table 6.1 Demolition & Construction Noise Assessment Results (Fixed Limits Method)

Ref	Description	Demolition Noise Level (dBA)	Construction Noise Level (dBA)	Criteria (dBA)	Within Fixed Noise Limit? (Demolition Phase)	Within Fixed Noise Limit? (Construction Phase)
R01	9 Goodison Road	70.9	65.5	75.0	Yes	Yes
R02	29a Goodison Road	72.0	63.7	75.0	Yes	Yes
R03	41 Goodison Road	68.1	64.5	75.0	Yes	Yes
R04	St Lukes C of E Church, Goodison Road	70.2	65.2	75.0	Yes	Yes
R05	21 Gwladys Street	71.8	65.7	75.0	Yes	Yes
R06	63a Gwladys Street	73.4	71.0	75.0	Yes	Yes
R07	105 Gwladys Street	64.5	62.0	75.0	Yes	Yes
R08	Gwladys Street Community Primary and Nursery School	70.1	69.9	75.0	Yes	Yes

Ref	Description	Demolition Noise Level (dBA)	Construction Noise Level (dBA)	Criteria (dBA)	Within Fixed Noise Limit? (Demolition Phase)	Within Fixed Noise Limit? (Construction Phase)
R09	2 Muriel Street	67.4	63.2	75.0	Yes	Yes
R10	1 Bullens Road	67.9	65.6	75.0	Yes	Yes
P01	Proposed Multi-Storey Flats, Walton Lane	70.8	69.2	75.0	Yes	Yes

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

The results indicate that the noise levels at the façades of the existing and proposed noise sensitive properties would be within the recommended criteria. Noise levels within the fixed limit criteria are likely to result in internal conditions where conversation would not be difficult.

It should be noted that there are expected to be certain phases during the demolition and construction works when the use of mobile plant and machinery in close proximity to existing dwellings surrounding the site (such as cranes, hoists etc.) may exceed the fixed noise limits. However, these events will be limited in number and duration and will adopt best practicable means (outlined in Appendix C) to reduce the impact of noise at nearby properties.

6.2 Construction Vibration Assessment

Calculation of vibration levels resulting from piling activities were carried out to determine at what distance there could be impact from potential piling activities; Figure 6.1 below shows the expected reduction in levels over distance from the works.

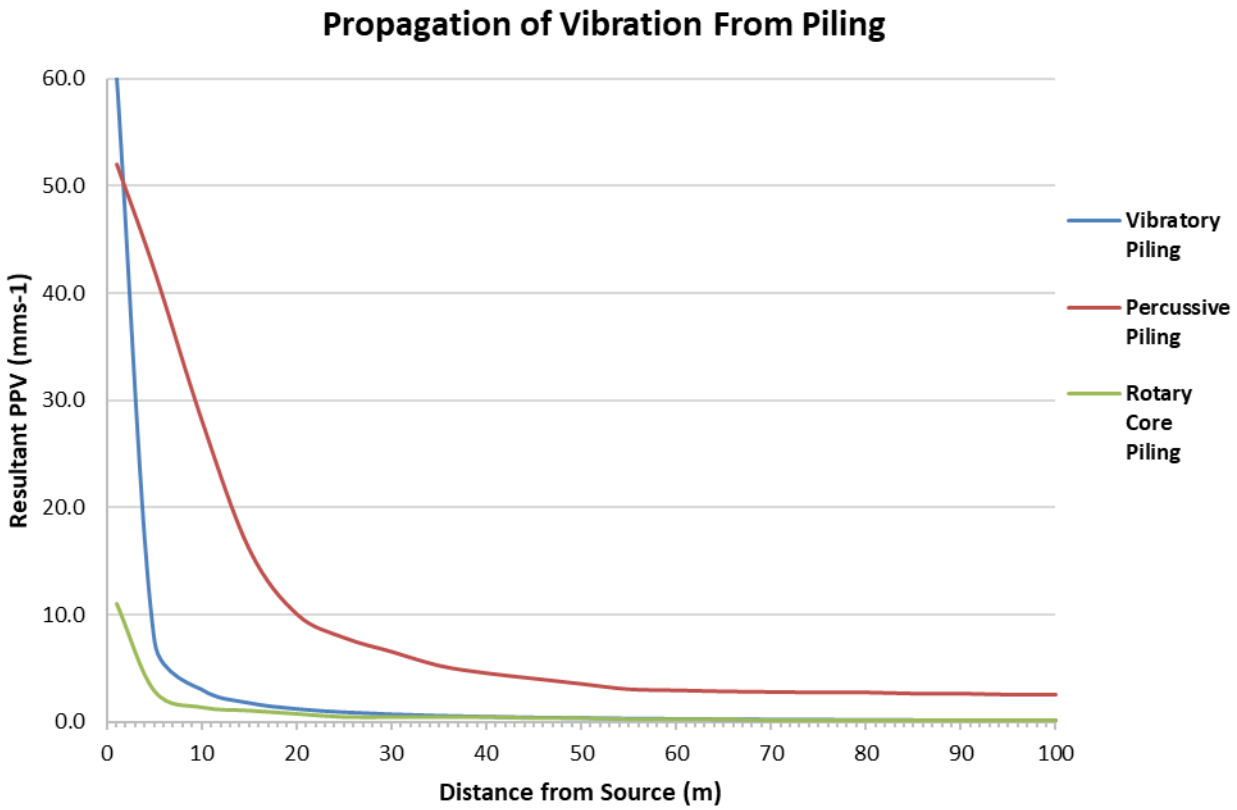


Figure 6.1 Graphical representation of the propagation of vibration from percussive piling

Comparison of the graph above with the criteria presented in Table 3.5, indicates that cosmetic damage to buildings is unlikely to occur beyond 14m. It should be noted that the graph above is representative of worst-case vibration associated with percussive piling activities, which are not proposed within the construction strategy by CBRE. Vibration associated with vibratory and auger piling typically reduces to less than 10mm/s at distances of less than 10m. Therefore, it is likely that vibration levels associated with the proposed construction activities will be lower at surrounding residential properties, which are all greater than 10m from the maximum extents of the proposed buildings.

There may be certain phases during the demolition and construction works when vibration-generating events/activities surrounding the site may be elevated. However, these events will be limited in number and duration and best practicable means will be adopted (outlined in Appendix C) to reduce the impact of vibration at nearby properties, including the implementation of vibration monitoring during demolition and construction works in proximity to off-site structures. In particular, the maximum extent of Plot E and Plot G are within 10m of St Luke the Evangelist Church, as such vibration-generating activities within 10m of the church associated with these blocks will be continuously monitored.

6.3 Cumulative Construction Noise Assessment

An assessment of the potential cumulative effects of construction noise has been undertaken, taking into account construction activity associated with the closest cumulative development (planning permission ref. 18F/1316) directly east of the development site on the assumption that both developments will be built out simultaneously.

Table 6.2 Cumulative Construction Noise Assessment Results (Fixed Limits Method)

Ref	Description	Construction Noise Level (dBA)	Criteria (dBA)	Within Fixed Noise Limit?
R01	9 Goodison Road	65.7	75.0	Yes
R02	29a Goodison Road	64.1	75.0	Yes
R03	41 Goodison Road	64.7	75.0	Yes
R04	St Lukes C of E Church, Goodison Road	65.3	75.0	Yes
R05	21 Gwladys Street	65.8	75.0	Yes
R06	63a Gwladys Street	71.0	75.0	Yes
R07	105 Gwladys Street	62.2	75.0	Yes
R08	Gwladys Street Community Primary and Nursery School	69.9	75.0	Yes
R09	2 Muriel Street	63.6	75.0	Yes
R10	1 Bullens Road	67.7	75.0	Yes

The results indicate that the cumulative noise levels at the façades of the existing noise sensitive properties would be within the recommended criteria. Noise levels within the fixed limit criteria are likely to result in internal conditions where conversation would not be difficult. Furthermore, although limited details regarding the proposed construction methodology of the adjacent site are available, it is expected that the development to the east will also adopt best practicable means to further reduce the impact of noise at nearby properties.

6.4 BS4142 Assessment (Building Services Plant)

This assessment has been undertaken to establish the maximum external noise emission levels from proposed plant associated with the development. The assessment compares the predicted worst-case breakout noise levels from potential plant with the existing measured average background noise L_{A90} at the closest existing residential receptors.

A series of predictions were made by defining different sound power levels at point sources. When the sound pressure levels are set as shown in Tables 6.3 (which are considered to be achievable), 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 Tables 6.4. All predicted rating noise levels fall within the Lowest Observed Adverse Effect Level; specific noise levels at proposed receptors are predicted to be below the measured background noise levels.

In accordance with section 9.2 of BS4142:2014+A1:2019 an overall +5 dB character correction has been applied to account for any tonal or intermittent characteristics of noise from the plant units which may be

just perceptible at the closest sensitive receptors. The worst-case assessment presented below considers the effects of 8 no. externally located items/areas of roof-mounted building services plant, placed in worst-case locations facing sensitive receptors, operating at full capacity, simultaneously. The locations of indicative worst-case, roof-mounted, building services plant is shown illustratively on SK02c of Appendix B.

Table 6.3 Proposed Emission Limits for BSP as Modelled

BSP Location	Noise Emission Limit - Sound Pressure Level	
	Daytime	Night-time
8 x Externally Located Sources	64.9 dB(A) at 1 m OR 55.3 dB(A) at 3 m	59.5 dB(A) at 1 m OR 49.9 dB(A) at 3 m

Table 6.4 BS4142 Assessment for Proposed Plant

Ref	Description	Measured Background L_{A90}		Rating level from plant		BS 4142 Score	
		Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	9 Goodison Road	52	49	32	28	-20	-21
R02	29a Goodison Road	52	49	34	30	-18	-19
R03	41 Goodison Road	52	49	38	34	-14	-15
R04	St Lukes C of E Church, Goodison Road	49	43	37	33	-12	-10
R05	21 Gwladys Street	49	43	36	33	-13	-10
R06	63a Gwladys Street	44	40	35	30	-10	-10
R07	105 Gwladys Street	44	40	28	24	-16	-17
R08	Gwladys Street Community Primary and Nursery School	44	40	32	28	-12	-12
R09	2 Muriel Street	49	46	31	26	-18	-20
R10	1 Bullens Road	49	46	35	31	-14	-15
P01	Proposed Multi-Storey Flats, Walton Lane	49	46	34	28	-15	-18

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

6.5 Internal Noise Level Noise Assessment

An assessment of overall noise intrusion levels has been undertaken with respect to the proposed sensitive receptors within the development. Internal noise levels 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 an assumption of glazing with specification $R_w + C_{tr}$ 33 dB has been used.

Noise intrusion levels have been determined using road traffic noise levels for 2032 (base + cumulative development + proposed development) which is considered to represent a worst-case scenario as it incorporates traffic from cumulative sites surrounding the proposed development as well as traffic associated with the proposed development site itself. The following calculations have been used to determine the daytime L_{Aeq} and night-time L_{Night} noise levels.

- Daytime L_{Aeq}

  $L_{Aeq(16\text{-hour})} = L_{A10(18\text{-hour})} - 2$ dB
- Night-time L_{Aeq}

  $L_{night} = 0.90L_{A10(18\text{-hour})} - 3.77$ dB

The results presented in tables 6.5-6.7 below show the predicted noise intrusion levels at sensitive spaces across the site. The recommended WHO/BS 8233 internal noise levels are met at nearly all receptors across the site during the daytime and night-time assuming a windows-closed scenario, with the exception of receptors adjacent to Walton Lane. In order to achieve the internal noise criteria, a range of mitigation measures are outline in Section 7.0 of this report, with SK07 in Appendix B showing the glazing and ventilation which will feature on façades of the proposed development.

Table 6.5 Daytime Noise Intrusion Levels $L_{Aeq,16hour}$

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
PR1	53.6	43.6	20.6	35
PR2	63.4	53.4	30.4	35
PR3	55.9	45.9	22.9	35
PR4	42.3	32.3	9.3	35
PR5	46.2	36.2	13.2	35
PR6	53.6	43.6	20.6	35
PR7	60.5	50.5	27.5	35
PR8	53.9	43.9	20.9	35
PR9	52.0	42.0	19.0	35
PR10	36.1	26.1	3.1	35
PR11	50.9	40.9	17.9	35
PR12	57.1	47.1	24.1	45
PR13	64.1	54.1	31.1	45
PR14	65.7	55.7	32.7	45
PR15	69.7	59.7	36.7	45
PR16	61.4	51.4	28.4	45
PR17	53.0	43.0	20.0	35
PR18	36.6	26.6	3.6	35
PR19	62.9	52.9	29.9	35
PR20	69.7	59.7	36.7	35
PR21	65.7	55.7	32.7	35
PR22	55.4	45.4	22.4	35
PR23	59.8	49.8	26.8	35
PR24	61.9	51.9	28.9	35
PR25	53.5	43.5	20.5	35
PR26	36.2	26.2	3.2	35
PR27	56.5	46.5	23.5	35
PR28	59.5	49.5	26.5	35
PR29	54.5	44.5	21.5	35
PR30	40.3	30.3	7.3	35
PR31	52.3	42.3	19.3	35
PR32	58.5	48.5	25.5	35
PR33	60.6	50.6	27.6	35
PR34	53.8	43.8	20.8	35

Table 6.6 Night-time Noise Intrusion Levels $L_{Aeq,8hour}$

Location	External L_{Aeq} at 1m from facade	Internal L_{Aeq} with windows open	Internal L_{Aeq} with windows closed	Criteria Internal L_{Aeq}
PR1	46.3	36.3	13.3	30
PR2	55.1	45.1	22.1	30
PR3	48.3	38.3	15.3	30
PR4	36.1	26.1	3.1	30
PR5	39.6	29.6	6.6	30
PR6	46.3	36.3	13.3	30
PR7	52.5	42.5	19.5	30
PR8	46.5	36.5	13.5	30
PR9	44.8	34.8	11.8	30
PR10	30.5	20.5	0.0	30
PR11	43.8	33.8	10.8	30
PR12	n/a			
PR13				
PR14				
PR15				
PR16				
PR17	45.7	35.7	12.7	30
PR18	31.0	21.0	0.0	30
PR19	54.6	44.6	21.6	30
PR20	60.8	50.8	27.8	30
PR21	57.2	47.2	24.2	30
PR22	47.9	37.9	14.9	30
PR23	51.9	41.9	18.9	30
PR24	53.7	43.7	20.7	30
PR25	46.2	36.2	13.2	30
PR26	30.6	20.6	0.0	30
PR27	n/a			
PR28				
PR29				
PR30				
PR31	45.1	35.1	12.1	30
PR32	50.7	40.7	17.7	30
PR33	52.6	42.6	19.6	30
PR34	46.5	36.5	13.5	30

Table 6.7 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}
PR1	64.4	54.4	31.4	45
PR2	74.6	64.6	41.6	45
PR3	67.1	57.1	34.1	45
PR4	52.1	42.1	19.1	45
PR5	57.2	47.2	24.2	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}
PR6	64.8	54.8	31.8	45
PR7	71.5	61.5	38.5	45
PR8	65.2	55.2	32.2	45
PR9	63.4	53.4	30.4	45
PR10	47.6	37.6	14.6	45
PR11	62.3	52.3	29.3	45
PR12	n/a			
PR13				
PR14				
PR15				
PR16				
PR17	65.0	55.0	32.0	45
PR18	48.2	38.2	15.2	45
PR19	75.0	65.0	42.0	45
PR20	81.7	71.7	48.7	45
PR21	77.2	67.2	44.2	45
PR22	65.8	55.8	32.8	45
PR23	71.2	61.2	38.2	45
PR24	71.9	61.9	38.9	45
PR25	57.5	47.5	24.5	45
PR26	47.3	37.3	14.3	45
PR27	n/a			
PR28				
PR29				
PR30				
PR31	55.1	45.1	22.1	45
PR32	61.7	51.7	28.7	45
PR33	68.1	58.1	35.1	45
PR34	61.2	51.2	28.2	45

Proposed D1 Use – Potential Educational Spaces (Plot F)

Internal noise levels within the proposed indicative educational spaces 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 an assumption of glazing with specification R_w + C_{tr} 33 dB has been used. The noise levels show that internal noise criteria outlined within BB93 is exceeded assuming a windows-open scenario. Therefore, mitigation is outlined with Section 7.0 of this report.

Proposed B1 Use – Potential Employment Spaces (Plot A)

Internal noise levels within the proposed indicative employment spaces 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 an assumption of glazing with specification R_w + C_{tr} 33 dB has been used. The noise levels show

that internal noise criteria outlined within BS 8233 is exceeded on a number of façades assuming a windows-open scenario. Therefore, mitigation is outlined with Section 7.0 of this report.

6.6 External Amenity Area Assessment

At this outline stage, the locations of any proposed balconies/amenity spaces is unknown, therefore external noise levels within the proposed communal external amenity space have been assessed. The results of the assessment show that noise levels within communal space are not predicted to exceed the BS 8233 Lower Guideline value of 50 dB, shown in Table 6.8 below, therefore all future occupiers of the development will have access to relatively sheltered external space within 5 minutes' walk, as well as access to existing tranquil areas within Stanley Park.

Table 6.8 Communal External Amenity Area Noise Levels

Location	External $L_{Aeq,16hr}$ Daytime Noise Levels	BS 8233 Lower Guideline Criteria L_{Aeq}
G01	44.7	50.0

6.7 Tranquillity Rating

An assessment of the existing tranquillity level of the application 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). By reference to these maps the development is assessed as falling into Zone 1 and is not considered to be an area of particularly high tranquillity value, therefore it is considered that any effect on tranquillity of the area would be negligible.

However, it should be noted that the proposals will also incorporate shared public recreation spaces within the development site that are sheltered from nearby road traffic noise sources and will incorporate pedestrian linkages. As such, it is considered that access to local areas of tranquillity (such as the adjacent Stanley Park) will be maintained with additional areas created by the development.

6.8 Traffic Assessment

Traffic data provided by Mott MacDonald have been used to determine the change in average road traffic noise levels as a result of the scheme; the assessment below compares the different scenarios presented to determine the change in noise levels resulting from both the scheme in the opening year 2028 (based on worst-case traffic flows) and in a future assessment year 2032 (also based on worst-case traffic flows). Reference is also given to the change in noise level that occurs from the change in traffic flows through general growth in traffic without the scheme; it should be noted that the 'without' development assessment assumes a non-matchday scenario.

A short-term traffic assessment compares 'with' and 'without' development scenarios in the opening year, whilst a long-term assessment compares 'with' and 'without' development scenarios from separate years (typically over a 10-15 year period).

Tables 6.9 – 6.11 below detail both short-term change in noise levels, with comparisons between the 2028 scenario 'with' and 'without' development and the 2032 'with' and 'without' development scenarios, as well as long-term change in noise levels, with a comparison between the 2028 'without' development scenario and the 2032 'with' development scenario.

Table 6.9 Difference between the 'with' and 'without' development 2028 scenario (short-term)

Location	Description	Traffic Noise Without Development 2028 ($L_{A10,18hr}$ dB(A))	Traffic Noise With Development 2028 ($L_{A10,18hr}$ dB(A))	Difference
TR01	161 Walton Lane	69.1	69.4	0.3
TR02	56a Spellow Lane	68.0	68.1	0.1
TR03	Spellow Lane Church, Spellow Lane	68.1	68.3	0.2
TR04	9 Goodison Road	66.3	66.7	0.4
TR05	37 Goodison Road	64.5	65.8	1.3
TR06	59 Andrew Street	56.8	56.9	0.1
TR07	41 Nimrod Street	54.5	56.5	2.0
TR08	71 Goodison Road	58.4	59.2	0.8
TR09	1 Frodsham Street	55.8	56.3	0.5
TR10	77a City Road	62.6	62.9	0.3
TR11	20 City Road	60.9	61.3	0.4
TR12	61a Gwladys Street	59.8	62.7	2.9
TR13	1 Bullens Road	59.5	62.3	2.8
TR14	267 Walton Lane	71.5	71.8	0.3
TR15	293 Walton Lane	71.6	71.9	0.3
TR16	333 Walton Lane	71.5	71.8	0.3

Table 6.10 Difference between the 'with' and 'without' development 2032 scenario (short-term)

Location	Description	Traffic Noise Without Development 2032 ($L_{A10,18hr}$ dB(A))	Traffic Noise With Development 2032 ($L_{A10,18hr}$ dB(A))	Difference
TR01	161 Walton Lane	69.3	69.5	0.2
TR02	56a Spellow Lane	68.2	68.2	0.0
TR03	Spellow Lane Church, Spellow Lane	68.3	68.5	0.2
TR04	9 Goodison Road	66.5	66.8	0.3
TR05	37 Goodison Road	64.7	65.9	1.2
TR06	59 Andrew Street	57.1	57.2	0.1
TR07	41 Nimrod Street	54.6	56.6	2.0
TR08	71 Goodison Road	58.5	59.4	0.9
TR09	1 Frodsham Street	56.0	56.5	0.5
TR10	77a City Road	62.8	63.1	0.3
TR11	20 City Road	61.1	61.4	0.3

Location	Description	Traffic Noise Without Development 2032 ($L_{A10,18hr}$ dB(A))	Traffic Noise With Development 2032 ($L_{A10,18hr}$ dB(A))	Difference
TR12	61a Gwladys Street	60.0	62.7	2.7
TR13	1 Bullens Road	59.6	62.4	2.8
TR14	267 Walton Lane	71.7	71.9	0.2
TR15	293 Walton Lane	71.8	72.0	0.2
TR16	333 Walton Lane	71.7	71.9	0.2

Table 6.11 Difference between the 'without' development 2028 scenario and the future 'with' 2032 scenario (long-term)

Location	Description	Traffic Noise Without Development 2028 ($L_{A10,18hr}$ dB(A))	Traffic Noise With Development 2032 ($L_{A10,18hr}$ dB(A))	Difference
TR01	161 Walton Lane	69.1	69.5	0.4
TR02	56a Spellow Lane	68.0	68.2	0.2
TR03	Spellow Lane Church, Spellow Lane	68.1	68.5	0.4
TR04	9 Goodison Road	66.3	66.8	0.5
TR05	37 Goodison Road	64.5	65.9	1.4
TR06	59 Andrew Street	56.8	57.2	0.4
TR07	41 Nimrod Street	54.5	56.6	2.1
TR08	71 Goodison Road	58.4	59.4	1.0
TR09	1 Frodsham Street	55.8	56.5	0.7
TR10	77a City Road	62.6	63.1	0.5
TR11	20 City Road	60.9	61.4	0.5
TR12	61a Gwladys Street	59.8	62.7	2.9
TR13	1 Bullens Road	59.5	62.4	2.9
TR14	267 Walton Lane	71.5	71.9	0.4
TR15	293 Walton Lane	71.6	72.0	0.4
TR16	333 Walton Lane	71.5	71.9	0.4

The results of the short-term assessments presented in Tables 6.9 and 6.10 indicate that the road traffic noise level changes at representative receptors following the implementation of the scheme would be no greater than 2.9 dB which is considered to be 'Minor' when compared to the short-term criteria outlined within Table 3.2.

The results of the long-term assessment shown in Table 6.11 indicate that at representative receptors as a result of the implementation of the scheme, there would be a change in noise level of up to 2.9 dB and is considered to be 'Negligible' when compared to the long-term criteria outlined in Table 3.2.

Therefore, the overall change in road traffic noise levels is considered to be within or below the Lowest Observed Adverse Effect Level at all sensitive receptors.

7.0 Acoustic Design Statement (Mitigation)

The mitigation measures below are sufficient to reduce the effects of noise from the surrounding environment by helping to prevent noise levels exceeding BS 8233 internal noise level criteria for L_{Aeq} and L_{Amax} within all residential spaces of the proposed development.

An outline glazing and ventilation strategy has been designed to achieve internal daytime L_{Aeq} of 35 dB, an internal night-time L_{Aeq} of 30 dB and an internal night-time L_{Amax} of 45 dB in habitable rooms of the proposed development.

Residential spaces on façades which are exposed to Walton Lane to the south of the site will feature enhanced glazing with a specification of $R_w + C_{tr}$ 37 dB and an alternative means of ventilation which matches the performance of this glazing. This can be provided in several ways from acoustic trickle vents (which need to have a minimum sound reduction equal to or greater than the glazing) to other passive and mechanical ventilation systems. All other façades will feature standard double glazing with a sound reduction of up to $R_w + C_{tr}$ 33 dB. Alternative ventilation will be required for façades adjacent to the surrounding road network. The full glazing and ventilation strategy is shown illustratively on SK07 of Appendix B.

Proposed D1 Use – Potential Educational Spaces (Plot F)

Internal noise levels within the proposed indicative educational spaces are expected to meet the requirements of BB 93 assuming a windows-closed scenario, featuring standard double glazing with a sound reduction of $R_w + C_{tr}$ 33 dB. Façades adjacent to the road network will require an alternative means of ventilation which can be provided in several ways from acoustic trickle vents (which need to have a minimum sound reduction equal to or greater than the glazing) to other passive and mechanical ventilation systems.

Proposed B1 Use – Potential Employment Spaces (Plot A)

Internal noise levels within proposed indicative employment spaces are expected to meet the requirements of BS 8233 assuming a windows-closed scenario, featuring standard double glazing with a sound reduction of $R_w + C_{tr}$ 33 dB. Façades adjacent to the road network will require an alternative means of ventilation which can be provided in several ways from acoustic trickle vents (which need to have a minimum sound reduction equal to or greater than the glazing) to other passive and mechanical ventilation systems.

8.0 Conclusions of Noise Assessment

This report presents the findings of an updated noise and vibration assessment undertaken to support an outline planning application for a mixed-use development at Goodison Park, Goodison Road, Liverpool on behalf of Everton Stadium Development Ltd (application reference 20O/0997). The NPPF (Section 180) raises two considerations relating to noise; considering these the following conclusions can be drawn:

Sections 170 (e), 180 (a & b), 182 and 183 of the NPPF provide test points relating to noise, considering each of these points, the following conclusions can be drawn in relation to the proposed development operations:

- During the demolition and construction phases of the proposed development, typical noise levels at existing and proposed noise sensitive properties would be within the BS 5228 fixed limit criteria. Assessments of the increase in road traffic noise as a result of the proposed development have shown that noise levels at nearby existing sensitive receptors are predicted to fall within and below the Lowest Observed Adverse Effect Level.
- Noise intrusion assessments have shown that L_{Aeq} and L_{Amax} noise levels are predicted to be within the BS 8233/WHO criteria at nearly all proposed receptor locations assuming a windows-closed scenario with standard double glazing featuring a sound reduction of $R_w + C_{tr}$ 33 dB. Façades adjacent to Walton Lane will feature enhanced glazing with a sound reduction of $R_w + C_{tr}$ 37 dB. Alternative ventilation will be required across a number of façades exposed to the adjacent road network.
- Given the low tranquillity value of the site, the proposed development is not expected to adversely affect the tranquillity of the area and will introduce publicly accessible recreation areas whilst maintaining access to other nearby areas of tranquillity.

Therefore, it is considered that the proposals will not have a 'significant adverse impact' on health or quality of life and are compliant with the provisions of the statutory development plan (Liverpool UDP) and the National Planning Policy Framework (NPPF). There are no noise-related matters which would preclude positive determination of the planning application.

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

WYGE – WYG Environment

Appendix B – Sketches

SK01 Noise Monitoring Locations

SK02a Proposed Sensitive Receptor Locations and Site Layout

SK02b Proposed External Amenity Receptor Locations

SK02c Closest Existing Sensitive Receptor Locations and Proposed Indicative BSP Locations

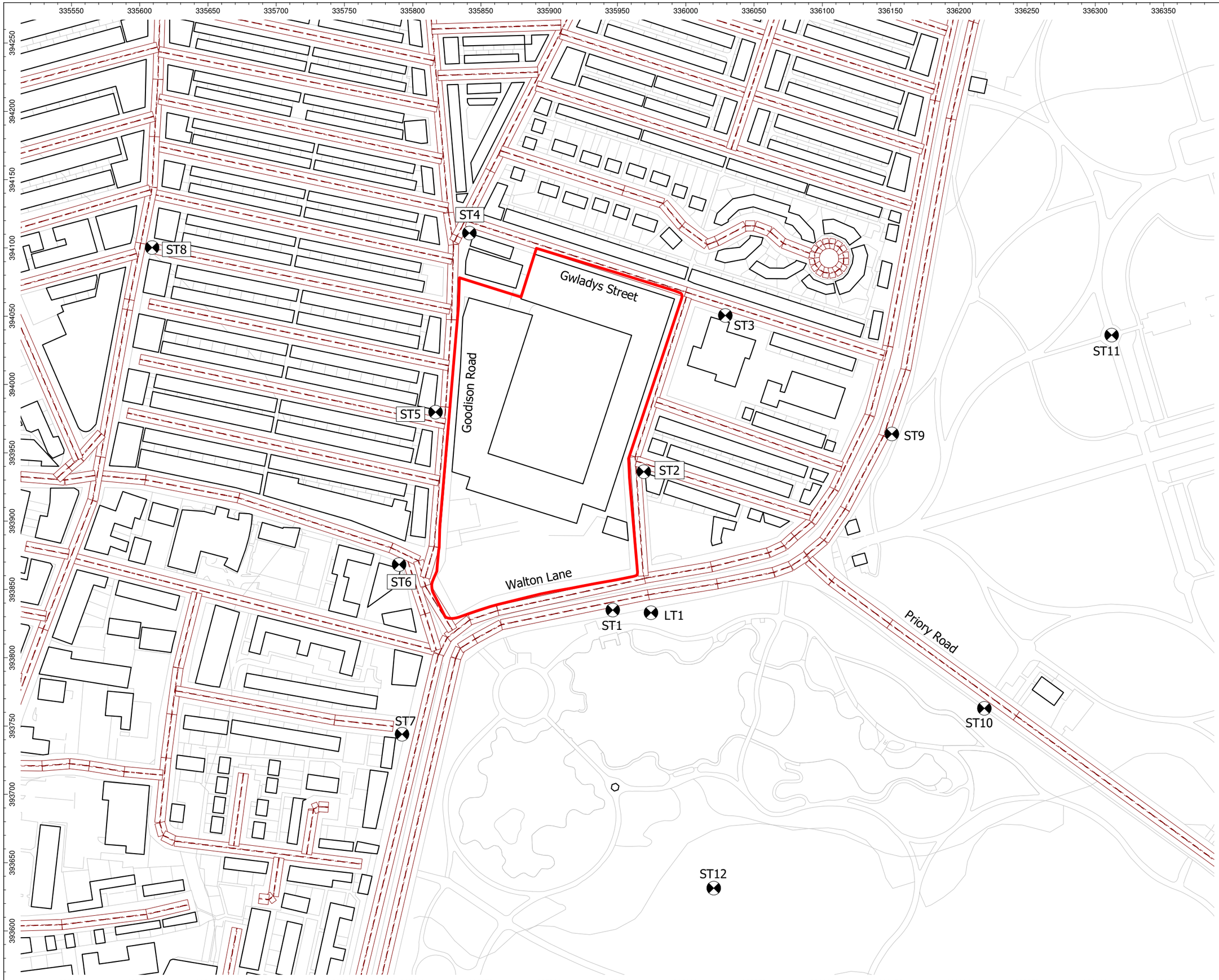
SK02d Existing Sensitive Traffic Receptor Locations

SK03 Do Minimum $L_{A10,18hr}$ Noise Contours (2028)

SK04 Do Something $L_{A10,18hr}$ Noise Contours (2032)

SK05 Do Minimum 2028 / Do Something 2032 Noise Level Difference Contours

SK06 Glazing and Ventilation Strategy



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Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Noise Monitoring Locations

Drawing Number:
SK01

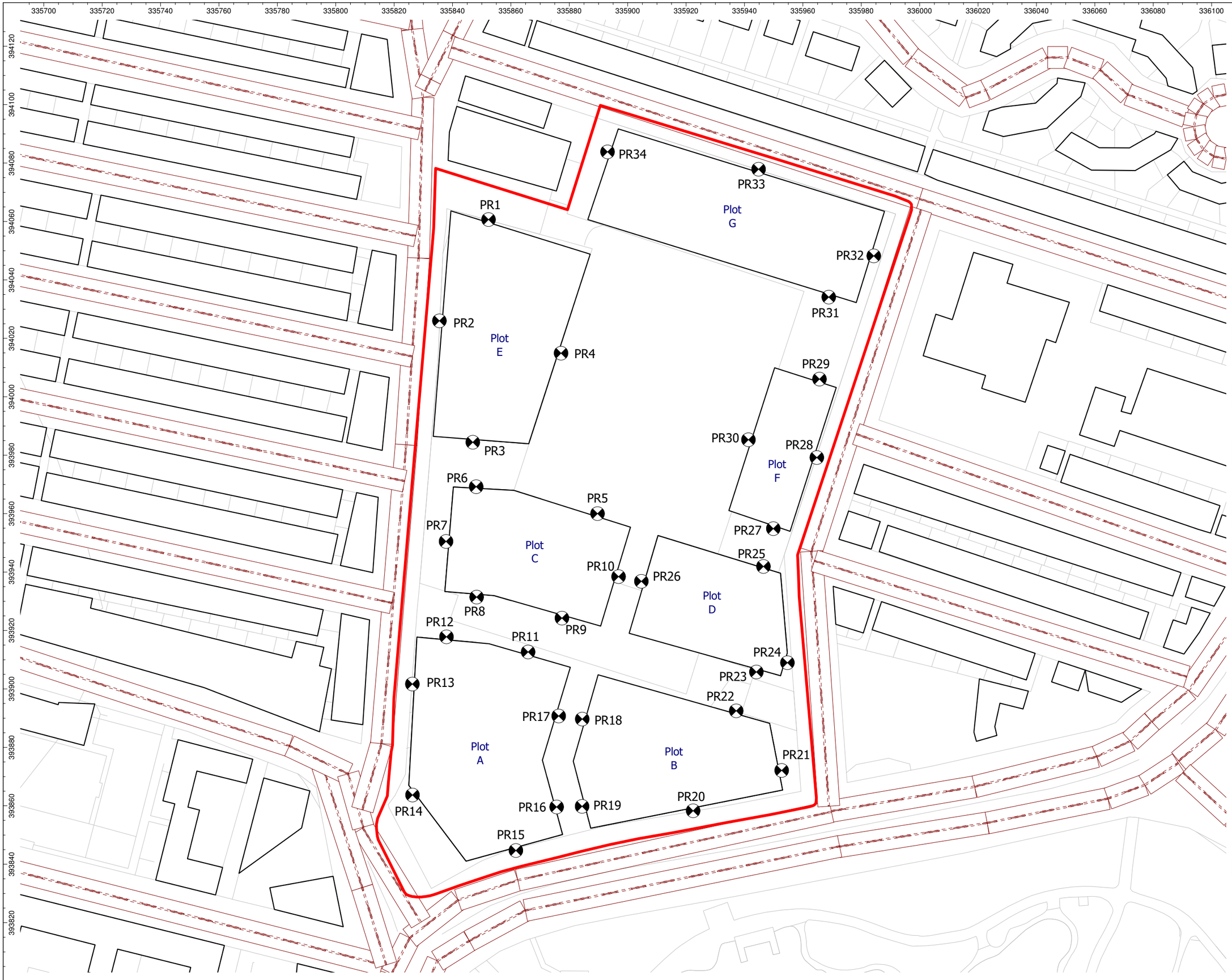
Key:

Site Boundary:

Scale : Not to scale

WYGE Leicester 30.11.20

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Proposed Sensitive Receptor Locations and Site Layout

Drawing Number:
SK02a

Key:

Site Boundary:

Scale : Not to scale

WYGE Leicester 30.11.20

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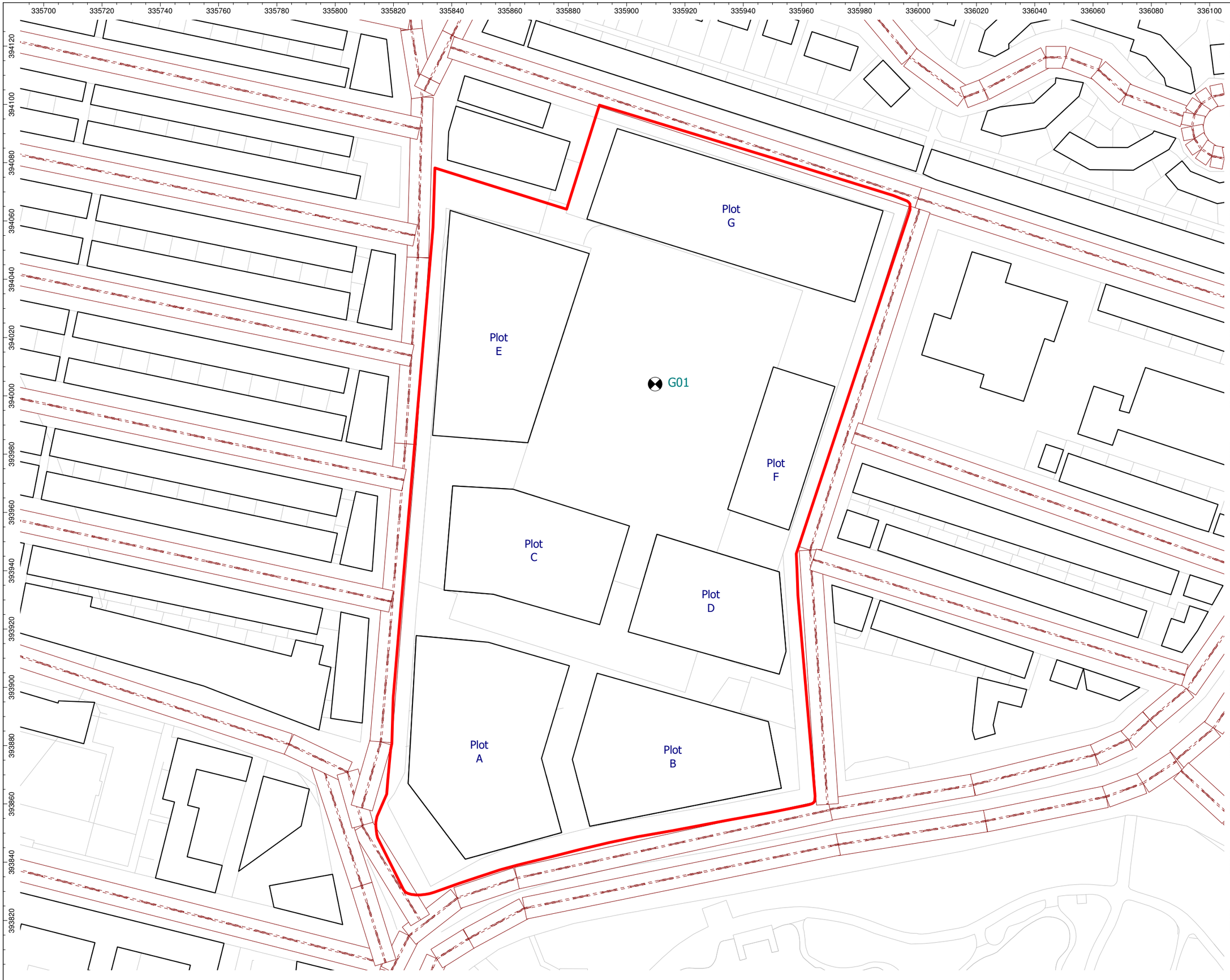
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Proposed Amenity Sensitive Receptor Locations

Drawing Number:
SK02b

Key:

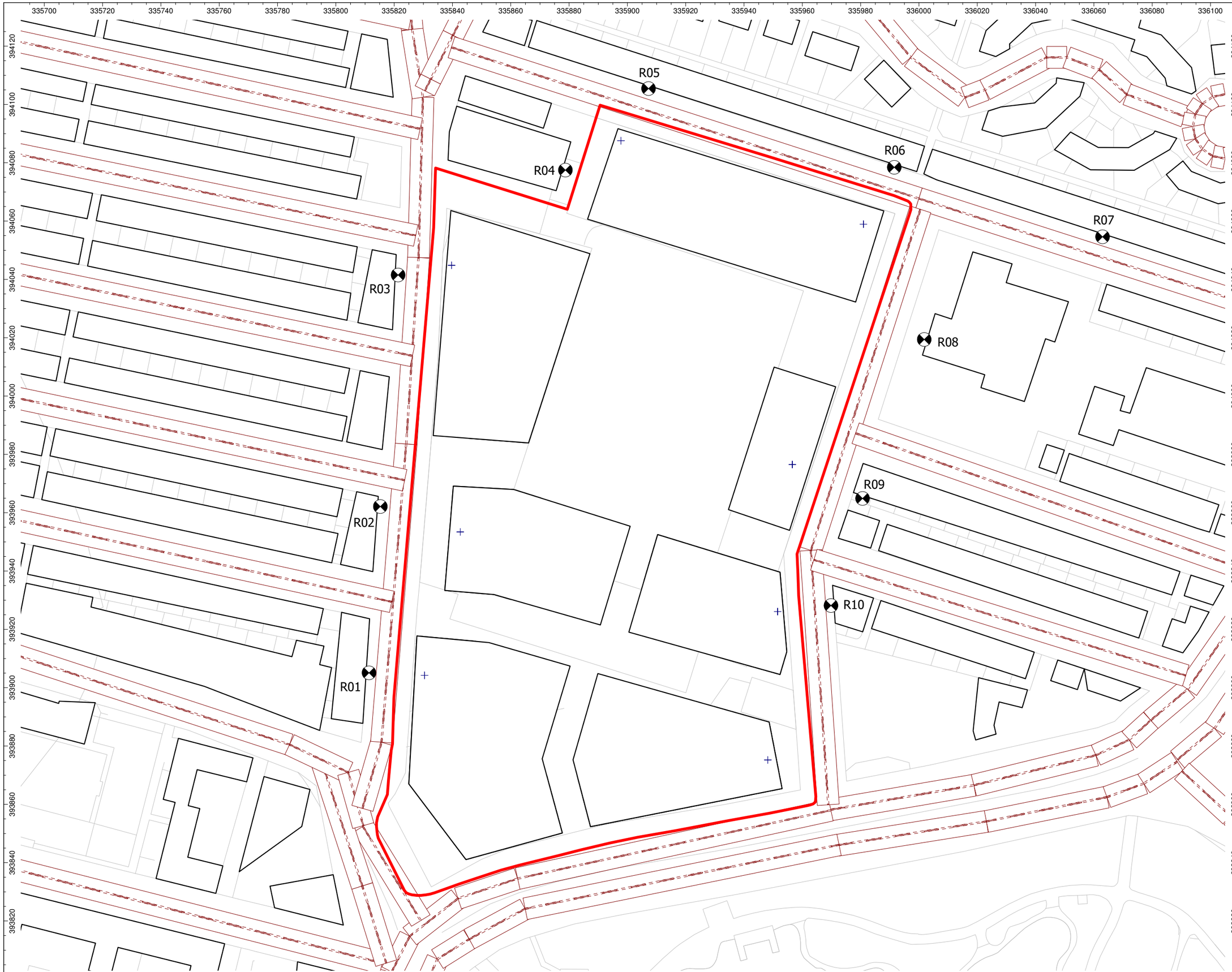
Site Boundary:

Scale : Not to scale

WYGE Leicester 30.11.20

Licence Number AL 553611

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Closest Existing Sensitive Receptor Locations and Proposed Indicative Plant Locations

Drawing Number:
SK02c

Key:

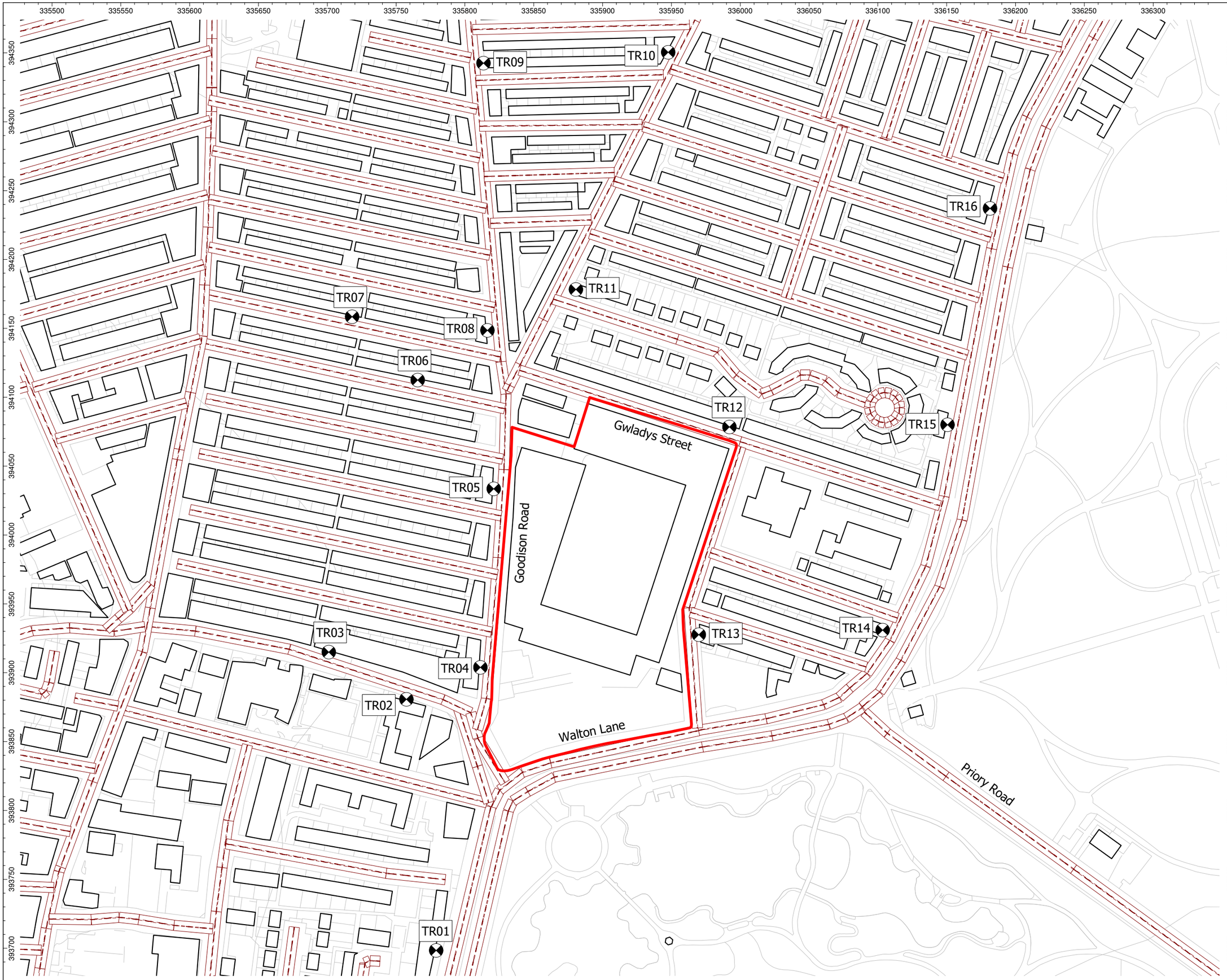
Site Boundary:

Indicative Roof-Mounted Plant Locations:

Scale : Not to scale

WYGE Leicester 30.11.20

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Existing Sensitive Traffic Receptor Locations

Drawing Number:
SK02d

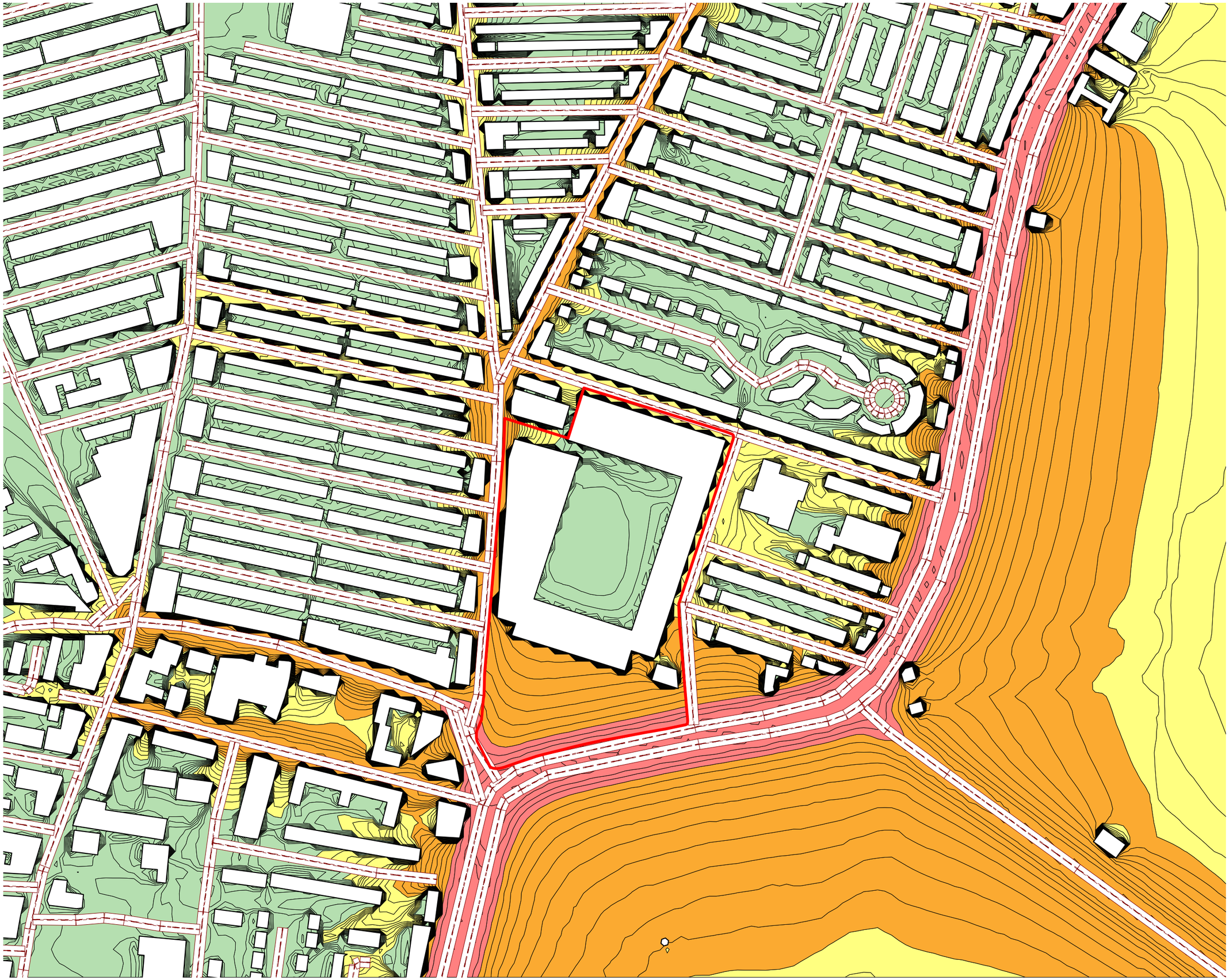
Key:

Site Boundary:

Scale : Not to scale

WYGE Leicester 30.11.20

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Do Minimum LA10,18hr Noise Contours (2028)

Drawing Number:
SK03

Key:

Site Boundary:

- 0.0 - 50.0 dB
- 50.0 - 60.0 dB
- 60.0 - 70.0 dB
- > 70.0 dB

Scale : Not to scale

WYGE Leicester 30.11.20

Licence Number AL 553611

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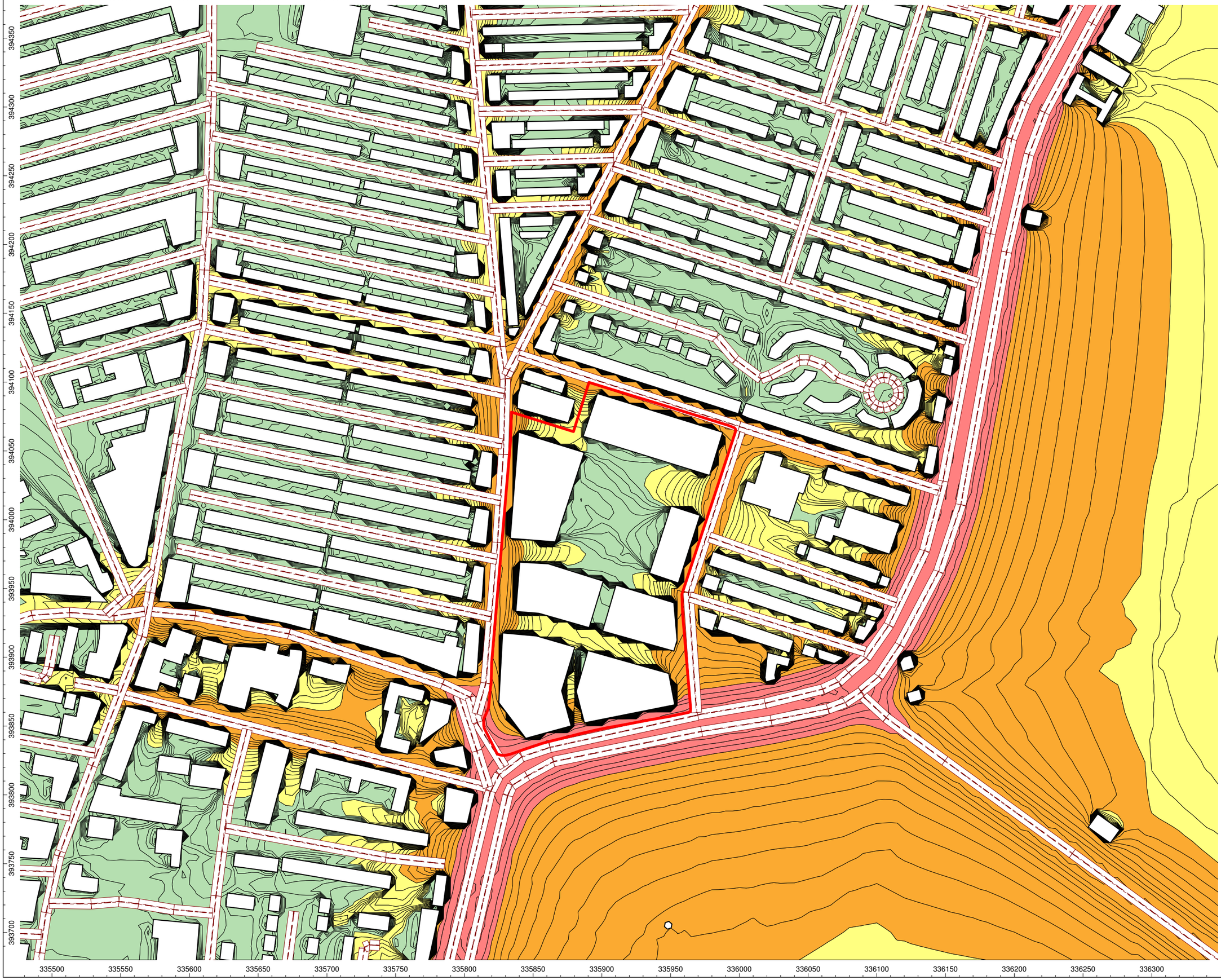
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Do Something LA10,18hr Noise Contours (2032)

Drawing Number:
SK04

Key:

Site Boundary:

- 0.0 - 50.0 dB
- 50.0 - 60.0 dB
- 60.0 - 70.0 dB
- > 70.0 dB

Scale : Not to scale

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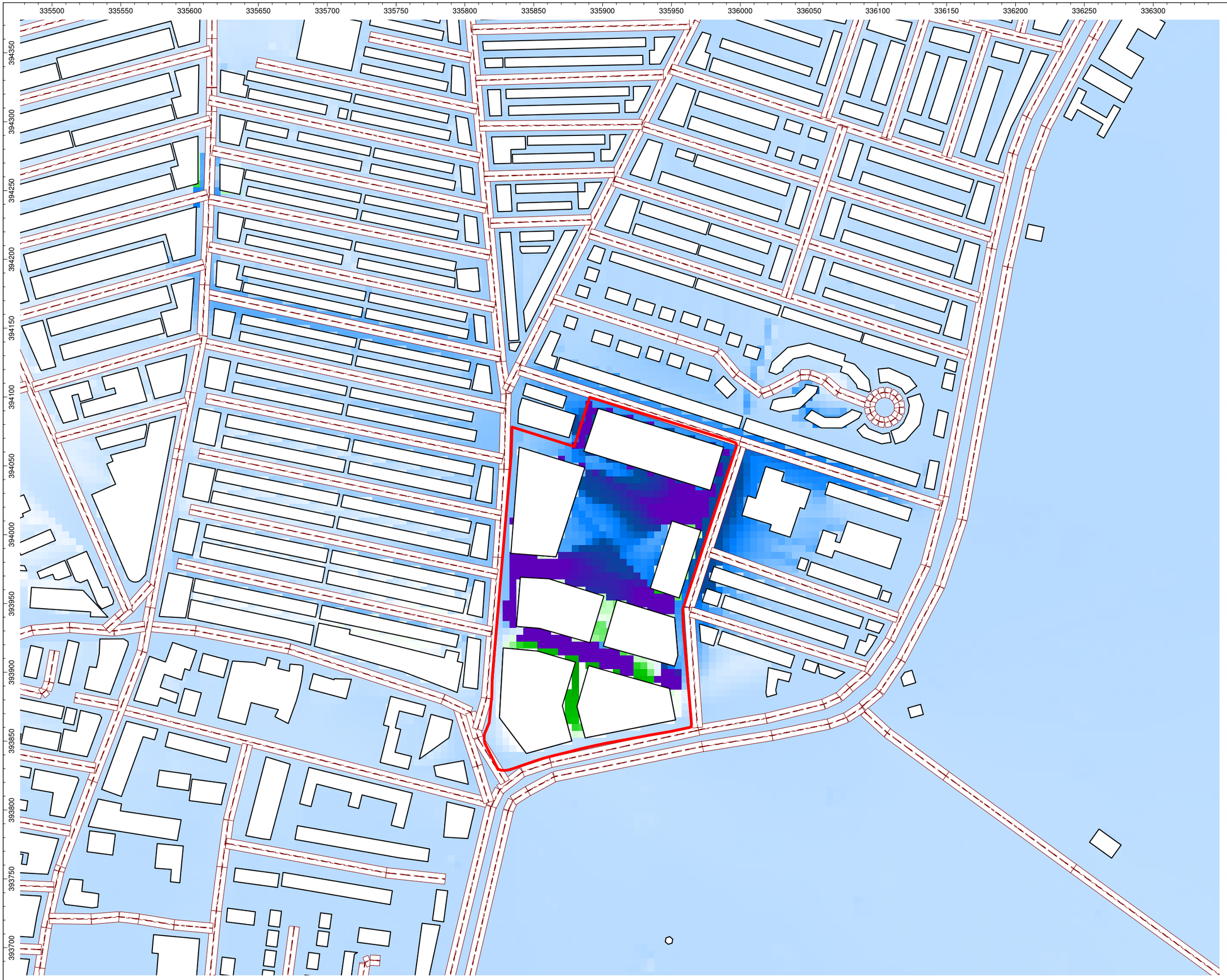
Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Do Minimum 2028 / Do Something 2032 Noise Level Difference Contours

Drawing Number:
SK05

Key:

Site Boundary:

- >= -10
- >= -5
- >= -3
- >= -1
- >= 4
- >= 5
- >= 10

Scale : Not to scale

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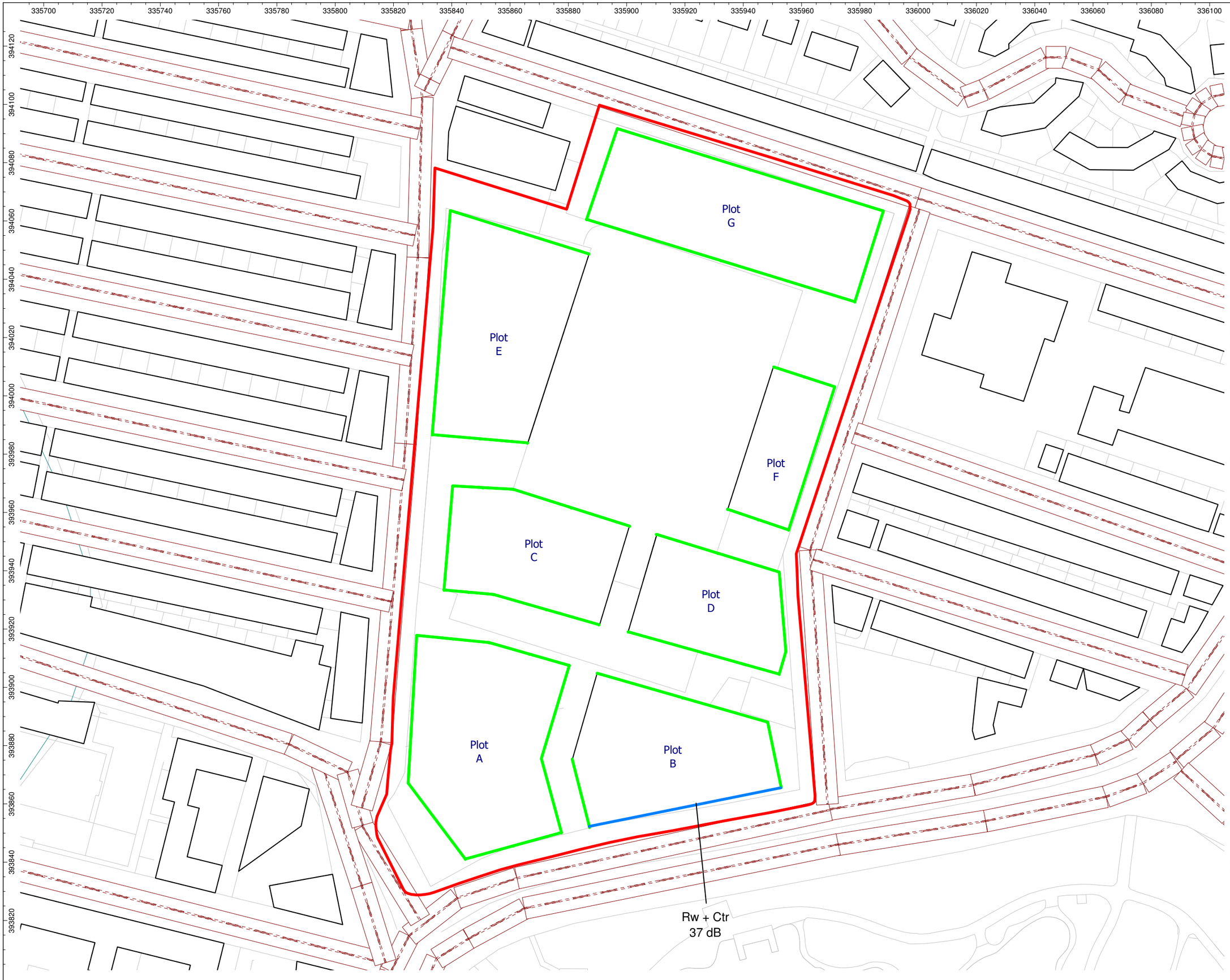
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000



Client:
Everton Stadium Development Ltd

Project:
Goodison Park, Legacy Project

Project Number:
A100795-1

Drawing Title / Scenario:
Glazing and Ventilation Strategy

Drawing Number:
SK06

Key:

Site Boundary:

Enhanced Glazing & Alternative Ventilation Rw + Ctr 37 dB:

Alternative Ventilation Rw + Ctr 30 dB:

All other facades will require standard double glazing (Rw + Ctr 30 dB)

Scale : Not to scale

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Licence Number AL 553611

Executive Park
Avalon Way
Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000

Appendix C – Construction and Environmental Management Plan (CEMP) – Noise

A construction noise assessment has been undertaken in accordance with BS 5228:2009+A1:2014 which demonstrates that noise from daytime construction activity on the site is not considered to be significant. The full details of the assessment are presented in the noise technical report which supports the proposed scheme.

Despite the favourable assessment, a number of additional mitigation measures are recommended to keep construction site noise to a minimum. The following practices are derived from those detailed in BS 5228-1 and those most appropriate to the site are outlined below.

Source Noise Control

Wherever possible noise will be controlled at source.

a) avoid unnecessary revving of engines and switch off equipment when not required;

b) keep internal haul routes well maintained and avoid steep gradients;

c) use rubber linings in, for example, chutes and dumpers to reduce impact noise;

d) minimize drop height of materials;

e) start up plant and vehicles sequentially rather than all together.

As far as reasonably practicable, sources of significant noise will be enclosed or screened. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements. For maximum benefit, screens will be close to the source of noise.

Plant Location

The plant and activities to be employed on that site will be reviewed to ensure that they are the quietest available for the required purpose; this is in accordance with best practicable means. For an existing operational site, where reasonably practicable, noisy plant or activities will be replaced by less noisy alternatives if noise problems are occurring. Noise from existing plant and equipment can often be reduced by modification or by the application of improved sound reduction methods, but this will only be carried out after consultation with the manufacturer. Suppliers of plant will often have ready-made kits available and will often have experience of reducing noise from their plant.

Working Methods

Where reasonably practicable, quiet working methods will be employed, including use of the most suitable plant, reasonable hours of working for noisy operations, and economy and speed of operations.

Scheduling of Works

It is proposed that the scheduling of any construction works at the site be within daytime hours. The following hours of construction working are proposed;

a) Monday to Friday: 07:00 – 19:00
b) Saturday: 07:00 – 13:00
c) Sundays and Bank Holidays: No Working

Where practicable, percussive piling activities will be scheduled to avoid migration/mating periods of sensitive ecological species as advised by the project ecologist.

Maintenance

Regular and effective maintenance by trained personnel is essential and will do much to reduce noise from plant and machinery. Increases in plant noise are often indicative of future mechanical failure.

Training

Operatives will be trained to employ appropriate techniques to keep site noise to a minimum, and will be effectively supervised to ensure that best working practice in respect of noise reduction is followed. All employees will be advised regularly of the following, as part of their training:

a) the proper use and maintenance of tools and equipment;

b) the positioning of machinery on site to reduce the emission of noise to the neighbourhood and to site personnel;

c) the avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment;

d) the protection of persons against noise;

e) the operation of sound measuring equipment (selected personnel).

Special attention will be given to the use and maintenance of sound-reduction equipment fitted to power tools and machines.

Community Relations

Good relations with people living and working in the vicinity of site operations are of paramount importance. Early establishment and maintenance of these relations throughout the duration of site operations, will go some way towards allaying people's fears. It is suggested that good relations can be developed by keeping people informed of progress and by treating complaints fairly and expeditiously. The person, company or organization carrying out work on site will appoint a responsible person to liaise with the public.

In general, the longer the duration of activities on a site, the more likely it is that noise from the site will prove to be an issue. In this context, good public relations and communication are important. The hours of working will be planned in advance and disseminated. There will be a need to adhere strictly to the stated schedule and ensure that the community is informed of their likely durations.

Noise Monitoring

On-site noise levels will be monitored regularly, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose. The following monitoring scheme is proposed;

Noise Monitoring Scheme

Noise monitoring during the construction phase will be undertaken in accordance with the guidance presented in Annex G of BS 5228-1:2009 which states that the following information will be recorded:

a) the measured values of L_{Aeq} and, where appropriate, $L_{pA(max)}$ or L_{A01}, together with details of the appropriate time periods;

b) details of the instrumentation and measurement methods used, including details of any sampling techniques, position of microphone(s) in relation to the site and system calibration data;

c) any factors that might have adversely affected the reliability or accuracy of the measurements;

d) plans of the site and neighbourhood showing the position of plant, associated buildings and notes of site activities during monitoring period(s);

e) notes on weather conditions, including where relevant, wind speed/direction, temperature, presence of precipitation, etc.;

f) time, date and name of person carrying out the measurement.

Proposed construction noise monitoring locations are shown on the accompanying Appendix C. It is proposed that noise levels will be routinely monitored and reported at these locations for 4 hours during construction activities on a monthly basis. Additional measurements will be undertaken to establish whether specific equipment or practices will be capable of achieving the Noise Emission Limits as set out below or in light of any complaints.

Vibration Monitoring

Vibration monitoring will be undertaken during the construction phase; monitoring will record ppv, max displacement, VDV and acceleration. Measurement will generally be undertaken in accordance with the procedure described in BS ISO 4866:2010: Guidelines for the measurement of vibrations and evaluation of their effects on structures.

Baseline monitoring to be undertaken prior to works starting on site to establish appropriate monitoring trigger levels for vibration and displacement.

Works will stop and alternative methods employed if vibration exceeds the established thresholds.

Records of the monitoring will be consistent with the requirements of BS7385:1990 and will include:

- Description of the vibration source
- Type and condition of the building
- Purpose of the measurement
- Reference to BS7385
- Position of transducer and manner of coupling type and make of transducer
- Frequency range and linearity
- Assessment of the sources of error
- PPV recorded and associated frequency

Appendix D – Acoustic Consultants' Qualifications

The lead project Acoustic Consultant is Graham Davis. The report has been checked by Nigel Mann. Relevant qualifications, membership and experience are summarised below.

Table D1 Acoustic Consultants' Experience & Qualifications

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)
Emma Aspinall	MGeol (2017)	Dec 2020	Jul 2017	-	-
Lewis Kelter	BSc (2016) PGd (2018)	Dec 2018	Jun 2016	Dec 2018	-
Graham Davis	BA (2008) PGd (2013)	Nov 2013	Sep 2011	Jan 2014	-
Nigel Mann	BSc (1997) MSc (1999)	Nov 2001	Nov 1998	Nov 2001	Jul 2005

Appendix E – Liverpool City Council Consultation Response

To: Felicity Collins
Development Control Division
Planning & Building Control
Municipal Buildings
Dale Street
L2 2DH

From: Dr I Rushforth
Environmental Protection Unit
Public Protection Division
Municipal Buildings
Dale Street
Liverpool L2 2DH

Tel: 104061

E-mail :
ian.rushforth@liverpool.gov.uk

Date: 3/8/20

Our Ref: EP/IR/

MEMORANDUM

APPLICATION NO: 20O/0997
SITE: Goodison Park, Goodison Road, L4
PROPOSAL: To demolish existing buildings and redevelop the site for a mix of uses, comprising residential units (Use Class C3); residential institution (Use Class C2); shops (Use Class A1); financial & professional services (Use Class A2); food and drink use (Use Class A3); drinking establishments (Use Class A4); hot food takeaways (Use Class A5); business use (Use Class B1); non-residential institutions (Use Class D1); and open space, with associated access, servicing, parking and landscaping. (Outline application with all matters (Access, Appearance, Landscaping, Layout and Scale) reserved)

The residential units hereby approved shall be acoustically insulation in accordance with the façade insulation scheme detailed in Drawing Number SK06 of Appendix 9.1 of the Environmental Statement which was submitted in support of this application.

REASON: To protect the amenity of future occupiers of the scheme.

I agree with the findings of Appendix 9.1 of the E.S. that the operational phase of the proposed development will not have any significant adverse noise or vibration impacts on existing nearby residents.

The standard Construction Environmental Management Plan condition should be attached to deal with temporary impacts during the demolition/construction phase.

<u>In relation to commercial units:</u>

The hours of operation set for the business (including servicing) should take into account the operating hours of similar businesses situated in the area concerned.

REASON: To protect amenity.

A kitchen extract system shall be installed to all areas where hot food is to be prepared. Any extract ducts included shall be acoustically insulated and acoustically isolated from associated fans and the building structure. The discharge point shall be at least 1 metre above the eaves or in other such position as to minimise the likelihood of nuisance to neighbouring premises.

REASON: To avoid reduction in amenity or causing nuisance by noise and odour.

Any waste generated by the business to be discarded as refuse should be kept within the curtilage of the premises and should only be placed outside on such days as trade refuse collection will occur.

REASON: To protect amenity.

Noise control measures must be employed within the development such that sound generated within the commercial entertainment areas does not give rise to noise levels exceeding NR30 in the residential accommodation (expressed in terms of the maximum $L_{Leq(1\ minute)}$ linear sound pressure level in each octave band).

REASON: To protect the amenity of such residential occupiers.

Informative:

During the site works the contractor shall pay full regard to the best practicable means available in respect of the control of noise and dust from the site. In addition, no operations which are audible at the site boundary shall be carried out:

(i) outside the hours of 0800 to 1800 weekdays
(ii) outside the hours of 0800 to 1300 Saturdays, and
(iii) at any time on Sundays or Bank Holidays.

.....
Dr Ian Rushforth
Senior Enforcement Officer

Appendix F – Report Conditions

This Report has been prepared using reasonable skill and care for the sole benefit of Everton Stadium Development Ltd ("the Client") for the proposed uses stated in the report by [WYG Environment Planning Transport Limited] ("WYG"). WYG exclude all liability for any other uses and to any other party. The report must not be relied on or reproduced in whole or in part by any other party without the copyright holder's permission.

No liability is accepted, or warranty given for; unconfirmed data, third party documents and information supplied to WYG or for the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report. WYG does not purport to provide specialist legal, tax or accounting advice.

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.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on Site during construction. WYG accept no liability for issues with performance arising from such factors.