



Broad Street Mall

Environmental Impact Assessment

Volume 1: Environmental Statement Main Report

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Chapter 1: Introduction

INTRODUCTION

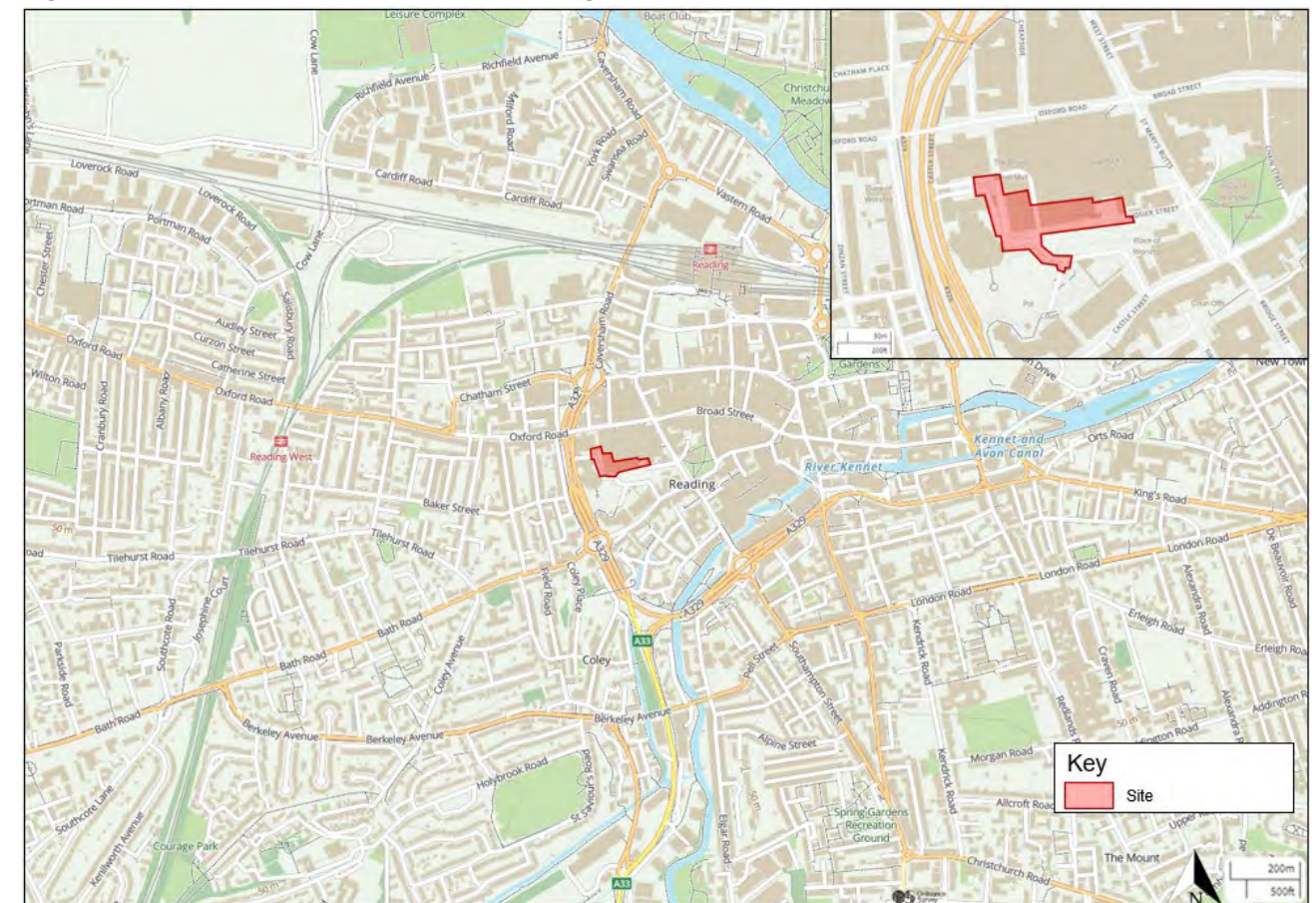
- 1.1 This Environmental Statement (ES) has been prepared on behalf of McLaren (Broad Street Mall) Ltd and UREF III LP (hereinafter referred to as the 'Applicant') in accordance with the statutory procedures set out in the Town and Country Planning (Environmental Impact Assessment) Regulations 2017¹ ('the EIA Regulations').
- 1.2 The Applicant is seeking full (detailed) planning permission for the proposed redevelopment of an area of land (comprising the existing Broad Street Mall). The Applicant is also seeking planning permission for a temporary construction planning application, covering land along Dusseldorf Way and Queens Walk. Together, both of these planning application boundaries are considered as the 'site'.
- 1.3 The site falls within the administrative boundary of the Reading Borough Council (RBC), and within the Abbey Ward. As shown in Figure 1.2 to Figure 1.5, four separate redline boundaries will be submitted (two for each planning application). The site areas for each are as set out below, and which overlap for the basement and ground floor levels:
 - Proposed Development – Basement: 7,931.83m²;
 - Proposed Development – Ground Floor: 6,238.61m²; and
 - Temporary Construction Scheme – Basement and Ground Floor levels, are each: 2,630.54m².
- 1.4 The location of the site (including the required land for temporary construction related works) is shown in Figure 1.1 (outlined in red) and the planning application redline boundaries are shown in Figure 1.2 to Figure 1.5.
- 1.5 As the Applicant is seeking approval for two planning applications, both will be considered together as the 'Proposed Development' for the purposes of the EIA.
- 1.6 The proposals for the Proposed Development will comprise the partial demolition of the existing building and structures on the site, and the comprehensive redevelopment of the site to deliver residential accommodation (use class C3), and non-residential floorspace (flexible class E), associated landscaping, public realm, car and cycle parking and associated works.
- 1.7 The description of development for the Proposed Development comprises:

Part-demolition of existing retail units, car park and service areas, demolition and rebuild of car park ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required.
- 1.8 The temporary construction planning application is required to allow construction vehicle access, to facilitate construction of the Proposed Development.
- 1.9 The description of development for the temporary construction planning application is seeking approval for:

Part-demolition of podium deck on Dusseldorf Way and Queens Walk, amendments to existing retaining wall, excavation works and road and hardstanding re-alignment to create a temporary construction area related to proposed redevelopment works at Broad Street Mall.

- 1.10 Further details of the Proposed Development are presented within **ES Volume 1, Chapter 4: The Proposed Development** and **Chapter 5: Demolition and Construction**.
- 1.11 Environmental Impact Assessment (EIA) is a process carried out which examines the available environmental information to ensure that the likely significant environmental effects of certain projects are identified and assessed before a decision is taken on whether a project is granted planning permission. This means environmental issues can be identified at an early stage and projects can then be designed to avoid or to minimise significant adverse environmental effects, and appropriate mitigation and monitoring can be implemented.
- 1.12 In accordance with the EIA Regulations, this ES reports on the likely significant effects of the Proposed Development. The ES describes the likely significant environmental and socio-economic effects of the Proposed Development during demolition, construction and on subsequent completion and occupation. The ES is designed to inform readers of the nature of the scheme proposed, the likely significant environmental and socio-economic effects and the measures proposed to protect the environment.

Figure 1.1 Site Location and Surrounding Context



¹ His Majesty's Stationery Office (2017); The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

Figure 1.2 Planning Application Redline Boundary – Basement

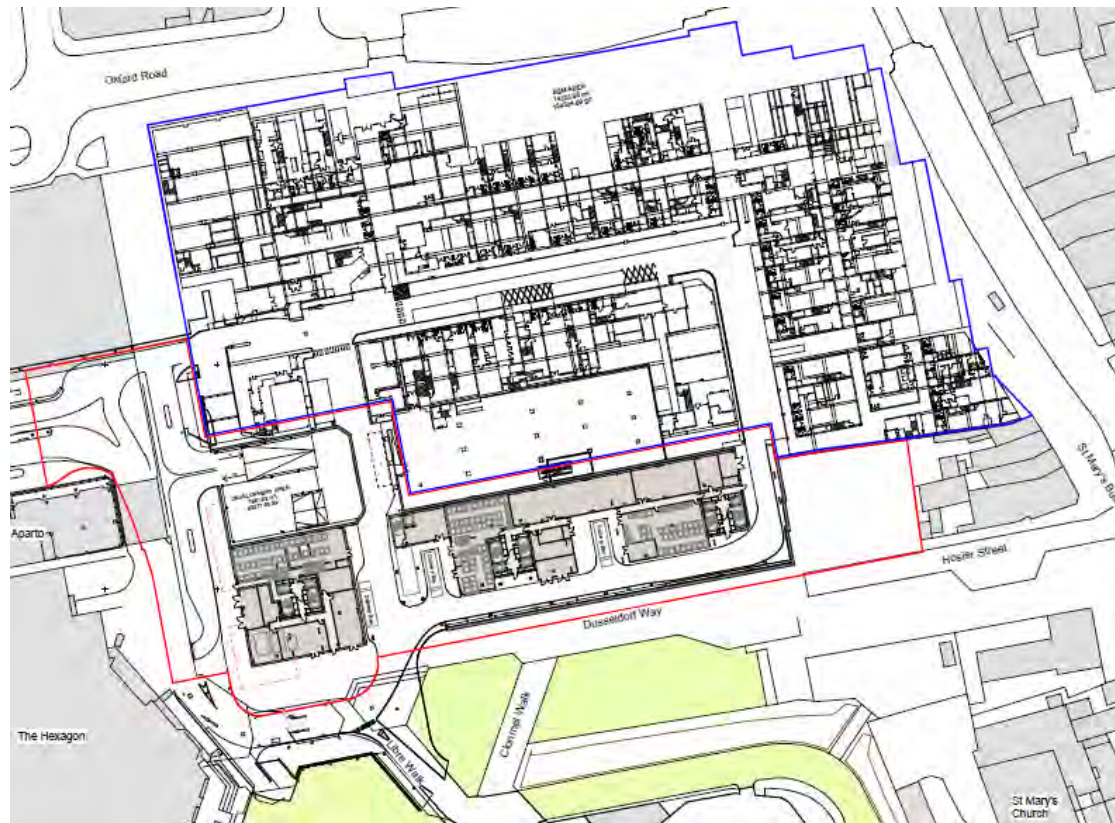


Figure 1.3 Planning Application Redline Boundary – Ground Floor



Figure 1.4 Temporary Construction Redline Boundary – Basement

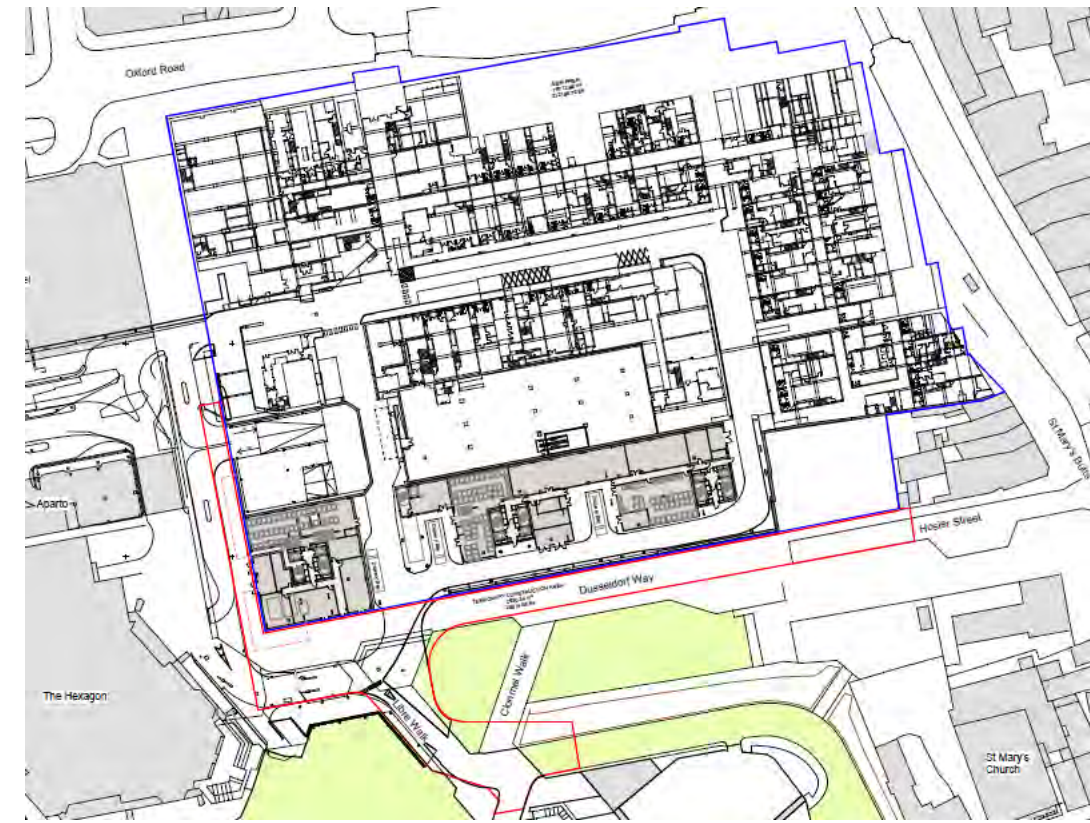
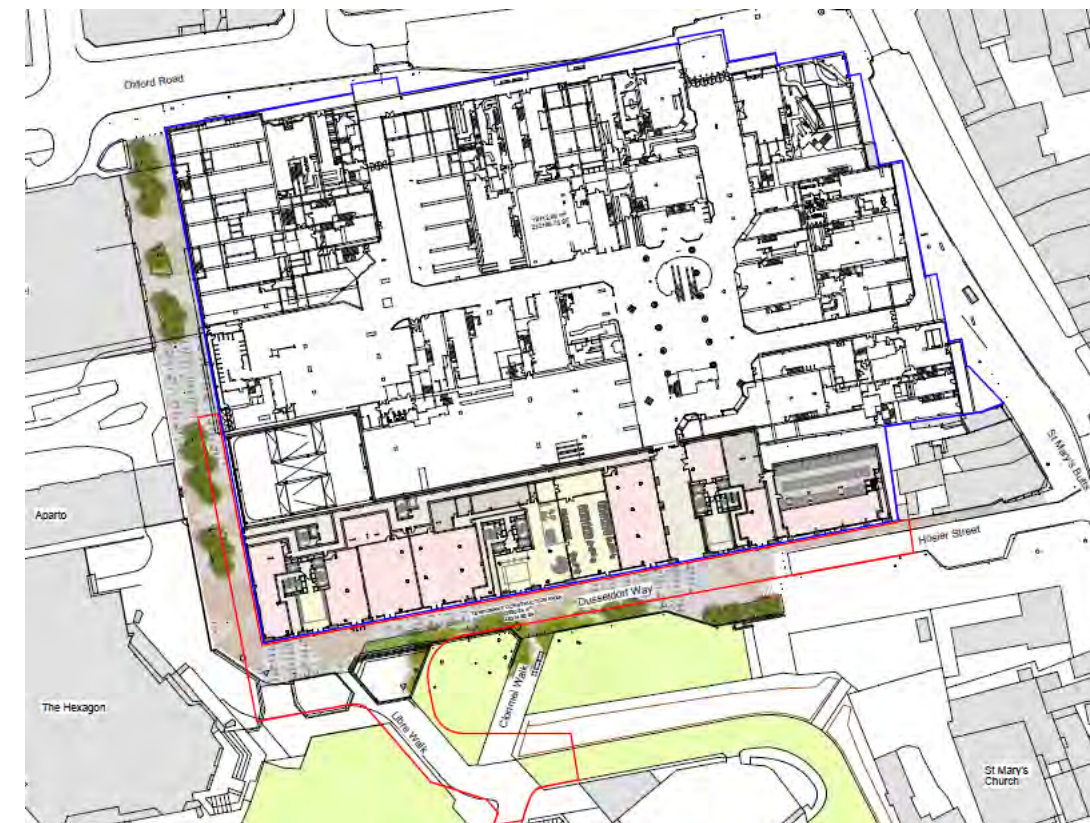


Figure 1.5 Temporary Construction Redline Boundary – Ground Floor



SITE INFORMATION

- 1.13** The following section presents a summary of the site location and existing site conditions. A description of the key features and designations associated with the site and surrounding environment are discussed in **ES Volume 1, Chapter 3: Alternatives and Design Evolution**. Further detail describing the existing baseline context is presented within **ES Volume 1, Chapters: 6 to 11** and **ES Volume 2, Heritage, Townscape and Visual Impact Assessment** as well as the supporting environmental reports presented within **ES Volume 3, Technical Appendices**.

Site Location

- 1.14** The centre of the site is centred at National Grid Reference: SU712733. The site is bound by:
- The remainder of the Broad Street Mall Shopping Centre and Pentahotel Reading to the north;
 - Commercial properties along Hosier Street beyond which lies St Mary's Butts to the east;
 - Dusseldorf Way, Hosier Street, San Francisco Libre Walk, Clonmel Walk, and Civic Centre Car Park to the south; and
 - Queens Walk, commercial properties along Queens Walk and The Hexagon to the west.

Site Context

- 1.15** The site is partially occupied by a shopping centre, Broad Street Mall, comprising retail units and public realm, with a Multi-Storey Car Park (MSCP) to the west and on the roof of the shopping centre. Overall (both within and outside of the site boundary) the MSCP comprises 700 car-parking spaces spread across three floors. The MSCP is a 24-hour car park, open seven days a week. Access to the site is gained from the west, via A329, through the basement.
- 1.16** The site covers part of the retail shopping mall, extending along the southern extent, and is arranged over basement level and ground level, within the site boundary. The basement level extends underneath the site and includes plant rooms, the main waste storage area and storage rooms associated with the retail units.

HISTORICAL PLANNING CONTEXT

- 1.17** The site has been the focus of a previous application for detailed planning permission in December 2018 (Planning Reference: 182137) by Inception (Reading) Sarl (c/o Moorgarth Group Ltd). The planning application was granted consent in December 2021.
- 1.18** Since this approval, the site was subsequently sold to the Applicant. As the scheme posed technical and deliverability challenges, the Applicant is proposing a new Proposed Development, which is the subject of a new planning application accompanied by this ES.
- 1.19** An area located to the southeastern corner of the site has been subject to a planning application for the demolition of all existing structures, erection of a part 7, part 8 storey building for use as 101 bed Hotel (Class C1 Use) at Ground - 8th Floor and Restaurant with ancillary Bar (Class A3/A4 Use) at ground floor, with means of access, servicing and associated works (Planning Reference: 182054). The planning application was permitted 4 November 2019.

THE LEGISLATIVE REQUIREMENTS FOR AN EIA

- 1.20** Applications for development that are covered by the Town and Country Planning (Environmental Impact Assessment) Regulations 2017² are termed 'EIA Applications'.
- 1.21** The requirement for an EIA is based on the likelihood of significant environmental effects arising from a proposed development; and it is either mandatory or conditional depending on the classification of the development project. EIA applications are divided into Schedule 1 and Schedule 2 applications under the EIA Regulations.

- 1.22** Schedule 1 developments constitute those that are likely to have significant effects on the environment, such as major chemical or petrochemical projects and construction of ground or air transport infrastructure, and for which EIA is mandatory. For all other developments which fall under Schedule 2, the need for an EIA is determined based on set criteria as follows:

- It is within one of the classes of development stated in Schedule 2; AND
- EITHER it exceeds the applicable threshold criteria for that class of development in Schedule 2; OR it is to be carried out in part or all of a sensitive area; AND
- It is likely to have significant effects on the environment by virtue of factors such as its nature, size or location.

- 1.23** The EIA Regulations Schedule 2 Part 10(b), states that for "urban development projects, including the construction of shopping centres and car parks, sports stadiums, leisure centres and multiplex cinemas", the thresholds which determine the need for a development to be screened for the potential for environmental effects comprise:

"(i) the development includes more than 1 hectare of urban development which is not dwelling / house development; OR

(ii) the development includes more than 150 dwellings; OR

(iii) the overall area of the development exceeds 5 hectares".

- 1.24** Given that the Proposed Development exceeds the EIA Regulations threshold with regards to the development including more than 150 dwellings (10(b)(ii)) and taking into account the scale and nature of the development proposed and the surrounding area, it is considered that there is the potential for significant environmental effects to arise. As such, the Proposed Development constitutes 'EIA Development' under the EIA Regulations and the Applicant has undertaken an EIA for the Proposed Development, the results of which are presented within this ES (**Volumes 1, 2 and 3**) which has been submitted as part of the planning application. The project has not been through EIA screening with the RBC.

ENVIRONMENTAL STATEMENT STRUCTURE

Environmental Statement

- 1.25** The ES comprises three technical volumes:

- **ES Volume 1: Main Environmental Statement** – a document which forms the main body of the ES and which comprises of the following non-technical and technical chapters:
 - Chapter 1: Introduction (this chapter);
 - Chapter 2: EIA Methodology;
 - Chapter 3: Alternatives and Design Evolution;
 - Chapter 4: The Proposed Development;
 - Chapter 5: Demolition and Construction;
 - Chapter 6: Socio-Economics;
 - Chapter 7: Air Quality;
 - Chapter 8: Noise and Vibration;
 - Chapter 9: Daylight, Sunlight and Overshadowing;
 - Chapter 10: Wind Microclimate;
 - Chapter 11: Climate Change and Greenhouse Gases;
 - Chapter 12: Effect Interactions;

² 2017 No. 571; TOWN AND COUNTRY PLANNING; The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended)

- Chapter 13: Likely Significant Effects and Conclusions;
- Chapter 14: Environmental Management, Mitigation and Monitoring Schedule;
- **ES Volume 2: Heritage, Townscape and Visual Impact Assessment** – a separate heritage, townscape and visual impact assessment (HTVIA) document that is accompanied by a full set of views and verified images;
- **ES Volume 3: Technical Appendices** – comprises background data, technical reports, tables, figures and surveys. The following appendices are included:
 - Appendix: Introduction:
 - Annex 1: Location of Information within the ES ('wayfinding' document)
 - Annex 2: Competent Experts and Relevant Expertise
 - Annex 3: Glossary of Terms and Abbreviations
 - Appendix: EIA Methodology:
 - Annex 1: EIA Scoping Document
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Non-Technical Summary

- 1.26** A separate document that comprises part of the ES and which is referred to as the Non-Technical Summary (NTS) provides a concise summary of the ES written in non-technical language. The NTS provides a description of the Proposed Development, the main alternatives considered, the potential environmental and socio-economic effects, any identified mitigation measures and the residual environmental and socio-economic effects of the Proposed Development.

Location of Information within the ES

- 1.27** Regulation 18(3) of the EIA Regulations defines that “*an environmental statement is a statement which includes at least -*
- (a) *a description of the proposed development comprising information on the Site, design, size and other relevant features of the development;*
 - (b) *a description of the likely significant effects of the proposed development on the environment;*
 - (c) *a description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;*
 - (d) *a description of the reasonable alternatives studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment;*
 - (e) *a non-technical summary of the information referred to in sub-paragraphs (a) to (d); and*
 - (f) *any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.”*
- 1.28** The above information defined in Regulation 18(3) is replicated within Schedule 4 of the EIA Regulations - this is provided in **ES Volume 3, Appendix: Introduction – Annex 1**, including sign-posting the location of the information within the ES.

PREPARATION OF THE ES – COMPETENT EXPERT

- 1.29** This EIA has been carried out by Trium Environmental Consulting LLP ('Trium') and several technical specialists. Regulation 18(5) of the EIA Regulations requires an applicant to “(a) ... *ensure that the environmental statement is prepared by competent experts;*” and also requires that “(b) *the environmental statement must be accompanied by a statement from the developer outlining the relevant expertise or qualifications of such experts*”, to ensure the completeness and quality of the ES. In accordance with this requirement, the following statement is provided:
- “Trium is an environmental consultancy specialising in urban regeneration and property development projects in the United Kingdom (UK). Trium’s Partners and Employees have extensive experience in managing the environmental issues and impacts surrounding large scale, high profile urban regeneration development projects. The Partners and Employees of Trium have, over the course of their careers to date (including with former employers), project directed, managed or contributed to many EIAs within the commercial, retail, residential, leisure, cultural, infrastructure and industrial sectors. Trium’s lead EIA practitioner for Broad Street Mall has 20 years EIA experience of managing EIA projects.”*
- 1.30** A summary of the credentials of Trium and the technical specialists who have led and authored the technical assessments that comprise this ES are provided in **ES Volume 3, Appendix: Introduction – Annex 2**. These technical specialists are also identified within the relevant sections of this ES (**ES Volume 1, Chapters 6-11 and Volumes 2 and 3**).

ES AVAILABILITY AND COMMENTS

- 1.31** The ES is available for viewing by the public during normal office hours at the RBC's Planning Department, and is viewable online at the RBC Planning Portal: http://planning.reading.gov.uk/fastweb_PL/welcome.asp.
- 1.32** Comments on the planning applications should be forwarded to the RBC at the following address:
Reading Borough Council
Civic Offices
Bridge Street
Reading, RG1 2LU
- 1.33** Electronic Copies of the NTS are available free of charge. To request a copy please contact hello@triumenv.co.uk quoting 'Environmental Statement NTS Request – Broad Street Mall' or Tel: +44 (0) 203 887 7118.
- 1.34** Printed and electronic copies of the ES and NTS can also be purchased from Trium Environmental Consulting LLP; for further details contact hello@triumenv.co.uk quoting 'Environmental Statement Request – Broad Street Mall', Tel: +44 (0) 203 887 7118 or contact by post at the address below:
Trium Environmental Consulting LLP
The Whitehouse, Belvedere Rd, London SE1 8GA
hello@triumenv.co.uk

Chapter 2: EIA Methodology

INTRODUCTION

2.1 This chapter of the ES sets out the overall approach to and methodology for undertaking the EIA. It details the process for identifying the environmental topics to be included in the EIA and the method of assessing the likely significant effects that have the potential to arise as a result of the Proposed Development, both during the demolition and construction works, and on completion and occupation of the Proposed Development.

2.2 Further detail on how the assessment methodology is applied to each topic is presented within the respective technical chapters of this **ES Volume 1, Chapter 6 - 11** and in **ES Volume 2: Heritage, Townscape and Visual Impact Assessment**.

EIA GUIDANCE AND POLICY

EIA Guidance

2.3 The EIA has been prepared in accordance with applicable legislation, guidance, and case law for the preparation of such documents. Specifically, this ES has been undertaken in accordance with the Institute of Environmental Management and Assessment ('IEMA') Quality Mark indicator checklist and with due consideration to the following:

- In February 2020, the Withdrawal Agreement¹ came into force that established the terms of the United Kingdom's orderly withdrawal from the European Union (EU). As the UK is no longer part of the EU, it is not required to adhere to EU laws (regulations, directives, decisions) or guidance. Nonetheless, reference has still been made to the European Commission's (EC's) various EIA guidance documents as these currently remain in line with the UK's EIA Regulations², and therefore provide applicable guidance³;
- At a European level, reference has been made to the European Commission's ('EC') various EIA guidance documents⁴;
- At a domestic level, reference has been made to the Ministry of Housing, Communities and Local Government's⁵ overarching Planning Practice Guidance⁶;
- In addition, the Department for Transport 'Design Manual for Roads and Bridges'⁷ has been referred to as applicable;
- In relation to publications from professional bodies, reference has been made to the IEMA publications as these include best practice/suggested improvements to the EIA process. This includes:
 - IEMA ES Review Criteria (COM3-6)⁸;
 - IEMA 'Guidelines for Environmental Impact Assessment' (2004)⁹;
 - IEMA 'Special Report into the State Environmental Impact Assessment Practice in the UK' (2011)¹⁰;
 - IEMA 'Shaping Quality Development' (2015)¹¹;
 - IEMA 'Delivering Quality Development' (2016)¹²;
 - IEMA 'Delivering Proportionate EIA' (2017)¹³;
 - IEMA 'Guide to Materials & Waste in EIA' (2020)¹⁴;
 - IEMA 'Climate Change Resilience and Adaption' (2020)¹⁵;
 - IEMA 'Major Accidents and Disasters in EIA: A Primer' (2020)¹⁶;
 - IEMA 'Principles of Cultural Heritage Impact Assessment in the UK' (2021)¹⁷;

- IEMA 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (2022)¹⁸;
- IEMA 'A New Perspective on Land and Soil in Environmental Impact Assessment' (2022);
- IEMA 'Determining Significance for Human Health in Environmental Impact Assessment' (2022)¹⁹
- IEMA 'Effective scoping of Human Health in Environmental Impact Assessment' (2022)²⁰; and
- IEMA 'Environmental Assessment of Traffic and Movement' (2023)²¹.

- Whilst primarily written for major infrastructure projects, reference is also made to guidance/advice notes published by the National Infrastructure Planning²² where appropriate, as these can include relevant/helpful information; and

- Applicable case law.

Planning Policy Context

2.4 The EIA considers legislation and relevant national and local planning policy guidance as summarised below.

National Planning Policy and Guidance

2.5 The EIA has been undertaken having regard to the National Planning Policy Framework²³ ('NPPF'). The NPPF sets out the Government's economic, environmental and social planning policies for England. The policies contained within the NPPF articulate the Government's vision of sustainable development, which are intended to be interpreted at a local level, to meet the requirements of local aspirations.

2.6 As relevant to the EIA, specifically to the scope, methodology and assessment of effects for the EIA technical topic, the NPPF has been considered throughout undertaking of the EIA and preparation of the ES.

2.7 The EIA has also referred to the Planning Practice Guidance (PPG), which is an online resource. The PPG aims to make planning guidance more accessible, and to ensure that the guidance is kept up to date.

Local Planning Policy and Guidance

2.8 Key local planning policy documents making up the borough's Development Plan that have been considered throughout preparation of the ES are outlined below.

Reading Local Plan

2.9 The Local Plan was adopted by Reading Borough Council (RBC) on 4 November 2019²⁴ and has subsequently replaced all existing development plans – including the Core Strategy (adopted 2008, amended 2015), Reading Central Area Action Plan (adopted 2009) and Sites and Detailed Policies Document (adopted 2012, amended 2015) which have ceased to be used since the Local Plan has been adopted.

2.10 The Local Plan is the document that contains the policies for how Reading will develop up to 2036. It identifies the amount of development that will take place, the areas and sites where development is expected to be accommodated, and where it will be restricted, and sets out policies for how planning applications will be decided.

Updated Local Plan

2.11 The RBC are currently undertaking a review of Reading Local Plan, which will result in a partial update to the adopted plan. The partial update will include about half of the policies set out in the adopted Local Plan, and will include policies related to housing, employment and site allocation policies.

¹ European Commission (2019); The EU-K Withdrawal Agreement. Available at: https://ec.europa.eu/info/strategy/relations-non-eu-countries/relations-united-kingdom/eu-uk-withdrawal-agreement_en

² His Majesty's Stationery Office (HMSO) 2017. The Town and Country Planning (Environmental Impact Assessment) (England) Regulations 2017 (as amended in 2018 and 2020).

³ European Commission (n.d.); Environmental Impact Assessment. Available at: <http://ec.europa.eu/environment/eia/eia-support.htm>

⁴ European Commission EIA Guidance Documents; <http://ec.europa.eu/environment/eia/eia-support.htm>

⁵ Now called the Department for Levelling Up, Housing and Communities

⁶ <http://www.gov.uk/guidance/environmental-impact-assessment>

⁷ Highways England, 2020. Design Manual for Roads and Bridges 'Sustainability and Environment' – LA104 Environmental Assessment and Monitoring

⁸ Institute of Environmental Management and Assessment, undated; EIA Quality Mark – ES Review Criteria COM 3-6.

⁹ Institute of Environmental Management and Assessment, 2004. Guidelines for Environmental Impact Assessment.

¹⁰ Institute of Environmental Management and Assessment, 2011. The State of Environmental Impact Assessment Practice in the UK.

¹¹ Institute of Environmental Management and Assessment, November 2015. Shaping Quality Development.

¹² Institute of Environmental Management and Assessment, 2016; Delivering Quality Development.

¹³ Institute of Environmental Management and Assessment, 2017; Delivering Proportionate EIA.

¹⁴ Institute of Environmental Management and Assessment, 2020; Guide to Materials and Waste in Environmental Impact Assessment

¹⁵ Institute of Environmental Management and Assessment, 2020; Climate Change Resilience and Adaption'

¹⁶ Institute of Environmental Management and Assessment, 2020, Major Accidents and Disasters Guidelines

¹⁷ Institute of Environmental Management and Assessment, 2021; Principals of Cultural Heritage Impact Assessment in the UK

¹⁸ IEMA, 2022. Institute of Environmental Management and Assessment (IEMA) Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance, 2nd Edition

¹⁹ Institute of Environmental Management and Assessment, 2022; Determining Significance for Human Health in Environmental Impact Assessment'

²⁰ Institute of Environmental Management and Assessment, 2022; Effective scoping of Human Health in Environmental Impact Assessment

²¹ Institute of Environmental Management and Assessment, 2022; Effective scoping of Human Health in Environmental Impact Assessment

²² Institute of Environmental Management and Assessment, 2022; Effective scoping of Human Health in Environmental Impact Assessment

²³ Institute of Environmental Management and Assessment, 1993 'Environmental Assessment of Road Traffic'

²⁴ Website - <https://infrastructure.planninginspectorate.gov.uk/>

²⁵ Ministry of Housing, Communities and Local Government (MHCLG), 2023; 'National Planning Policy Framework.'

²⁶ Website: <https://www.reading.gov.uk/planning-and-building-control/planning-policy/new-local-plan/>

- 2.12** The RBC commenced this process in early 2023 and it is currently identified in the Local Development Scheme that the Local Plan Update will be adopted in Summer 2025.
- 2.13** Any additional planning policy and guidance documents considered relevant to the technical assessments which are covered by the EIA have also considered as appropriate.
- Minster Quarter Area Development Framework (MQADF) (adopted 2018)²⁵*
- 2.14** The Minster Quarter area is the subject of a policy in the Local Plan. However, with the various sites, and other adjoining land being in different ownerships, and likely to come forward at different times, RBC have identified a need for a detailed framework to be prepared to guide and co-ordinate the various developments and to ensure the most appropriate form of development to serve the wider area.
- 2.15** The framework for the Minster Quarter area has therefore been prepared. This provides a comprehensive masterplan and urban design framework for the area with a particular emphasis on creating high quality public realm around which various mixed uses will be located.
- 2.16** The MQADF was presented to the Council's Strategic Environment Planning and Transport Committee on 12 December 2018 where it was formally adopted.
- 2.17** The Minster Quarter area is an area of significant change as a result of:
- The demolition of the Council offices which leaves a large vacant site (area located adjacent, to the south of the site);
 - The Proposed Development; and
 - The review by Thames Valley Police of their existing headquarters buildings operations (located to the south of the site).
- 2.18** Further details of how the MQADF has been taken into consideration as part of the design evolution of the Proposed Development is contained within **ES Volume 1, Chapter 3: Alternatives and Design Evolution**.
- 2.19** Given the framework and guidance provided by the MQADF, the ES has regard to the MQADF as a 'future development scenario' as part of the cumulative effects assessment (see section 'Cumulative Effects with Other Cumulative Schemes').
- Supplementary Planning Notes and Guidance*
- 2.20** RBC has adopted and is preparing a number of Supplementary Planning Documents (SPDs) to provide further guidance on policies set out in Local Plan documents and a series of technical reports and background evidence.
- 2.21** Any additional regional planning policy and guidance documents considered relevant to the technical assessments which are covered by the EIA are also considered within the respective technical ES chapter.
- Other Guidance*
- 2.22** In addition, where relevant to the assessment, the technical ES chapters also present a summary of any pertinent recognised industry guidance documents.

EIA SCOPING AND CONSULTATION

Consultation

- 2.23** Consultation with the RBC has helped inform the design of the Proposed Development. **ES Volume 1, Chapter 3: Alternatives and Design Evolution** provides a review of the consultation undertaken by the Project team in respect of the alternatives considered by the Applicant and the design evolution of the Proposed Development, with regard to environmental considerations.
- 2.24** The Application is supported by a Planning Statement and a Statement of Community Involvement which together summarise the wider consultation that has been undertaken with various consultees throughout the pre-application consultation process.

EIA Scoping

- 2.25** EIA Scoping forms one of the first stages of the EIA process and it is through EIA scoping that the environmental topics that should be included in the EIA are defined. EIA Scoping is not a mandatory process under the EIA Regulations. The Applicant has not requested an EIA Scoping Opinion from the RBC. Instead, the EIA team (on behalf of the Applicant) has undertaken a scoping exercise to define an appropriate scope for the EIA. The scope has been defined through consideration of all the technical topics cited within the EIA Regulations and with reference to the EIA that was undertaken for the consented scheme (Ref: 182137).
- 2.26** The purpose of the EIA scoping process has been to:
- Define the approach to the EIA;
 - Identify any available existing baseline data and appropriate baseline surveys to be undertaken;
 - Identify sensitive receptors;
 - Identify potential environmental considerations and potential environmental effects;
 - Identify the topics to be included within the scope of the EIA and the methodology for assessment;
 - Identify the topics that can be scoped out of the EIA (i.e. excluded), with justification provided as to why likely significant environmental effects are not anticipated;
 - Define the methodology for the assessment of the likely significant environmental effects; and
 - Identify other development schemes to be considered within a cumulative effects assessment.
- 2.27** **ES Volume 3, Appendix: EIA Methodology – Annex 1** sets out a description of the Proposed Development at the time of undertaking the scoping exercise and the potential key environmental impacts and likely significant effects to be considered as part of the EIA. The EIA Scoping document includes the proposed approach that has been adopted for the EIA including the proposed scope and assessment methodology to predict the nature and scale of effects and to assess whether the effect is 'significant' in each case.

'Scoped-In' Aspects

- 2.28** The potentially significant environmental issues that were identified during the EIA Scoping process and that have been addressed within this EIA are listed below:
- Demolition and Construction (**ES Volume 1, Chapter 5**);
 - Socio-Economics (**ES Volume 1, Chapter 6**);
 - Air Quality (**ES Volume 1, Chapter 7**);
 - Noise and Vibration (**ES Volume 1, Chapter 8**);
 - Daylight, Sunlight and Overshadowing (**ES Volume 1, Chapter 9**);
 - Wind Microclimate (**ES Volume 1, Chapter 10**);
 - Climate Change: In accordance with Schedule 4, paragraph 5(f) of the EIA Regulations, to consider "the impact of the project on climate" and "the vulnerability of the project to climate change", consideration is given within this ES to greenhouse gases that would be generated by the Proposed Development (in **ES Volume 1, Chapter 11: Climate Change and Greenhouse Gases**), as well as the Proposed Development's resilience to climate change (addressed across the ES as a whole, and discussed in more detail below); and
 - Heritage, Townscape and Visual Impact Assessment (HTVIA) (**ES Volume 2**).

Topics Scoped Out of the EIA

- 2.29** The EIA Scoping process identified several environmental topic areas which are not likely to give rise to significant environmental effects and therefore would not need to be assessed further as part of the EIA. Full

²⁵ Website: http://www.reading.gov.uk/media/9963/Minster-Quarter-Area-Development-Framework-Part-1/pdf/Minster_Quarter_Area_Development_Framework_Part_1.pdf

details of the justification for scoping these topics out can be found within **ES Volume 3, Appendix: EIA Methodology – Annex 1**.

2.30 In summary, the topics scoped out of the EIA include:

- Archaeology;
- Ecology;
- Geoenvironmental (Land Contamination, Ground Conditions and Groundwater);
- Health;
- Highways and Transport;
- Light Pollution and Solar Glare;
- Project Vulnerability;
- Waste and Materials; and
- Water Resources and Flood Risk.

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

2.31 The method behind the EIA process generally considers the existing conditions of the area into which the development is being introduced (**the baseline**), with a future baseline context for assessments provided where relevant. Reasonable predictions of the likely change (**the impact – in terms of magnitude**) that may occur, during its demolition, construction and when the development is completed and operating as proposed are then identified. As appropriate, embedded or primary mitigation is considered when reviewing the potential for impacts and effects. The predicted impact is considered in terms of key environmental and social aspects (**receptors**) found within the surrounding area, and based on their sensitivity to change, the scale of the resulting change experienced by the receptor/resource (**the effect**) is then determined. A determination on whether the resulting effect is significant or not is then included.

2.32 Any mitigation measures required to reduce or eliminate adverse effects are then considered and assessed, with the resulting residual effect scale being determined as significant or not.

2.33 Effects resulting from a combination of the Proposed Development and other surrounding schemes (**cumulative schemes**) are also assessed. All the likely effects of the development are reported (**within an environmental statement**) and the likely significant effects are specifically highlighted.

Baseline Conditions

2.34 The baseline comprises existing information and information collected through baseline surveys undertaken during the course of the EIA process. This information is used in the ES to present (within each of the individual technical ES chapters (**ES Volume 1, Chapters 6 to 11**, and **ES Volume 2: HTVIA**) an up to date description of the current baseline conditions of the site and surrounding area.

2.35 The purpose of the EIA is to predict how environmental conditions may change as a result of the Proposed Development. The assessment of the nature and scale of a predicted change is undertaken against a reference condition, known as the 'baseline'. In most cases, the baseline represents the environmental condition of the site being assessed and the surrounding area at the time of the assessment.

2.36 For most technical disciplines, the baseline has been taken as the existing conditions within the site. However, in some cases it is necessary to apply a 'future' baseline (with reference to the construction programme, taken as the opening year of the development, i.e. when the development is complete and occupied).

2.37 Where this is required, the approach to defining the future baseline has been explained (with reference to the assessment scenarios) within the relevant technical ES chapter (for example **ES Volume 1, Chapter 7: Air Quality**; and **ES Volume 1, Chapter 8: Noise and Vibration**).

Evolution of the Baseline

2.38 In accordance with the requirements of the EIA Regulations, consideration as to how the existing baseline condition may evolve in the future in the absence of the Proposed Development. The EIA Regulations state (Schedule 4(3)):

"A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge."

2.39 This requirement is presented in the ES (within each of the individual technical ES chapters (**ES Volume 1, Chapters 6 to 11**, and **ES Volume 2: HTVIA**)) under the heading 'Evolution of the Baseline Condition'. The description of the evolved baseline is characterised by interpreting an indeterminate point in the future, for a scenario which assumes that all the cumulative schemes are built in the surrounding environment and that the surrounding environment, including the site, has naturally evolved in the absence of the Proposed Development being implemented. In most cases, this is a qualitative approach (professional opinion), but in some instances is quantitative.

2.40 The Air Quality, Noise and Vibration and Greenhouse Gas assessments include a projected future environmental condition (specifically in relation to future road traffic flows to account for any background growth in road traffic between the baseline and the future opening year of the Proposed Development), this information has been provided by Stantec and has been provided in **ES Volume 3, Appendix: EIA Methodology – Annex 3**. The anticipated opening year (and so future baseline year) for the Proposed Development is 2028 (**ES Volume 1, Chapter 5: Demolition and Construction**). Further details on the methodology for defining the future baseline conditions in respect of road traffic are provided within **ES Volume 1, Chapter 8: Air Quality**, **ES Volume 1, Chapter 9: Noise and Vibration** and **ES Volume 1, Chapter 11: Climate Change and Greenhouse Gases**.

2.41 The approach taken to providing an outline of the evolution of the baseline is described within each of the individual technical ES chapters (**ES Volume 1, Chapters 6 to 11**, and **ES Volume 2: HTVIA**).

Potentially Sensitive Receptors

2.42 When undertaking an EIA, it is important to identify key potential receptors from the surrounding baseline context which may be impacted by the Proposed Development and may need to be considered as part of the assessment.

2.43 Within each of the technical ES chapters (**ES Volume 1, Chapters 6 to 11**, and **ES Volume 2: HTVIA**), a list of sensitive receptors is presented which are considered to have the potential to be affected by the Proposed Development.

2.44 The sensitive receptors identified within the technical ES chapters have been identified from a review of the available information collected as part of the description of the surrounding environmental and socio-economic context, as well as from historic and currently available information relating to the site itself (presented as part of the 'Baseline' description within the respective ES chapter). Potential receptors have also been identified from a review of the description of the Proposed Development sought for approval (see **ES Volume 1, Chapter 4: The Proposed Development**) and the potential impacts and resultant effects which may occur as a result of the redevelopment of the site.

Table 2.1 Potential Environmental Sensitivities / Sensitive Receptors

Topic	Potential Environmental Receptor
Socio-Economics	• Existing employment • Existing additional expenditure • Construction employment • Construction additional expenditure and supply chain • Availability of housing • Capacity of primary healthcare • Capacity of primary schools • Capacity of secondary schools • Capacity of open space • Capacity of play space • Availability of employment • Employee expenditure • Household expenditure

Topic	Potential Environmental Receptor
Air Quality	- Residential Properties along A329 (Receptors C11-C25) - Residential Properties along Castle Street (Receptors C1-10, C26, and C27) - Introduced receptors within the Proposed Development (D1-D23)
Noise and Vibration	- Existing receptors: 42 Oxford Street (R1) - McIlroys Building (R2) - City Wall House Aparthotel (R3) 59-61 St Marys Butts (R4) - Allied Arms Public House (R5) - Castle Street flats (R6) - The Sun Inn Public House (R7) - Queens Court student accommodation (R8) - Pentahotel Reading (R9) - Travelodge Reading Central (R10) - Hexagon Theatre (R11) 2 – 42 Howard Street (R12) - Broad Street Mall (R13) - Introduced Receptors: - Building C (R14) - Building D (R15)
Daylight, Sunlight, Overshadowing	40-42 Oxford Road 38 Oxford Road - McIlroys Building 61-62 St Mary's Butts 59-60 St Mary's Butts 58 St Mary's Butts 57 St Mary's Butts 55-56 St Mary's Butts - Reading Minster 2-6 Castle Street 8 Castle Street - Church of St Mary's 16 Castle Street 15 Queens Walk (Queens Court) - Amenity Areas: 1: Public space - pedestrian shopping street - Oxford Road 2: Public space - pedestrian shopping street - St Mary's Butts 3: Public amenity space (adjacent to St Mary's Butts, the south of site) 4 and 5: Public space - pedestrian shopping street - Hosier Street 6: Public space - pedestrian shopping street - Queens Walk
Wind Microclimate	- On-site locations: - Throughfares - Entrances - Car Parks - Amenity Areas Upper Levels - Balconies - Off-site locations: - Throughfares - Entrances - Amenity Areas Ground Level
Climate Change	Global Climate

Topic	Potential Environmental Receptor
Heritage, Townscape and Visual	- Heritage: 1: Church of St Mary 2: Greyfriars Church 4: Church of St Mary 5: 15 and 17 Castle Street and 19 Castle St and associated front railings 6: Culvert on Holy Brook 7: Holybrook House 8: Nos 154-160 (even) and railings to street 11: The Sun Inn 12: The Allied Arms Inn 13: 55 and 55a St Mary's Butts 14: 8, 10 and 12 Castle Street and former cottage at rear of no.8 15: Queen Victoria Jubilee Foundation 16: 38 Oxford Road and 3 and 5 Cheapside 17: 33, 36 and 37 St Mary's Butts and the Horn Inn 18: 21, 23 and 25, 27 and 29 Castle Street 19: 11, and 13, Castle Street 20: 33, 35, 37 and 39 Castle Street 21: 7 and 9 Castle Street 22: Jubilee Cross 23: Group of 4 Churchyard Tombs North of St Mary's Church 24: 43,45,47,49 and 51 Castle Street 25: 67 and 68 Broad Street 26: 2 and 4, and 6, 8 and 10 Bridge Street 29: Church House, and Building to the West of Church House 30: Talbot House 31: Kent House 33: Vachel Almshouses 34: Group of 4 Churchyard Tombs, East of St Mary's Church 35: 7,8 and 9 Gun Street 36: Rix Borough House 37: 59 and 61 Castle Street 39: 10, 11 and 12, and 13 and 14, Gun St 40: Quadrant Walls and Railings to Former No 64 (Greyfriars Vicarage) 41: La Corbiere Restaurant 42: Seven Bridges House 45: Mannson House 46: Horse and Jockey Public House, and Culham House 47: Simmonds Malthouse 48: Building now part of Courage's Brewery 49: 97-105 Castle Street 52: 24, 126, and 128-132, Castle St 53: 107, 109, and 111, Castle St. 55: 33-39 Baker Street 56: 134-144 Castle Street 60: 113, 115, and 117-121, Castle Street 61: 39 and 141, Oxford Road 66: Church of The Holy Trinity 67: Castleton House, and Clevedon House 68: 55 Baker Street 69: 144a-152, Castle Street 73: 6-22 Russell Street 74: 118 Oxford Road 75: 41 Russell Street 79: 24-34 Russell Stret 81: 2-13 Coley Hill 83: 26 and 28 Southampton Street 86: 149-169 Oxford Road 89: 15, 15a,17 and 17a, Coley Hill 91: 36, 38 and 38a, 40 and 42, 44 and 46, and 48 and 50, Russell St 95: 62a Castle Street 97: 21-25, 27, 29, and 31-35 Coley Hill 103: 120 and 122 Oxford Road 105: Yeomanry House 106: 68, 172 and 174, Castle St 107: Reading Synagogue 108: Church of St Giles and Churchyard Tombs 110: 171-177 Oxford Road 112: 124 Oxford Street 117: 61-79 Baker Street

Topic	Potential Environmental Receptor
	- A: St Mary's Butts Conservation Area - B: Russell Street and Castle Hill Conservation Area - 122: The Forbury Garden (Registered Parks and Gardens) - 121: The Former Cross Keys PH (Non-designated heritage receptor) • Townscape Character Area: - 1: Reading Town Centre - 2: Residential - 3: Historic Core: - 4: Civic Centre • Visual: - Road users within Reading town centre - Pedestrians within Reading town centre - Leisure/amenity users of Reading town centre - Users of St Mary's Church and Churchyard - Residents on the edge of Reading town centre - Users of Forbury Gardens - Users of Balmore Park - Users of McIlroy Park - Users of Kings Meadow

Impact Assessment – General Methodology

- 2.45 Detailed methodologies for the assessment of each of the environmental topic areas scoped into the EIA are provided within each technical ES chapter (ES Volume 1, Chapters 6 to 11, and ES Volume 2: HTVIA), however, in general terms, the assessments have been based upon:
 - Understanding the baseline condition, either through:
 - Desk-top studies;
 - Site surveys;
 - Understanding the policy context and the implications for assessment, including:
 - Consideration of relevant legislation;
 - Consideration of relevant planning policies (national, regional and local);
 - Identify potentially sensitive receptors that could be impacted by the Proposed Development;
 - Identification of potential environmental impacts, with an evaluation of their likely magnitude, and resultant effects in terms of their nature, scale, geographic extent, duration and whether they are direct or indirect or transboundary, involving either:
 - The use of technical guidance and best practice; and/or
 - Expert opinion; and/or
 - The consideration of any embedded or primary mitigation;
 - Consideration of the requirement for any additional mitigation; and
 - Consultation with any interested and affected parties.
- 2.46 Mitigation is the term used to refer to the process of avoiding where possible and, if not, minimising, controlling and/or off-setting potentially significant adverse effects of a development. Mitigation measures can relate to the design stage; the construction stage; or the activities associated with the operation of the completed Proposed Development.
- 2.47 As part of the EIA, an iterative approach has been adopted where significant environmental effects have been identified and avoided where possible in the first instance through consideration of alternative design solutions and design refinements, as reported upon within ES Volume 1, Chapter 3: Alternatives and Design Evolution. Where able, opportunities to reduce or control impacts and effects have been identified and incorporated into the Proposed Development (i.e. embedded mitigation). In addition, the design process seeks to promote opportunities to enhance the beneficial environmental effects of the Proposed Development.

- 2.48 Within each technical ES chapters (ES Volume 1, Chapters 6 to 11 and ES Volume 2: HTVIA), the assessment of the effects that are likely to arise because of a potential impact / change to receptors from the Proposed Development is presented. If any mitigation measures are required, further to the already integrated into the Proposed Development throughout its evolution, these are incorporated, and the Proposed Development is reassessed to ascertain the likely residual effects and any which are significant. This is reported on within each technical ES chapter (ES Volume 1 and ES Volume 2).
- 2.49 How the Proposed Development might affect the environment relies on predictions about what impact a certain action will have. Some predictions can be made using mathematical or simulation models (i.e. quantitative assessment). Other impacts are less easy to predict in quantitative terms, and in such cases, the EIA attempts to quantify the anticipated scale of impact using professional judgement (i.e. qualitative assessment).
- Impact Assessment
- 2.50 Impact assessments are undertaken for the following stages of the Proposed Development:
 - During the demolition and construction works;
 - Once the Proposed Development is complete and occupied; and
 - Cumulative effects assessment – the Proposed Development with other surrounding development schemes, often referred to as ‘cumulative schemes’.
- Demolition and Construction
- 2.51 The ES Volume 1, Chapter 5: Demolition and Construction provides an outline of the anticipated demolition and construction programme, as well as related activities and aspects (i.e. enabling works, substructure works, superstructure works etc., excavation volumes and construction material quantities, HGV movements and HGV routing).
- 2.52 The programme represented is based on reasonable assumptions in terms of the sequencing of the works and site logistics that will be implemented. The programme is considered achievable based on the current level of demolition and construction planning and anticipates the period of demolition and construction works are continuous. The programme presents an overlap of construction activities with other stages of work and therefore assumes multiple construction activities occurring across the site. It is also assumed that impacts of a higher magnitude over a shorter duration are considered to be potentially greater in terms of the likely effect on a receptor, than an impact of lower magnitude spread over a longer duration. The EIA, therefore, assesses the worst case effects (in terms of magnitude of impact) as a result of multiple construction activities occurring on-site at any particular time.
- 2.53 The information presented informs the demolition and construction impact assessments of each technical ES chapters (ES Volume 1, Chapters 6 to 11, and ES Volume 2: HTVIA).
- 2.54 In summary, the ES includes a quantitative assessment of the demolition and construction related effects for the following technical topics: socio-economics, air quality, noise and vibration and greenhouse gas. Demolition and phased construction effects associated with daylight, sunlight and overshadowing, wind microclimate, townscape, built heritage and visual impacts are qualitatively addressed within the ES, mainly in respect of temporary effects relating to the temporary loss of massing on-site as a result of demolition and the progressive increase in massing as a result of construction of the Proposed Development and effects on daylight / sunlight availability and microclimate to surrounding receptors and temporary effects to the setting of buildings with heritage value and local views.
- 2.55 Within the construction impact assessments, standard environmental controls required under legislation and best practice guidance are considered (i.e. embedded mitigation) and will be clearly presented within the respective technical ES chapter as to how they are accounted for within the corresponding assessment..
- 2.56 The construction assessments also identify (where required) the need for any additional or bespoke environmental management or mitigation measures in order avoid, prevent, reduce or off-set any significant adverse effects identified.
- 2.57 A description of any proposed monitoring arrangements is also provided and defines (where appropriate) the procedures regarding the monitoring of the relevant significant adverse effects, the types of parameters to be monitored and the monitoring duration.
- 2.58 All the measures proposed within the technical ES chapters are compiled and presented in a mitigation and monitoring schedule within ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring.

2.59 It is anticipated that any required construction related environmental management / mitigation and monitoring measures identified within the ES would be secured and controlled through appropriate Construction Environmental Management Plan (CEMP) and Construction Logistics Plan (CLP) (further discussed within **ES Volume 1, Chapter 5: Demolition and Construction** and it is proposed that the requirement for these documents be secured by means of suitably worded planning conditions to be attached to the permissions (if granted).

2.60 The socio-economics assessment has also considered the loss of existing employment resulting from the Proposed Development. As it is understood that the existing TK Maxx retail store will be relocated from the Broad Street Mall Shopping Centre to the nearby Oracle Shopping Centre, this has been considered as part of the assessment.

Phasing

2.61 The demolition and construction of the Proposed Development will be predominantly carried out within one continuous phase, as discussed within **ES Volume 1, Chapter 5: Demolition and Construction**. However, staggered occupation of the site on completion of the individual buildings is proposed, occurring over a 6-month period. Where relevant, this is considered within the technical assessments.

Completed and Occupied Development

2.62 The ES presents a description of the Proposed Development in **ES Volume 1, Chapter 4: Proposed Development** to provide suitable context to enable the assessment of potential and likely significant environmental effects. Enough information on the Proposed Development, in terms of the key aspects (as listed below), is presented to allow an understanding of the development being proposed, to enable the assessment of potential impacts and likely significant environmental effects of the completed and occupied development. Any assumptions are clearly presented in the narrative.

2.63 Information on the details of the Proposed Development sought for approval are provided in **ES Volume 1, Chapter 4: Proposed Development** and include but are not limited to:

- Layout – building footprints;
- Means of access and egress and circulations – vehicular and pedestrian and cyclist accessibility into, out of and around the site;
- Scale – the massing, specifically heights of buildings;
- Amount of development – floors areas and uses classes, residential unit numbers and mix;
- Appearance – architectural detail and materiality of the new build;
- Landscaping – including planting strategy, species and habitats;
- Amenity space – amount of on-site provision;
- Plant locations;
- Proposed energy strategy;
- Deliveries and servicing strategy (including overview of estimates of the types and quantities of waste anticipated, and strategy for waste storage, handling and collection);
- Parking provision (including vehicles, motorcycle, and cycle); and
- Utilities overview (including water supply and wastewater / surface water drainage volume estimates).

2.64 In addition, where necessary to inform the impact assessments, details of the Proposed Development have been taken from other documents that have been prepared for the purposes of and which are submitted as part of or in support of the planning application, for example, the Design and Access Statement, Energy Strategy, Sustainability Statement and Planning Statement. Where information from these documents have been relied upon, the information has been presented within the ES.

Flexible Use Class E

2.65 The Proposed Development will provide up to 1,770m² Gross Internal Area (GIA) of flexible use class E floorspace across the site. For the purposes of the Proposed Development, all sub-uses under class E may be applied. These comprise the following:

- Use class E(a) for the display or retail sale of goods, other than hot food, principally to visiting members of the public; and/ or
- Use class E(b) for the sale of food and drink principally to visiting members of the public where consumption of that food and drink is mostly undertaken on the premises; and / or
- Use class E(c) for the provision of:
 - (i) financial services, or
 - (ii) professional services other than health or medical services, or
 - (iii) any other services which it is appropriate to provide in commercial, business or service locality; and / or
- Use class E(d) for indoor sport, recreation or fitness, not involving motorised vehicles or firearms principally to visiting members of the public; and / or
- Use class E(e) for the provision of medical or health services, principally to visiting members of the public, except the use of premises attached to the residence of the consultant or practitioner; and / or
- Use class E(f) for a creche, day nursery or day centre not including a residential use, principally to visiting members of the public; and / or
- Use class E(g) for
 - (i) an office to carry out operational or administrative functions; and / or
 - (ii) the research and development of products or processes; and / or
 - (iii) industrial processes.

2.66 While the Proposed Development is seeking flexible Class E uses within the ground floor level of the buildings, the main assessment of the impacts of the non-residential elements of the Proposed Development are understood to likely comprise of the following: Class E (a) (retail), Class E(b) (food and beverage), and Class E(c) (office and flexible workspace) space, which is based on the indicative split of Class E sub-uses set out in **ES Volume 1, Chapter 4: The Proposed Development**. These comprise the following (in GIA):

- Class E (a) (retail) and Class E(b) (food and beverage) – 1,770m²; and
- Of which, 464.50m² could comprise Class E(c) (office and flexible workspace) space.

2.67 To ensure that the ES considers a worst-case scenario in terms of the potential Class E uses that could come forward as part of the Proposed Development, the following sections detail how this has been assessed for the technical topics affected by floorspace use flexibility. Details of the worst-case scenarios assessed in relation to these uses is set out in the 'Impact Assessment Methodology' sections of the respective technical chapters of **ES Volume 1**.

Minimum Employment Generating Scenario

2.68 A sensitivity test has been undertaken as part of the socio-economics assessment presented within **ES Volume 1, Chapter 6: Socio-Economics** to determine how the flexibility within use class E could affect the conclusions of the assessment.

2.69 For the purposes of the assessment, it has been assumed that all the non-residential floorspace be considered against a worst-case scenario for both employment generation and additional spending impacts on the local economy. Refer to **ES Volume 1, Chapter 6: Socio-Economics** for details on this approach.

Maximum Transport Generating Scenario

2.70 In terms of traffic and transport, the uses which are likely to result in the highest number of vehicle movements have been considered as the reasonable worst-case within the main assessment. A review of the worst-case land uses by the Transport Consultant (Stantec) identified that the consideration of the floorspace comprising a mixture of retail and food and beverage uses would be a reasonable worst-case assessment, due to the number of trips generated.

2.71 As the traffic flows are utilised by the air quality, noise and vibration and climate change assessments, these assessments have also inherently assessed a reasonable worst-case with regards to traffic generation.

IDENTIFICATION OF IMPACTS, EFFECTS AND EFFECT SIGNIFICANCE

Terminology and Definitions

Reference to 'Impact' and 'Effect'

2.72 The terms 'impact' and 'effect' are distinctly different. Having gained an understanding of the likely impact it is then important to know whether the change in environmental or socio-economic conditions results in a significant environmental effect. The impacts of the Proposed Development may or may not result in significant effects on the environment, depending on the sensitivity of the resource or receptor and potentially other factors (such as duration). The assessment of the likely significant effects of the development is a requirement identified by Schedule 4 of the EIA Regulations.

Receptor Sensitivity and Magnitude of Impact

2.73 To achieve a consistent approach across the different technical disciplines addressed within the ES, assessments broadly define the sensitivity of the receptors that could be affected by the Proposed Development and the magnitude of impact or change from the baseline conditions in order to derive the resultant effect.

2.74 Terminology available to describe the sensitivity of receptors and magnitude of impact or change from the baseline conditions is broadly as follows:

- High;
- Medium;
- Low;
- Very Low; and
- No Impact (in relation to magnitude of impact or change only).

2.75 Each of the technical assessment chapters of the ES (ES Volume 1, Chapters 6 to 11, and ES Volume 2, HTVIA) provide further detail on the definition of each of the above terms specific to the topic in question and also provide the criteria, including sources and justifications, for quantifying the different levels of receptor sensitivity and 'impact magnitude'. Where possible, this is based upon quantitative and accepted criteria (for example, national standards for air quality and noise), together with the use of value judgement and expert interpretation.

2.76 Alternatively, some technical assessment chapters differ in the terminology adopted to describe the magnitude of impact or change from the baseline conditions. Where this occurs, the alternative terminology adopted has been clearly set out within the individual ES chapter.

Identification of the Scale of Effect

2.77 The basis for determining the resultant scale of effect generally takes into account the sensitivity of the receptor and magnitude of impact or change from the baseline conditions, which when combining these two factors into a matrix, can help determine the resultant scale of effect (representative matrix as shown in Table 2.2).

Table 2.2 Scale of Effect Matrix

Receptor Sensitivity	Magnitude of Impact			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very Low	Minor	Negligible	Negligible	Negligible

2.78 Table 2.3 provides the broad definition of the 'scale' of the resultant effect i.e. definitions of Major, Moderate, Minor and Negligible effects. The definitions in Table 2.3 may be adjusted to suit the technical topic in question; where this is the case revised definitions of effect scale are presented in the technical assessment chapters (ES Volume 1, Chapters 6 to 11, and ES Volume 2: HTVIA).

2.79 Where there is no impact to a receptor and therefore 'No Effect', this is stated.

Table 2.3 Broad Definitions of the Scale of the Effect

Scale of Effect	Description
Major	These effects may represent key factors in the decision-making process. Potentially associated with sites and features of national importance or could be important considerations at a regional or district scale. Major effects may also relate to resources or features which are unique to a receptor and which, if lost, cannot be replaced or relocated.
Moderate	These effects, if adverse, are likely to be important at a local scale and on their own could have a material influence on decision-making.
Minor	These effects may be raised as local issues and may be of relevance in the detailed design of the project but, are unlikely to be critical in the decision-making process.
Negligible	Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error, these effects are unlikely to influence decision-making, irrespective of other effects.

Effect Nature

2.80 Table 2.4 provides a definition of the 'nature' of the resultant effect.

Table 2.4 Definition of the Nature of the Effect

Nature of Effect	Description
Adverse	Detrimental or negative effects to an environmental / socio-economic resource or receptor. The quality of the environment is diminished or harmed.
Beneficial	Advantageous or positive effect to an environmental / socio-economic resource or receptor. The quality of the environment is enhanced.
Neutral	Either there is no noticeable beneficial or adverse effect, or the effect is considered neither beneficial nor adverse overall, having made a 'net equation' judgment that takes into account both beneficial and adverse impacts.

Geographic Extent of Effect

2.81 The ES (Volume 1 and Volume 2) identifies the geographic extent of the identified effects. At a spatial level, 'site' or 'local' effects are those affecting the site and neighbouring receptors, while effects upon receptors in the wider area / borough, beyond the vicinity of the site and its neighbours, are at a 'district / borough' level. Effects affecting Berkshire are at a 'regional' level, whilst those which affect different parts of the country, or England, are considered being at a 'national' level. Global effects (i.e. effects on the global climate) are at an 'international' level.

Effect Duration

2.82 For the purposes of the ES, effects that are generated as a result of the construction works (i.e. those that last for this set period of time) will be classed as 'temporary'; these maybe further classified as either 'short term' or 'medium-term' effects depending on the duration of the construction works that generate the effect in question. Effects that result from the completed and operational Proposed Development will be classed as 'permanent' or 'long-term' effects.

Direct and Indirect Effects

2.83 The ES identifies whether the effect is 'direct' (i.e. resulting without any intervening factors) or 'indirect' or 'secondary' (i.e. not directly caused or resulting from something else).

Effect Significance

2.84 Following identification of an effect and the implementation of mitigation measures, the residual effect scale, nature, geographic extent and duration and whether the effects are direct or indirect, using the above summarised terminology, a clear statement is then made within the ES (Volumes 1 and Volume 2) as to whether the effect is significant or not significant. Each technical assessment determines at what scale an effect is deemed to be significant, as this varies depending on the topic.

2.85 As a general rule, the following applies although where this differs for a technical topic, this has been clearly stated in the topic's methodology):

- 'Moderate' or 'major' effects are deemed to be 'significant';
- 'Minor' effects are 'not significant', although they may be a matter of local concern; and
- 'Negligible' effects are 'not significant' and not a matter of local concern.

2.86 Where mitigation measures are identified to either eliminate or reduce adverse effects, these will be incorporated into the ES, for example either through the design, or will be translated into construction commitments; or operational or managerial standards / procedures. It should be noted that mitigation is not required for effects that are deemed to be negligible as the effect will be imperceptible.

2.87 The ES will then highlight the 'residual' effects (those effects which remain following the implementation of suitable mitigation measures).

Cumulative Effects and Effect Interactions

2.88 The EIA Regulations require that, in assessing the effects of a particular development proposal, consideration should also be given to the likely significant effects arising from the "cumulation with other existing and/or approved projects" (Schedule 4, 5(e)).

2.89 Cumulative effects can occur as interactions between the effects associated with a number of projects in an area which may, on an individual basis be insignificant, but together (i.e. cumulatively), result in a significant effect. Cumulative effects arising from the Proposed Development in combination with other development schemes ('cumulative schemes') has been considered throughout the ES. The potential for cumulative effects arising during the demolition and construction works, and once the Proposed Development is complete and operational is considered.

2.90 Each individual technical chapter of the ES presents an assessment of the cumulative effects of the Proposed Development coming forward in isolation and alongside other surrounding cumulative schemes..

2.91 The EIA identifies the potential for the following, which is described below:

- Effect Interactions; and
- Cumulative Effects with Other Developments.

Effects Interactions

2.92 Effect interactions from the Proposed Development itself on surrounding sensitive receptors during the construction works and also once the Proposed Development is completed are considered within this ES (**ES Volume 1, Chapter 12: Effects Interactions**). Effect interactions occur as interactions between effects associated with just one project, i.e. the combination of individual effects arising as a result of the Proposed Development; for example, effects in relation to noise, airborne dust or traffic on a single receptor.

2.93 Effect interactions from the Proposed Development itself on particular receptors at the site and surrounds has been considered during the demolition and construction works, and also once the Proposed Development is completed and operational. Dependent on the relevant sensitive receptors, the assessment focuses either on key individual receptors or on groups considered to be most sensitive to potential effect interactions. The potential interaction of residual effects that are of minor, moderate or major scale (see section 'Identification of Impacts, Effects and Effect Significance' above for further details) has been considered within this assessment. Residual effects which are negligible are excluded from this assessment as, by virtue of their definition, they are considered to be imperceptible; therefore, the combination of any imperceptible effects should remain as being imperceptible.

2.94 There is no established methodology for assessing effects interactions on a particular receptor. Therefore, a scale of effect is not be applied to the combination of individual effects (such as Negligible, Minor, Moderate or Major). However, the European Commission has produced guidelines to assist EIA practitioners in developing an approach which is appropriate to a project. These guidelines²⁶ have been used to develop an approach which uses the defined residual effects of the Proposed Development (as presented within the technical chapters of the ES) to determine the potential for effect interactions. Therefore, relevant effect interactions are discussed and where possible, professional judgement has been applied to determine whether the effect interaction is considered significant.

2.95 Consideration of effect interactions are presented within **ES Volume 1, Chapter 11: Effect Interactions**.

Cumulative Effects with Other Cumulative Schemes

2.96 The EIA Regulations require that, in assessing the effects of a particular development proposal, consideration should also be given to the likely significant effects arising from the "cumulation with other existing and/or approved projects" (Schedule 4, 5(e)).

2.97 Cumulative effects can occur as interactions between the effects associated with a number of projects in an area which may, on an individual basis be insignificant, but together (i.e. cumulatively), result in a significant effect. Cumulative effects arising from the Proposed Development in combination with 'other existing and / or approved projects' ('cumulative schemes') are considered throughout the ES. The potential for cumulative effects arising during the demolition and construction works, and once the Proposed Development is complete and operational, are considered. Each individual technical chapter of the ES presents an assessment of the cumulative effects of the Proposed Development coming forward alongside the cumulative schemes.

2.98 For ease of reference, the 'Cumulative Assessment' section within each ES chapter presents the consideration of the cumulative schemes as 'Scenario 1' – the alternative scenario taking into account the Minster Quarter Street Area Development Framework (MQADF) will be presented as 'Scenario 2' (see further discussion below).

2.99 The cumulative schemes that are considered within the ES are typically be located within a 1km radius from the site, as this spatial extent is considered appropriate for determining cumulative effects in this locality.

2.100 This catchment area has been set to provide a reasonable study area for the assessment of cumulative effects. It is acknowledged that for certain topics of the EIA (specifically townscape and visual), there may be a need to consider more distant schemes within the cumulative effects assessment. This is entirely appropriate, given for example, the view locations associated with the townscape and visual effects assessment.

2.101 With regards to traffic and transport considerations, major schemes beyond the 1km radius may also be accounted for to acknowledge the spatial connection with the Proposed Development via the local road network (refer to list of schemes presented within **ES Volume 3, Appendix: EIA Methodology - Annex 2**. It should be noted that the approach to the assessment of cumulative effects is synonymous with the impact assessment methodology by virtue of the fact that deriving a future road traffic baseline would account for road traffic movements associated with the cumulative schemes as background road traffic growth, many of which are likely to be more than 1km distant on the road network from the site. This approach is entirely appropriate, given the potential for wider reaching noise and air quality traffic impacts.

2.102 Generally, the criteria for the cumulative schemes included within the cumulative effects assessment includes the following:

- Are located within a 1km radius from the centre of the Proposed Development, as this spatial extent is considered appropriate for determining cumulative effects in this locality;
- Have full planning consent, a resolution to grant consent, or are applications that have been submitted but not yet determined;
- Produce an uplift of more than 10,000m² (Gross External Area (GEA) of mixed-use floorspace), or over 150 residential units; and
- Any office to residential conversions (granted under the General Permitted Development Order) giving rise to more than 150 residential units.

2.103 These parameters have been set to allow for an initial screening exercise to determine the schemes that, based on the scale of redevelopment (amount and mix of uses), could potentially have a cumulative effect with the Proposed Development and should be considered further within the cumulative effects assessment of the EIA.

2.104 By applying these parameters to all the schemes coming forward, the cumulative effects assessment of the EIA becomes more focused on the larger schemes (i.e. those with the potential to interact in a cumulative manner), which have more potential to interact in a cumulative manner. Each technical chapter of the ES is clear on the cumulative schemes that have been considered within the cumulative effects assessment of the topic in question, including a reasoning behind their inclusion. Where cumulative schemes are 'screened out' of the cumulative effects assessment, the reasoning for doing so is presented.

2.105 The following cumulative schemes have been considered:

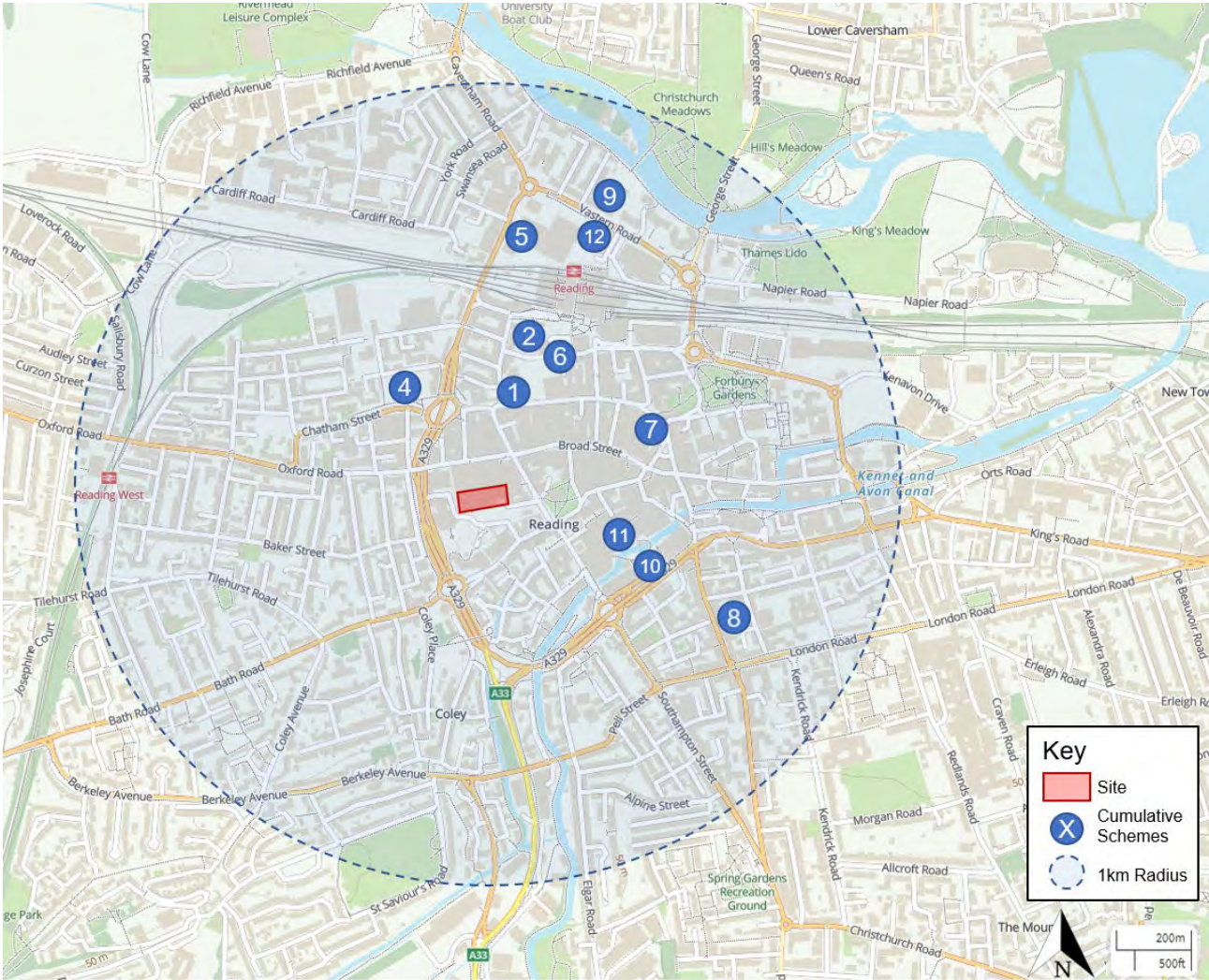
²⁶ European Community (1999); Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions.

- 1 52-55 Friar Street Reading and 12 Greyfriars Road, RG1 1DX
- 2 Station Hill, Reading including Plot E and Telecom House
- 4 Land between Weldale Street and Chatham Street Reading
- 5 Former Sorting Office, Caversham Road / Vastern Road
- 6 29 Station Road, Reading, RG1 1LG
- 7 Bristol & West Arcade Market Place Reading RG1 1JL
- 8 Former Car Park East Street Reading RG1 4QH
- 9 55 Vastern Road Reading RG1 8BU
- 10 Existing Vue Cinema Complex Land West of Yield Hall Place / London Road The Oracle Reading RG1 2AG
- 11 Former Debenhams Department Store West of Yield Hall Place The Oracle RG1 2AS
- 12 Vastern Court Caversham Road Reading

* Reference 3 not used.

2.106 The location of the cumulative schemes is shown in Figure 2.1, and full details of these schemes are included in **ES Volume 3, Appendix: EIA Methodology - Annex 2.**

Figure 2.1 Cumulative Schemes



Minster Quarter Street Area Development Framework

- 2.107 The MQADF has been prepared by RBC (see section 'Planning Policy Context – Local Planning Policy') and provides a comprehensive masterplan and urban design framework for the area in and around Hosier Street, with a particular emphasis on creating high quality public realm around which various mixed uses will be located. The MQADF presents the development principles for the regenerating the Hosier Street area, including an outline framework and development parameters to assist with potential schemes coming forward in the future.
- 2.108 The 'Cumulative Effects Assessment' section within each ES chapter presents a consideration (qualitative assessment) of the MQADF, in addition to the Proposed Development and other cumulative schemes, as 'Scenario 2'.

STRUCTURE OF TECHNICAL ASSESSMENTS

2.109 This ES reports on the (as appropriate depending on the consideration of any embedded mitigation) potential (before mitigation) and residual (after mitigation) environmental effects of the Proposed Development during demolition and construction works and on subsequent completion and operation. The ES also concludes with a summary of the likely significant beneficial, neutral and adverse environmental effects of the Proposed Development (**ES Volume 1, Chapter 12: Likely Significant Effects**).

2.110 Each of the environmental topics considered in the EIA has been assigned a separate chapter in **ES Volume 1, Chapters 6 to 11**. Within each of the **ES Volume 1** technical chapters the assessment is presented and reported in the following format

- An Introductory Table - setting out the author of the technical topic assessment, identification of relevant appendices and any key topic related considerations;
- Assessment Methodology – an explanation of the approach to defining the baseline conditions and assessment scenarios and evolved baseline conditions, undertaking the impact assessment (construction and operation, and any key assumptions made) and the definitions of the nature and scale of effect and what effects are deemed to be significant;
- Baseline Conditions – a description of the baseline conditions of the site and surrounding area (as relevant to the technical topic in question);
- Receptors and Receptor Sensitivity – identification of the existing and introduced (new) receptors on the site and in the surrounding area that may be affected by the Proposed Development and identification of their sensitivity;
- Potential Effects – an assessment of the likely significant effects of the Proposed Development during demolition and construction and on completion, setting out the impacts and effects associated with each aspect of the assessment and an evaluation of their significance against defined criteria without the implementation of mitigation;
- Mitigation Measures, Monitoring and Residual Effects - a description of the mitigation measures that are being committed to and a summary of the residual effects of the Proposed Development;
- Assessment of Future Environment – an assessment of the likely significant effects of the Proposed Development in relation to both an evolution of the baseline conditions and any 'in combination' effects with the agreed cumulative schemes; and
- Likely Significant Effects – a short statement confirming which residual effects are considered to be significant.

2.111 **ES Volume 2** which comprises the Heritage, Townscape and Visual Impact Assessment, is structured as follows:

- Executive Summary – A summary of the TVIA
- Introduction – setting out the purpose of the volume;
- Methodology – an explanation of the assessment framework, in accordance with guidance relevant to townscape, built heritage and visual assessments.

- Legislation and planning policy – Including identification of relevant townscape, built heritage and visual legislation and planning policy;
 - Baseline: Heritage – an assessment of the site and its surroundings in the current site condition, including an overview of the history of the area;
 - Baseline: Townscape – an assessment of the site and its surroundings in the current site condition, including an overview of townscape baseline conditions;
 - Baseline: Visual – an assessment of the site and its surroundings in the current site condition, including an overview of the current visual conditions;
 - Consultation and Mitigation by Design – a summary of the consultation which has been undertaken for the Proposed Development and any embedded mitigation;
 - Assessment: Heritage – an assessment of the likely significant effects of the Proposed Development on built heritage receptors, including an assessment of the built heritage effects during the demolition and construction phase;
 - Assessment: Townscape – an assessment of the likely significant effects of the Proposed Development on townscape receptors, including an assessment of the townscape effects during the demolition and construction phase;
 - Assessment: Visual – an assessment of the visual receptors and an assessment of the likely significant effects of the Proposed Development, including an assessment of the visual effects during the demolition and construction phase, and the Proposed Development in conjunction with relevant cumulative schemes;
 - Temporary Construction Area Assessment – an assessment of the heritage, townscape, and visual effects during the temporary construction; and
 - Conclusion and Residual Effects Summary.
- Consented or reasonably foreseeable cumulative schemes will be implemented substantially in accordance with information that is publicly available and subject to the same regulatory regimes and good practice management controls as this Proposed Development.

ASSUMPTIONS AND LIMITATIONS

2.112 The principal assumptions that have been made, and any limitations that have been identified, in undertaking the EIA are set out below. Assumptions specifically relevant to each technical topic have been set out in each technical chapter of the ES:

- Baseline conditions have been established from a variety of sources, including historical data, but due to the dynamic nature of certain aspects of the environment, conditions at the site and surrounding land uses may change;
- It is assumed that information received from third parties is accurate, complete and up to date;
- The assessments contained within each of the technical assessment chapters of the ES (**ES Volume 1, Chapters 6 to 11**, and **ES Volume 2: HTVIA**) are based on the assumption that mitigation measures are implemented – as set out in application drawings, through regulatory regimes or via the management controls, within **ES Volume 1, Chapter 4: Proposed Development** and **ES Volume 1, Chapter 5: Construction**, as well as the mitigation and monitoring measures outlined within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**;
- Demolition and construction works across the site would take place substantially in accordance with the programme of works described in **ES Volume 1, Chapter 5: Demolition and Construction**;
- The aim of the EIA is not to assess the Proposed Development's compliance / performance against planning policy, as this is considered within the Planning Statement that accompanies the planning application. Instead, reference is made to relevant national, regional and local policy and guidance to inform the scope of the assessment, the assessment methodologies applied, and the existence of any sensitive receptors to be considered;
- Where detailed information has not been available, reasonable assumptions have been made, and have been clearly set out, based on the professional experience of the author of the ES chapter based on other developments of similar type and scale, to enable assessment of likely significant effects; and

Chapter 3: Alternatives and Design Evolution

INTRODUCTION

- 3.1 Under the 2017 EIA Regulations (as amended)¹, an ES is required to provide a “description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects”.
- 3.2 This chapter summarises the main design alternatives considered by the Applicant and provides a qualitative comparison of their relevant environmental aspects. The design evolution of the Extant Consent (**ES Volume 1, Chapter 1: Introduction**) has played a key role in establishing the principles of the design for the Proposed Development. This chapter therefore includes an overview of the design evolution of the Extant Consent for context.
- 3.3 A narrative is provided on the evolution of the selected design option for the site focussing on key design modifications made during the design evolution process. This information has been drawn from the Design and Access Statement, which provides a detailed review of the evolution of the design of the Proposed Development. Environmental considerations which have influenced the design evolution process are discussed where relevant.

POLICY BRIEF

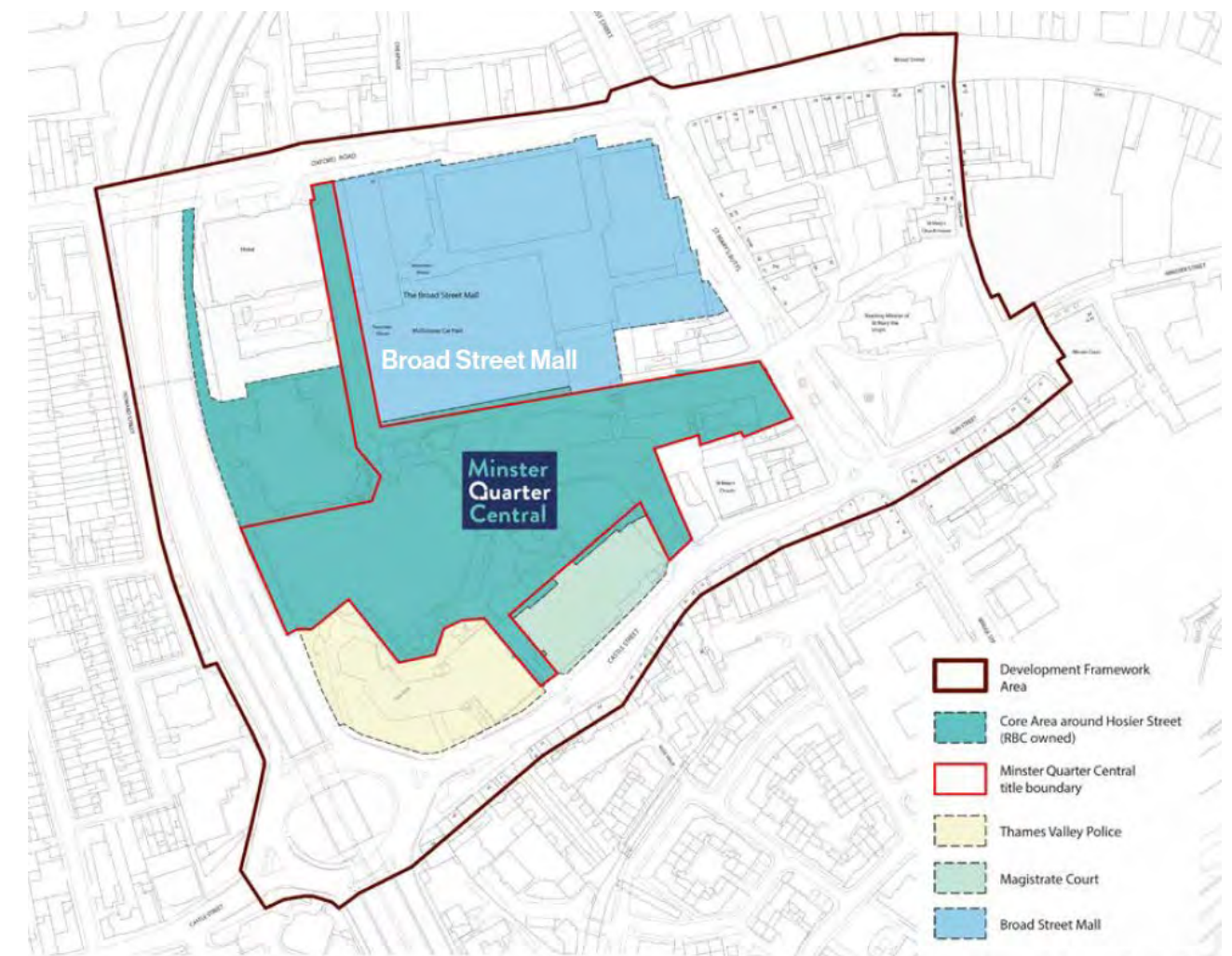
Minster Quarter Area Development Framework (MQADF)² (2018)

- 3.4 The Minster Quarter area is the subject of a policy in the Reading Borough Local Plan (see background context, refer **ES Volume 1, Chapter 2: EIA Methodology**). However, with the various sites, and other adjoining land being in different ownerships, and likely to come forward at different times, Reading Borough Council (RBC) has identified the need for a detailed framework to guide and co-ordinate the various developments and to ensure the most appropriate form of development to serve the wider area.
- 3.5 The vision for this area is:
- “a distinctive and high quality, high density, mixed use area within Reading’s Central Core. The area will portray a unique character and sense of place retaining the historical associations of the area and its wider environs, providing high quality public realm, both through the enhancement of existing public spaces adjacent to the site and the provision of new spaces that provide a setting and focus for new development.”*
- 3.6 A key note on the building heights in relation to Station Hill development³ is set out below:
- “The hub and spoke approach to tall buildings in the town assigns pre-eminence and dominance to the central cluster at Station Hill. Consequently buildings on the site will need to perform a supporting function to the central cluster at the station.”*
- 3.7 The framework identifies the opportunity for four tall buildings located on the podium level of the Broad Street Mall. Additionally, the framework stipulates a nominal height capacity of 20 storeys above podium level, in relation to the Station Hill development (referenced as a cumulative scheme for inclusion in the cumulative assessment of this ES, see **ES Volume 1, Chapter 2: EIA Methodology**).
- 3.8 The framework identifies that the tall buildings within the area should be subservient to the development at Station Hill, but the nonetheless should be a significant landmark with long range and skyline visibility.
- 3.9 The framework identifies the height classifications as well as the general principle of grading down towards the St Mary’s Butt’s and Castle Street Conservation Area.
- 3.10 The core area of the MQADF, as identified in Figure 3.1, is currently subject to a bidding process which is nearing completion and will provide more certainty regarding likely future development scenarios for the adjacent land to the south. In line with policy ambitions set out in the Local Plan Update regarding housing quantum and mix, it is possible that opportunity for higher densities and height will be explored in order to meet challenging housing need requirements imposed on the Council post-adoption of the current Local Plan⁴. However, as this is not currently considered within policy, nor the bidding process for future development finalised, consideration has been given to the adopted MQADF.

Reading Tall Building Strategy

- 3.11 The Reading Tall Building Strategy⁵ identifies that site is located within the Western Cluster (Figure 3.2).
- 3.12 The Western Cluster is identified as being suitable for:
- ‘Up to three tall buildings would be appropriate, focused along the line of the Inner Distribution Road (IDR), to mark the area as the civic heart of Reading and a gateway to the centre’*
- ‘Transition in scale should be achieved by including angular planes which ensure that tall buildings step away from the lower scaled neighbouring buildings and the use of setbacks that are aligned with surrounding building heights.’*

Figure 3.1 Location of Broad Street Mall within the context of the Minster Quarter Area Development Framework



¹ His Majesty’s Stationery Office (HMSO) 2017. The Town and Country Planning (Environmental Impact Assessment) (England) Regulations 2017 (as amended in 2018 and 2020).

² Website: http://www.reading.gov.uk/media/9963/Minster-Quarter-Area-Development-Framework-Part-1/pdf/Minster_Quarter_Area_Development_Framework_Part_1.pdf

³ Located approximately 500m northeast of site, planning reference: 151427.

⁴ Through the NPPF 2021 Standard Methodology ‘Urban Uplift’

⁵ Reading Borough Council (RBC) 2008. Reading Tall Building Strategy

Figure 3.2 Preferred Tall Building Locations



ENVIRONMENTAL CONTEXT

Air Quality

- 3.13** The site is located within RBCs Air Quality Management Area (AQMA) occupying the centre of Reading and the main arterial roads. The Reading AQMA was declared for exceedances of the annual mean nitrogen dioxide (NO₂) Air Quality Objective (AQO).

Noise and Vibration

- 3.14** The likely sources of noise and vibration for the site would be from the Hexagon Theatre, adjacent to the site to the southeast, the railway line to the north of Reading city centre, and the A329 ring road 80m to the west.
- 3.15** Noise and vibration sensitive receptors in the vicinity of the site include existing and future residents, offices, Lavender Place Community Gardens, and the commercial units associated with Broad Street Mall and those in the wider surrounding area.

Highways and Transport

- 3.16** The site is located within Reading town centre and therefore within easy walking distance of high frequency public transport services. Numerous bus stops are accessible via a short walk which are served by approximately 30 routes which have frequencies in the range of 1 per hour to 8 per hour.
- 3.17** The site is located less than 750m walking distances (approximately 9 minutes) of Reading Railway Station, which has direct connections to major destinations in the UK including London, Gatwick Airport, Bristol and the South West, Birmingham and Southampton.
- 3.18** Primary vehicle access to the site is gained from the basement level which provides access to the shopping centre service area and Multi-Storey Car Park (MSCP). The basement level access roads can be accessed from the south via Castle Street and from the west via the A329 Inner Distribution Road (IDR). To the east Hosier Street provides access to Dusseldorf Way.
- 3.19** Pedestrian access to the site can be gained from multiple points around the site. Queens Walk and Dusseldorf Way, which form the west and southern boundary of the site, provide traffic free routes and link to Oxford Road and Hosier Street / St Mary's Butts. To the south, pedestrian and cycle access is provided onto Castle Street via San Francisco Libre Walk.

Ecology and Biodiversity

- 3.20** No semi-natural habitats or notable features are provided on-site (with the exception of active feral pigeon nests). There is considered to be no potential for protected species to utilise the site, with the exception of breeding birds. Potential impacts and legislation breaches relating to breeding birds will be mitigated by a check for nests by a suitably qualified ecologist immediately ahead of works commencing and protection of any active nests.
- 3.21** The site is not subject to any statutory or non-statutory nature conservation designations. There are no statutory nature conservation designations within 1km radius and there are three non-statutory designated sites (Local Wildlife Sites) within a 1km radius, including:
- Holy Brook (LWS) located approximately 490m south of site;
 - River Kennet / Kennet and Avon Canal (LWS) located approximately 780m south of site; and
 - Cow Lane Depot (LWS) located approximately 880m northwest of site.

Archaeology

- 3.22** An Archaeological Desk-Based Assessment (DBA) of the site has been undertaken. The DBA is appended to the ES (presented in **ES Volume 3, Appendix: Archaeology – Annex 1**).
- 3.23** The DBA identifies that there are no World Heritage, Historic Battlefield or Historic Wreck study sites within the site, or within the study area (note, the study area was a 250m radius around the site).
- 3.24** The Reading Area Action Plan (AAP) designation boundary lies adjacent, to the south, east and north, of the site. This designation comprises areas indicated as having the potential for archaeological discoveries. The archaeological potential can be influenced by geological, land use and topographical factors.
- 3.25** The site can be considered to have a low to moderate potential for post-medieval remains, low to moderate potential for Saxon remains and low to moderate potential for late medieval remains.
- 3.26** The existing basement covers approximately 88% of the site and will have removed all archaeological remains within its footprint. 5% remaining of the site is located at the northern edge of the footprint and is described on the topographic survey as a 'floated area'. It is assumed for the purposes of assessment that the depth of truncation is at least as deep as that of the existing basement levels. The remaining 7% of the site at the eastern edge and southeast corner of the footprint will also have been disturbed as part of the process of excavating the existing basement and the construction of the retaining walls. It is thus also very likely that this area has been heavily disturbed however, this has not been confirmed.
- 3.27** Subject to agreement with RBC's archaeological advisor in respect of relevant planning conditions attached to any consent for the Proposed Development (if granted), an investigation strategy is suggested for geo-archaeological boreholes to determine the depth of the underlying deposits in the areas outside of the existing basement. The results would be used to target further archaeological evaluation if necessary to confirm the

presence, nature and significance of archaeological remains and to ensure a mitigation strategy to render residual effects not significant in archaeological terms.

Townscape and Visual

- 3.28** The site forms part of the West Side Major Opportunity Area and is designated under Policy CR12d as a site for redevelopment. It also forms part of an area within Reading Borough identified as being appropriate for tall buildings, CR10b: Western Grouping.
- 3.29** Townscape character areas within 500m of the site boundary include Reading Town Centre, Residential, St Mary Butts Conservation Area, Shopping Centres, Institutional, Light Industrial, and the A329/Associated Roundabouts.
- 3.30** The site's baseline visibility is limited to the immediate roads and properties that overlook it, due to the site and surrounding area's flat landform and intervening built form and transport infrastructure.

Built Heritage

- 3.31** The site is not located in a conservation area and does not include any statutorily or locally listed buildings.
- 3.32** The St Mary's Butt's and Castle Street Conservation Area (made up of three character areas: St Mary's Church and Graveyard; St Mary's Butts and Gun Street and Castle Street Frontages), is located approximately 120m to the east of the centre of the site. The conservation area includes a number of statutorily listed buildings which include the following:
- St Mary's Church (Grade I) located approximately 145m to the east of the site;
 - 15, 17, 19 Castle Street (Grade II*), located approximately 135m to the southeast of the site;
 - Church of St Mary, Castle Street (Grade II*), located approximately 105m to the southeast of the site;
 - Culvert, Holy Brook (Grade II*), located approximately 185m to the southeast of the site;
 - Holybrook House (Grade II*), located approximately 250m to the southwest of the site;
 - Sun Inn (Grade II), located approximately 100m to the southeast of the site;
 - The Allied Arms Inn (Grade II), located approximately 30mm to the east of the site;
 - 8 and 10 and 12, Castle Street and Former Cottage at Rear of No 8 (Grade II), located approximately 125m to the southeast of the site;
 - 11 and 13 Castle Street (Grade II), located approximately 150m to the southeast of the site;
 - 33-37 and 39 Castle Street (Grade II), located approximately 160m to the southeast of the site;
 - 3 and 5, 7 and 9 Castle Street (Grade II), located approximately 165m to the southeast of the site;
 - Jubilee Cross (Grade II), located approximately 150m to the southeast of the site;
 - Group of 4 Churchyard Tombs North of St Mary's Church (Grade II), located approximately 155m to the southeast of the site;
 - 43, 45, 47 and 49 and 51 Castle Street (Grade II), located approximately 180m to the southwest of the site;
 - 2 and 4 and 6-10 Bridge Street (Grade II), located approximately 185m to the southeast of the site;
 - Church House and Building to West of Church House (Grade II), located approximately 190m to the east of the site;
 - Talbat House (Grade II), located approximately 220m to the southwest of the site;
 - Vachel Almshouses (Grade II), located approximately 215m to the southwest of the site;
 - Group of 4 Churchyard Tombs, East of St Mary's Church (Grade II), located approximately 210m to the east of the site;

Broad Street Mall Chapter 3: Alternatives and Design Evolution

- 7, 8 and 9 Gun Street (Grade II), located approximately 210m to the southeast of the site;
 - 59 and 61 Castle Street (Grade II), located approximately 240m to the southwest of the site;
 - 10, 11 and 12, and 13 and 14, Gun Street (Grade II), located approximately 225m to the southeast of the site; and
 - La Corbiere Restaurant (Grade II), located approximately 230m to the southeast of the site.
- 3.33** No 1 1 Gun Street (the former Cross Keys PH) is identified as a 'building of townscape merit' in the conservation area appraisal.
- 3.34** Outside the St Mary Butt's and Castle Street Conservation Area, but in close proximity to the site are the following heritage receptors:
- Queen Victoria Jubilee Fountain (Grade II) – located approximately 130m to the southeast of the site;
 - 3 and 5 Cheapside (Grade II) located approximately 30m to the northwest of the site;
 - 67 and 68 Broad Street (Grade II) located approximately 240m to the northeast of the site; and
 - Congregational Church and Nos 89 and 89a (Grade II), located approximately 200m to the northeast of the site.
- 3.35** There is one Registered Park and Garden, The Forbury Garden (Grade II), located approximately 660m away from the site.
- 3.36** There is one scheduled monument, Reading Abbey, located approximately 710m away from the site.

Water Resources and Geoenvironmental (Land Contamination, Ground Conditions and Groundwater)

Flood Risk and Surface Water Drainage

- 3.37** The Proposed Development is located within Flood Zone 1, located between the River Thames to the north and the River Kennet to the south and east. A surface water feature (Holy Brook) is located approximately 155m southeast.
- 3.38** Flood Zone 1 is classified as an area where there is a low probability of fluvial and tidal flooding, having less than 1 in 1000 annual probability of flooding. The site is also at low risk from surface water flooding, this is defined as chance of 0.1% to 1% annually.

Geoenvironmental

- 3.39** A Phase 1 Environmental Desktop Study for the site has been undertaken. The study is appended to the ES (presented in **ES Volume 3, Appendix: Ground Conditions – Annex 1**).
- 3.40** The British Geological Survey (BGS) 1:50,000 Digital Geological Map of Great Britain shows that the site is underlain by superficial deposits relating to the Taplow Gravel Member (Sand and Gravel). The Taplow Gravel Member comprises a succession of sand and gravel, locally with lenses of silt, clay or peat. The bedrock geology underlying the site comprises the Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated), part of the White Chalk subgroup. The Chalk is underlain by the Upper Greensand and the Gault Formation at depth.
- 3.41** The underlying Seaford and Newhaven Chalk Formation is designated as a Principal Aquifer, geology comprising high intergranular and/or fracture permeability - meaning they provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- 3.42** Groundwater abstractions are present within a 1km radius of the site (for various retail, commercial / industrial / public services).
- 3.43** The site is not located within a Source Protection Zone.
- 3.44** A preliminary contamination risk assessment has been carried out and the conceptual site model (CSM) identifies the site as generally having a very low risk to current and future users, workers, neighbouring residents and construction workers. The site has been subjected to significant industrial use during its history,

including on-site uses of steam sawmill, smithy, brewery, car park and garage. This is likely to have resulted in the introduction of a variety of soil contaminants to the site however, the current shopping centre and the Proposed Development are hard-standing underlain entirely by a basement and therefore there is no viable pathway associated with impacted soil and current/future site users.

- 3.45** The site is designated as having a low risk for Unexploded Ordnance (UXO). The risk associated with UXO is considered further minimised due to the previous development on-site, including the basement, and the limited scope of intrusive works associated with the Proposed Development.

Socio Economics

- 3.46** The site is situated within a West Side Major Opportunity Area, specifically 'CR12d – Broad Street Mall', of the Reading Borough Local Plan, and currently comprises existing retail space and office space at Broad Street Mall, including Quadrant House and Fountain House. The area immediately surrounding the site is dominated by retail and office uses of varying density and some of poor quality.
- 3.47** There are eight primary schools located within 1km of the site, including but not limited to: Civitas Academy approximately 470m northwest of the site; Coley Primary School and Nursery approximately 500m to the south of the site; Katesgrove Primary School approximately 590m to south of the site; Oxford Road Community School approximately 600m west of the site; Kendrick School which is located approximately 700m southeast the site; EP Collier Primary School approximately 760m north of the site; The Deenway Montessori School approximately 800m east of the site; and All Saints Junior School approximately 860m west of the site. There are 11 secondary schools within 2.7km of site, Kendrick School being the closest (approximately 720m to the southeast of the site). Greyfriars Day Nursery is a nursery school located approximately 260m north of the site.
- 3.48** The healthcare facilities within the surrounding area of the site include the Reading Walk-in Health Centre (located within Broad Street Mall), Chiltern Medical Centre (approximately 100m to the northwest of the site) and Royal Berkshire Hospital (approximately 1.1km at its closest point north-west of the site). Dental practices are similarly located to the site, the closest being the Friar Street Dental Surgery approximately 320m at its closest point northeast of the site).
- 3.49** Children's play area/communal gardens located within close proximity to the site include the communal gardens along Dusseldorf Way and Hosier Street (approximately 10m south of the site) and the play areas and communal gardens serving properties along Tilehurst Road and Pell Street (both located approximately 650m west and southeast of the site respectively).

Wind Microclimate

- 3.50** Long-term meteorological climate data has been used to determine the baseline wind conditions at the site, collected from London Heathrow Airport. These wind conditions are deemed to be representative of the local wind microclimate for the Reading area. The prevailing wind throughout the year is from the southwest, which is typical for many areas of southern England. There is a secondary peak from the northeast during the late spring and early summer. The winds from the northeast are not as strong as the prevailing winds from the southwest, although the winds are colder.

ALTERNATIVES

- 3.51** The following sections review the alternatives to the Proposed Development that have been considered by the Applicant, including:
- Alternative Sites;
 - The Do-Nothing / No Development Alternative; and
 - Alternative Designs (Extant Consent).

Alternative Sites

- 3.52** No alternative sites or locations have been considered for the Proposed Development.
- 3.53** The Applicant owns the site and the Applicant is keen to continue the redevelopment of the site and introduce a mixed-use development on-site. Aiding the development of this key central urban area of Reading.
- 3.54** Additionally, the site is identified in local policy (Minster Quarter Area Development Framework) as suitable for residential provision.

Do Nothing / No Development Alternative

- 3.55** The Do-Nothing / No Development Alternative refers to the option of leaving the site in its current state.
- 3.56** The option of Do-Nothing / No Development whatsoever on the site has not been considered as the site represents an opportunity for the continued development of the existing shopping centre in a sustainable manner, which will be capable of providing new residential floorspace and new public realm. Regeneration of this nature will lead to employment opportunities and other direct and indirect socio-economic benefits that would otherwise not be realised should the site be left in its current status.

Alternative Designs

- 3.57** As set out within **ES Volume 1, Chapter 1: Introduction**, the site has an Extant Consent which was approved in 2021. Since the Extant Consent was granted, ownership of the site has transferred to the Applicant. Subsequent assessment of the Extant Consent revealed a number of technical failings and the Applicant consequently is proposing a new Proposed Development, and therefore the Extant Consent does not constitute a viable alternative design.
- 3.58** The Extant Consent is not considered viable due to the structural complexity of the scheme. The new building structure was to be constructed on top of the existing retail and MSCP levels of the Broad Street Mall, with the building cores passing through the retail and MSCP levels. Additionally, the core of Building A was designed to pass through the middle of the existing MSCP ramp, resulting in a less aesthetic and functional staggered building line, as shown in Figure 3.6. Further, the retention of the existing concrete façade of the MSCP is considered to be incompatible.
- 3.59** The Extant Consent was also considered to inadequately match health and safety expectations. The construction of the building structures on top of the existing retail and MSCP levels is considered to potentially result in health and safety implications on the running of the existing Broad Street Mall. The existing buildings were also designed with single staircases for means of escape, failing to meet best practice guidelines in relation to Fire Safety and Part B of the Building Regulations⁶.
- 3.60** Additionally, the design of the apartments within the Extant Consent do not meet guidance standards. The apartment sizes are assessed to be below the minimum requirements of the Nationally Described Space Standards⁷. Also, the Extant Consent does not provide accessible (M4(2) and M4(3)) apartments, required by the Access to and Use of Buildings Regulations⁸.
- 3.61** The Extant Consent included an area of the mall north of the site, referred to as Block E. neAll affordable housing of the Extant Consent was located within Block E, which had the following issues:
- Inability to implement due to the structure running through the Broad Street Mall main entrance from Oxford Road;
 - The provision of a separate affordable door scheme;
 - Impact on the Oxford Road streetscape, with impact on adjacent listed buildings; and
 - Loss of car parking at roof level.
- 3.62** The site was subject to an additional planning consent which was approved in 2019 for a hotel, located in the east of the site. The planning consent for the hotel has now fallen away leaving a vacant development plot. The plot has been incorporated into the site for the Proposed Development and incorporates the residential

⁶ Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, *Fire Safety: Approved Document B* (2010).

⁷ Department for Communities and Local Government, *Technical Housing Standards – Nationally Described Space Standards* (2015).

⁸ Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, *Access to and Use of Buildings: Approved Document M* (2015).

proposals to allow comprehensive regeneration of Dusseldorf Way and Hosier Street, and to meet the increased housing need within Reading Borough.

- 3.63** Design evolution for Extant Consent is included in the '*Extant Consent Design Evolution*' section of this ES chapter.
- 3.64** Where design options have been influenced by environmental considerations and assessment work, this has been discussed within the '*Design Evolution*' section of this ES chapter as relevant.

DESIGN INFLUENCES

Site Constraints

- 3.65** The site is subject to constraints which have been key drivers in shaping the design of the Proposed Development, the constraints are listed below:
- The existing Broad Street Mall shopping centre on-site;
 - The existing MSCP;
 - 1970s mall design leads to a blank inward looking development and does not respond well to its context or public realm;
 - The urban environment although green is drab and inactive;
 - Poor quality and tired architecture and poor gateways;
 - St Mary's Butts / Castle Street Conservation Area located to the south and east of site; and
 - Views towards St Mary Church / Reading Minster.

Site Opportunities

- 3.66** The site's location provides opportunities for the design of the Proposed Development as outlined below:
- The site is centrally located and near to numerous forms of public transport;
 - The site is located within the Western Cluster of the Reading Tall Building Strategy; and
 - The site is located within the Minster Quarter Area Development Framework.

DESIGN BRIEF

- 3.67** The design aspirations for the Proposed Development are focused on the Applicant's vision for the continued renovation and development of the Broad Street Mall site, changing the site to a mixed-use development.
- 3.68** The design brief included making the most of the opportunities, as outlined below:
- Opportunity to take advantage of one of the few brownfield sites in the centre of Reading to accommodate the growing demand for urban living;
 - Potential for improved landscape and public realm provision;
 - Potential for improved retail frontage;
 - Opportunity to provide tall buildings in line with the Reading Tall Building Strategy;
 - To strengthen the area as a key quarter, as it once was, through new development;
 - Ensure where possible that the new development has an active outward looking aspect both at street level and upper level;
 - Become a vibrant catalyst for future development in this quarter of the city;
 - Take advantage of a highly accessible public transport area;
 - Ensure good quality design and architecture; and

Broad Street Mall Chapter 3: Alternatives and Design Evolution

- Ensure that the development aligns with the principles set out in the Minster Quarter Area Development Framework.

CONSULTATION

Pre-Application Discussions and Public Consultation

- 3.69** The Applicant has recognised the ongoing need to provide clarity about the proposals. As a result, the project team thought it was important to facilitate an open and transparent discussion about the proposals. The aim was to provide information about the proposals to Broad Street Mall and address any queries from councillors, community and amenity groups and local residents / the general public. Further details can be found within the Planning Statement that is submitted in support of the planning application.
- 3.70** Meetings have been held with the following groups to date:
- Abbey Ward Members - 11th November 2021, 3rd March 2022, 5th December 2022, 21st March 2023;
 - Meeting with Cllr. Leng – Lead Member for Planning and Assets, 27th June 2023;
 - Reading Borough Council Officers – 5th August 2022, 19th October 2022, 5th December 2022, 22nd December 2022;
 - Design South East, 28th June 2023;
 - Broad Street Mall Traders Engagement Events – 3rd – 5th July;
 - Public Exhibitions – 13th and 19th July;
 - Reading Civic Society, Conservation Area Advisory Committee, 13th July 2023 (Pre-Exhibition);
 - Reading BID, 19th July 2023 (within Public Exhibition);
 - Baker Street Area Neighbourhood Association, 19th July 2023 (within Public Exhibition);
 - Presentation to Reading Older Persons Forum – 13th October 2023;
 - Meeting with Historic England – 8th November 2023; and
 - Reading Borough Council Officers – 12th December 2023.
- 3.71** In addition, all Reading Borough Councillors were notified of the public exhibitions and Reading Economic Development Agency (REDA) and Reading BID were invited to the exhibitions.
- 3.72** To provide notice of the exhibitions, a leaflet drop to c.3,000 homes and businesses was undertaken a week before the first event and notices were placed on Nextdoor and InYourArea. Press releases were also sent to Reading Chronicle and Reading Today, who published details of the event in their respective publications and online.
- 3.73** To support the public exhibitions, a dedicated project website – www.bsmfuture.co.uk was developed and published. This went online on 13th July to coincide with the first exhibition.
- 3.74** In the region of 170 people attended the exhibitions, whilst the web page attracted 821 individual users over the engagement period.
- 3.75** The feedback received as part of this engagement has influenced the overarching design approach.

DESIGN EVOLUTION OF THE EXTANT CONSENT

- 3.76** Prior to engaging in pre-application discussions with RBC, initial studies were undertaken into the main design elements of the Extant Consent. This process allowed the scheme and brief to be tested and developed, to ensure the Proposed Development meets the needs and demands of building users. Extensive consultation with RBC was then undertaken in relation to the Extant Consent which consequently fed into its design evolution to result in the Proposed Development. The main design elements that have evolved through the design evolution process are as follows:
- Height and Massing; and

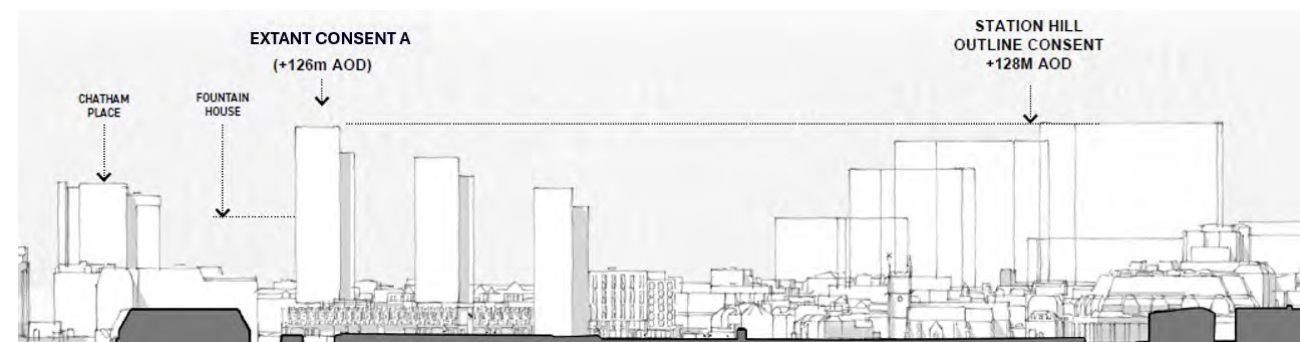
- Layout.

The Extant Consent - Height and Massing

Buildings A, B and C

- 3.77** The key driver in the design development of Buildings A to C related to the presence of the St Mary's Butts / Castle Street Conservation Area to the south and east, and the presence of Reading Minster of St Mary (Grade I listed) and its protected view located approximately 100m to the east of site.

Figure 3.3 Extant Consent Height Within the Context of Other Tall Buildings Within Reading



- 3.78** As previously mentioned in the 'Policy Brief' section of this ES chapter, the site is located within the Western Grouping for Reading's Tall Building Strategy and the Minster Quarter Area Development Framework identifies the potential for a cluster of tall buildings to be present on-site with a suggested height of 20 storeys above the existing mall roof level. During meetings with RBC in relation to the extant consent, RBC suggested the proposals for the Broad Street Mall site could be taller than policy subject to the quality of the architecture.
- 3.79** Consequently, the Extant Consent included two buildings (Blocks A and B) that sat above the podium level of Broad Street Mall and one tall building on South Court immediately adjacent to the Mall's southern entrance (Block C). The tallest building (Block A) of the Extant Consent is 22 storeys above podium height (25 storeys in total).



September 2016

- 3.80** The initial Massing studies were based upon available space / core locations at ground level and testing various height options against the Station Hill Outline Consent.



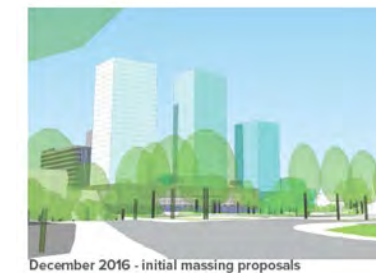
October 2016

- 3.81** Further development of the scheme that comprises the Extant Consent to provide student accommodation. This involved linking the 3 distinct towers at the lower levels immediately above the MSCP. It was felt however that this massing option was inappropriate due to lack of permeability through the site from a North to South aspect.



November 2016

- 3.82** A tall massing option was developed as private residential with a square floorplate.



December 2016

- 3.83** The architectural treatment began to develop in order to achieve a tall, slender looking family of buildings. The orientation of the cores was also interrogated.



May 2017

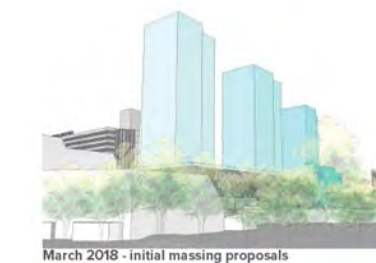
- 3.84** The floorplates of Buildings A to C were inset, helping break down the mass and improving the vertical emphasis of the forms.

- 3.85** Buildings A and B were shown at the same height but with a step in the massing to respond to the adjacent conservation area.



August 2017

- 3.86** The heights of sites A and B were still shown similar in height but the architectural treatment was developed further.



March 2018

- 3.87** The step in the mass was retained and the scheme that comprises the Extant Consent was lowered following further advice from the RBC who had reservations on the scale.

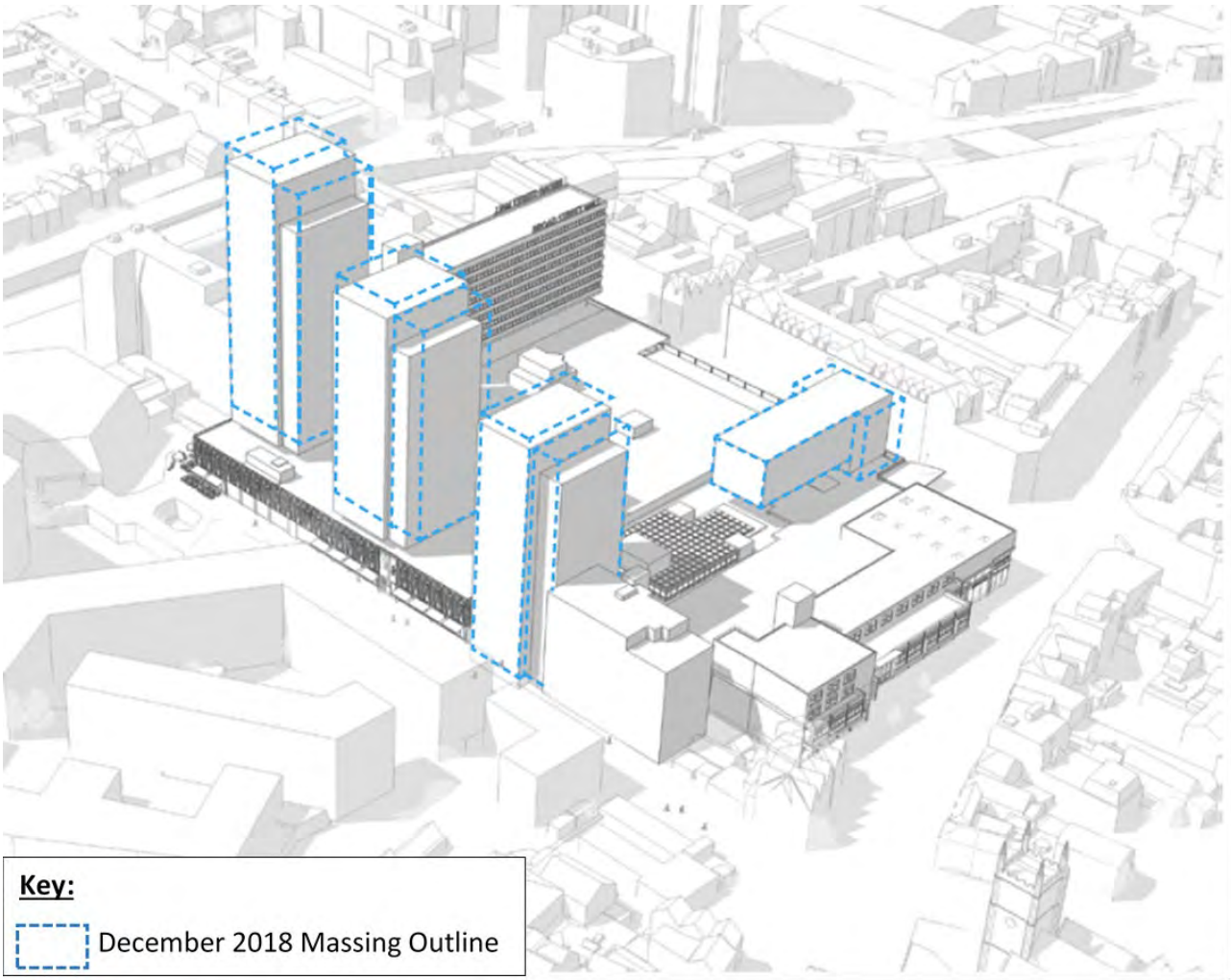
2019 Design Evolution

- 3.88** Following the Design South East (DSE) Panel review in December 2018 it was felt that the massing was not justified. The overall height of the scheme was not justified and they did not support the scheme that was tabled.

The floor plans were interrogated and the apartment plans were redesigned to mitigate all north facing single aspect units. The circulation core for Block B was redesigned to replicate that of Block A, helping reduce the

massing of Block B considerably. The reconfiguration of the apartments also helped to slim down the massing of each Block. Revisiting the structural strategy of the towers allowed the scheme to be reduced in height by one storey whilst still maintaining the current number of residential storeys. This in turn helped reduce the cumulative visual impact along Dusseldorf Way.

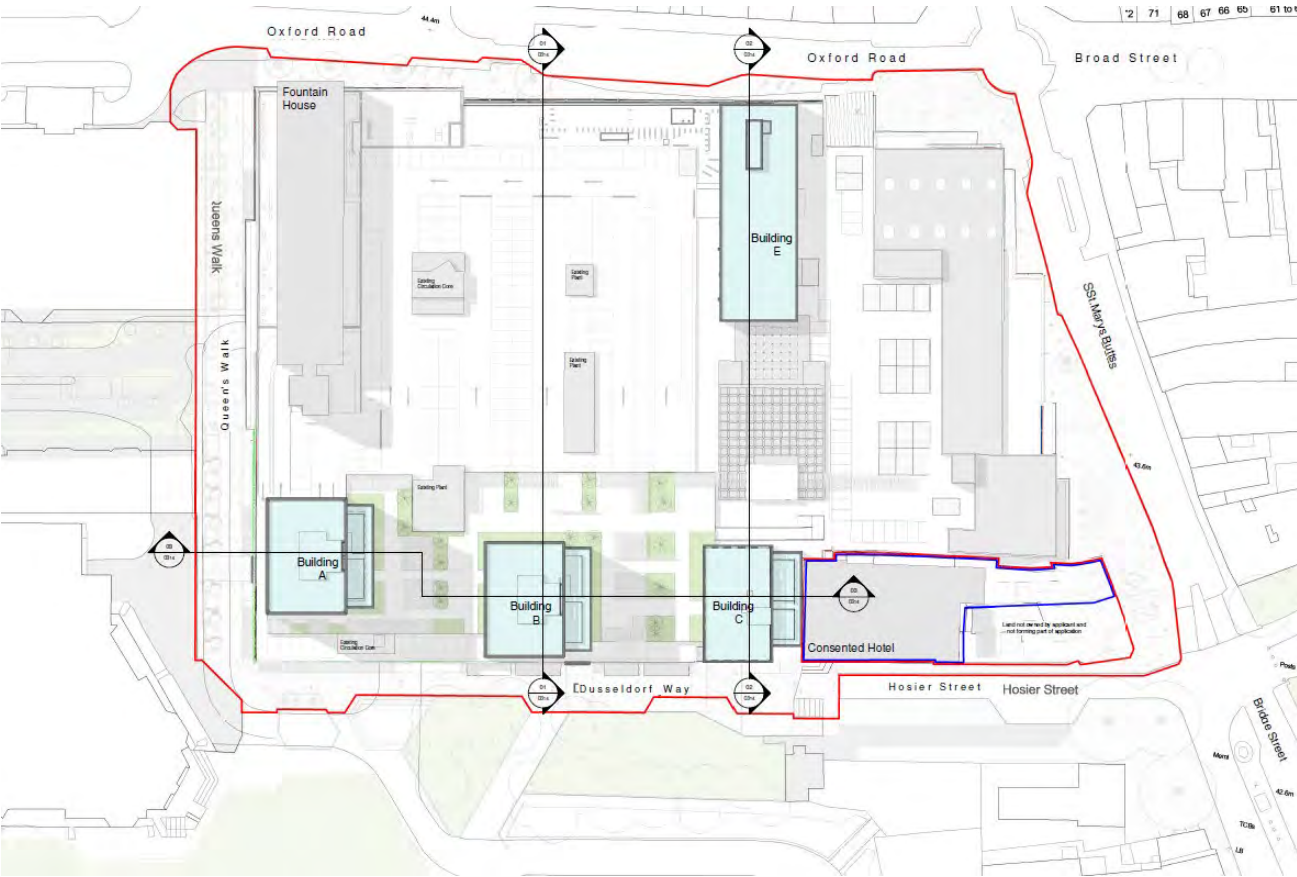
Figure 3.4 Reduction in Massing



Block E

- 3.89 The massing and design of Block E evolved from two buildings to a reduced massing in a single building to minimise the daylight, sunlight and overshadowing and rights of lights impact on the residential buildings adjacent to the north of site.
- 3.90 At the DSE review in December 2018 it was felt that the massing of Block E could be further simplified. The original design was based upon apartment types and aspects. Revisiting this, the scheme massing was simplified to be rectilinear in plan removing two units overall. The elevation was also updated to take a cue from the adjacent, existing Fountain House. This was welcomed at the second DSE review.

Figure 3.5 Consented Scheme Site Masterplan



The Extant Consent - Layout

- 3.91 When considering the layout for a scheme on the Broad Street Mall site, the design team considered it important to ascertain where new development could meet the ground level to allow easy access and activate the street frontage.
- 3.92 In a constrained live retail environment, the areas available for development were limited and it was important to minimise disturbance to the existing retail environment. The final residential core locations for the Extant Consent can be seen in (Figure 3.6).
- 3.93 The core positions were defined by the areas where it was anticipated that they would have the least disruption to the existing retail centre, subsequently a structural strategy was compiled to work within the constraints of a live retail environment.
- 3.94 The design team also proposed a series of aesthetic updates and improvements to the existing Mall as part of the extant consent.

Figure 3.6 Extant Consent Residential Building Core Locations



The Extant Consent - Materiality

3.95 Materiality of the Extant Consent was developed following discussion with RBC regarding quality and the relationship to the adjacent Conservation Area and Minster Quarter. It was felt after further development that the material palette could be simplified further. Along with structural constraints following the updated structural strategy, the proposed material palette for all Blocks was a metal cladding system with bespoke laser cut metal infill panels and aluminium framed glazing system.

The Extant Consent - Amenity Areas

3.96 Following comments at the DSE review in October 2019 it was felt that the amenity space on-site needed to increase in size. This was then increased in area further northwards on the plan so as to not affect the visual impact along Dusseldorf Way. The Extant Consent subsequently includes for amenity on the rooftop of Block E.

3.97 The public realm proposals of the Extant Consent evolved following a dialogue with RBC, Public Consultation and Design South East Review Panel in December 2018 and October 2019.

DESIGN EVOLUTION OF THE PROPOSED DEVELOPMENT

3.98 The Extant Consent set a series of key design principles which have helped to determine the appropriate approach for the Proposed Development; these principles are set out below:

- The Extant Consent responds to the regeneration aims and aspirations of the wider Minster Quarter Development Framework;
- The Extant Consent introduces much needed housing within the town centre;

- The Extant Consent reflects RBC's Tall Buildings policy CR10 and the identified 'western grouping' for this site;
- The principle of three ascending towers from the Minster Quarter towards the road network respects the setting and significance of Reading Minster and the adjacent Conservation Area;
- The Extant Consent creates improved active frontages along Dusseldorf Way to help animate the area and interface with the emerging Minster Quarter Development; and
- The Extant Consent's improvements to the public realm along Dusseldorf Way and Queens Walk will interact with the emerging Minster Quarter Development.

Height and Massing

3.99 The MQADF also identifies that:

'Additionally, primacy of a central tall building and supporting tall buildings providing a stepped transition to the high point is the preferred configuration for tall building distribution within the site and takes into account:

- *The high percentage of listed buildings locally, especially:*
 - *St Mary's Grade 1 Listed Church and views thereto.'*

3.100 The principles regarding height of the Proposed Development have broadly remained to the Extant Consent, with the towers descending in height from Building A in the west down to Building C in the east. The height of the buildings has been designed to correspond with the heights of nearby buildings at the Station Hill Cluster and at Chatham Place. The principle of the descending height of the buildings was supported by DSE during consultation in July 2023.

3.101 The maximum height of the buildings has increased during the design process of the Proposed Development from the Extant Consent. The maximum height presented in Pre-Application Meeting 1 was 135.250m AOD (Figure 3.7), however, following feedback from RBC which welcomed further increases in height, the height of the Proposed Development was increased to 142.855m AOD (Figure 3.8). The proposed AOD of the tallest tower is +142.855m, which approximately 20m below the 163m of the tallest building of Plot C of the Station Hill Cluster.

3.102 This increase in height of Buildings A to C from the Extant Consent is shown in Table 3.1.

Figure 3.7 Proposed Development Height within the context of other Tall Buildings within Reading and the Extant Consent (in red) – Pre-Application Meeting 1

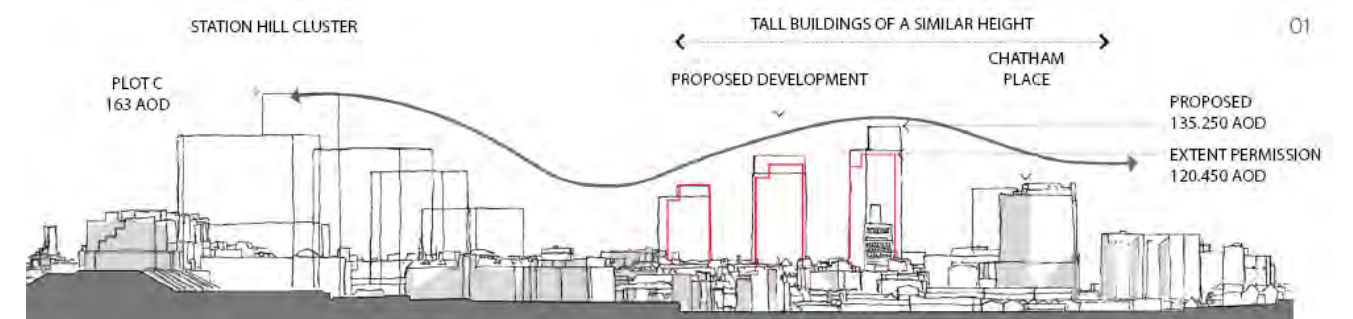


Figure 3.8 Proposed Development Height within the context of other Tall Buildings within Reading and the Extant Consent (in red) – Post Pre-Application Meeting 1

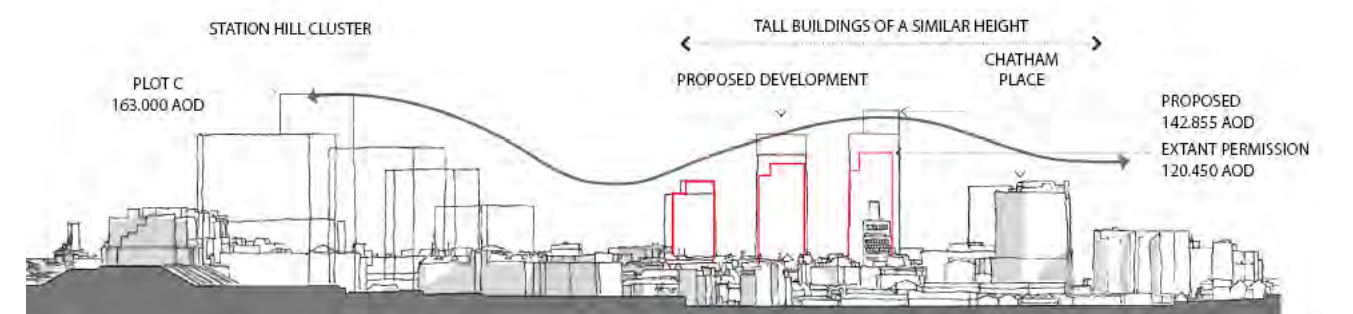


Table 3.1 Extant Consent and Proposed Development Height Comparison

Building	Extant Consent	Proposed Development
A	126.000m AOD	142.855m AOD
B	114.000m AOD	130.355m AOD
C	105.000m AOD	106.18m AOD

- 3.103** Buildings A to C have been designed to step down in height to east, to minimise the Proposed Developments impact upon the Reading Minster of St Marys as outlined within the MQADF.
- 3.104** The changes in building height, as well as balcony design, have improved the on-site wind conditions from the Extant Consent, which resulted in significant wind safety exceedances at the podium and roof level amenity spaces. As a result of the design evolution process regarding building height and balconies, no significant wind safety exceedances are present in the updated design for the Proposed Development.

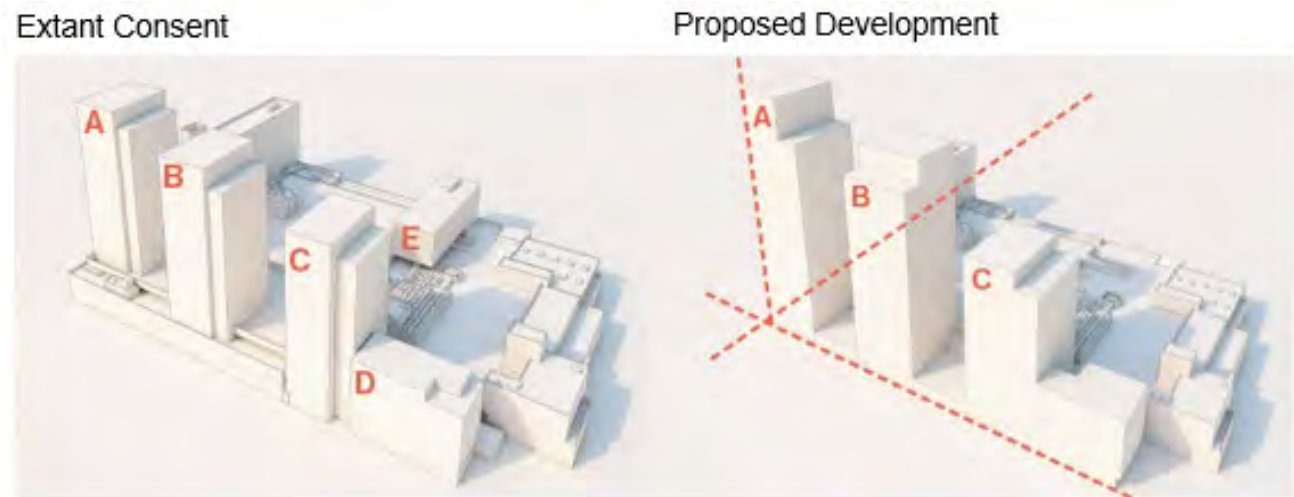
Housing Provision

- 3.105** The increase in height from the Extant Consent has resulted in a higher number of residential units being included within the design. The ES that supported the Extant Consent concluded Moderate Beneficial effects at the Local level as a result of increased housing supply. In consideration of this beneficial effect on housing supply, the developed design provides an uplift in residential units which increases the geographic extent of this beneficial effect, now serving to address housing needs for Reading Borough as opposed to the local area.

Layout

- 3.106** The internal layout of the typical floors of the buildings of the Proposed Development has gone through multiple design iterations.
- 3.107** Design evolution of the Proposed Development from the Extant Consent has included the repositioning of Building A. Building A has been moved southwards to align with the frontages of Buildings B, C and D (Figure 3.9).

Figure 3.9 Comparison of the Position of Building A



- 3.108** As a result of feedback from DSE in relation to the number of apartments and the quantum of amenity space, the layout of the amenity space at podium level has evolved from that in the Extant Consent, with a single storey of apartments being relocated north of the amenity spaces between Buildings A and B and Buildings B and C, connecting the respective buildings.
- 3.109** Additionally, since the Extant Consent, Building E has been removed from the Proposed Development. It was considered that Building E was unable to be implemented due to the structure running through the Broad Street Mall Main Entrance from Oxford Road, which would have resulted in the Mall Entrance having to close during construction.

- 3.110** The Proposed Development has also included Building D within its design, which was not included in the Extant Consent. Building D is located in the east of the site, in the location of a plot of land that had a planning consent for a hotel scheme, which has now lapsed. Since the consent of the hotel scheme, the plot has been acquired by the Applicant and is subsequently included in the Proposed Development.
- 3.111** As raised during consultation, the Extant Consent had apartment sizes that were below the minimum requirements of the Nationally Described Space Standard (NDSS), the buildings were designed with single staircases for means of escape and did not provide M4(2) (accessible and adaptable dwellings) apartments across the scheme. In response, the design of the Proposed Development has evolved, incorporating the latest thinking in terms of fire safety, and including policy compliant M4(2) and M4(3) (wheelchair user dwellings) apartments throughout.
- 3.112** The layout of the basement has changed from that of the Extant Consent, with the area increasing. Additionally, the basements of Building B and C are now connected. Further, Building D shares the basement space of Building C.
- 3.113** Additionally, the number of units brought forward by the Proposed Development has changed throughout the design process. At the Pre Application Meeting in October 2022, the number of units proposed was 621. This reduced to 615 units at the Pre Application Meeting in December 2022, and further reduced to 601 units at the Design Review Presentation in July 2023. This was then increased to 644 units for the Proposed Development, resulting in an uplift of 198 units from that of the Extant Consent. Similarly, the floorspace of the commercial area reduced from 1,594m² to 1,588m², then to 1,501m², and finally 1,355m² (NIA).

Appearance

- 3.114** The appearance of the Proposed Development has not changed from that of the Extant Consent, with similar material pallets being selected.
- 3.115** The design has evolved from the Extant Consent to include crowns at the top of Buildings A, B, and C, and the base of the buildings no longer retain the façade of the existing Mall, with three storey glazed bases with large columns.
- 3.116** Additionally, the cladding of the eastern gable Building C has been selected to be sympathetic to the existing surrounding character of the Conservation Area.

Landscaping

- 3.117** The layout of the podium amenity space has changed from the Extant Consent in a number of ways. As the position of Building A has moved south to align with Buildings B, C and D, the amenity space that was located south of Building A has been removed. Additionally, the amenity space at podium level north of Building B has been removed and the amenity space at podium level between Building A and Building B and Building B and Building C has been reduced to allow for a single storey of apartments north of the amenity space.
- 3.118** The landscaping design, as well as building layout and design (as mentioned in paragraph 3.98), for the Extant Consent resulted in significant wind safety exceedances at the podium and roof level amenity spaces. The design evolution for the Proposed Development has resulted in improvements to the wind conditions on-site, with no significant wind safety exceedances being concluded in the wind microclimate assessment.
- 3.119** Additionally, elevated amenity space at roof level has been included in the design, deferring from the Extant Consent. The elevated amenity space of the Extant Consent was located on the north, south, east and west sides of the Buildings, whereas these locations now include rooftop amenity space.
- 3.120** In contrast to the Extant Consent, publicly accessible external amenity space will be included south of the site.
- 3.121 ES Volume 1, Chapter 4: The Proposed Development** presents a description of the Proposed Development for which planning permission is sought. It provides relevant and sufficient information on the Proposed Development to aid the identification and assessment of potential environmental and socio-economic impacts and likely environmental and socio-economic effects across the environmental topic areas addressed by the EIA and as presented in **ES Volume 1: Chapters 6 to 11 and ES Volume 2: Heritage, Townscape, and Visual Impact Assessment**.
- 3.122** Further details on the Proposed Development can be found within the Design and Access Statement (DAS) that has been submitted as part of the planning application.

Chapter 4: The Proposed Development

INTRODUCTION

- 4.1** This chapter of the ES presents a description of the Proposed Development for which planning permission is sought. It provides relevant and sufficient information on the Proposed Development to aid the identification and assessment of potential environmental and socio-economic impacts and likely environmental and socio-economic effects across the environmental topic areas addressed by the EIA and as presented in **ES Volume 1: Chapters 6 to 11** and **ES Volume 2: Heritage, Townscape and Visual Impact Assessment**.
- 4.2** Further details on the Proposed Development can be found within the Design and Access Statement (DAS)¹ that has been submitted as part of the planning application.

DESCRIPTION OF THE PROPOSED DEVELOPMENT

- 4.3** As set out in **ES Volume 1, Chapter 1: Introduction**, the Proposed Development is subject to two planning applications; a full (detailed) planning application for the Proposed Development, and a temporary construction planning application.
- 4.4** The full (detailed) planning application for the Proposed Development seeks permission for:
Part-demolition of existing retail units, car park and service areas, demolition and rebuild of car park ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required.
- 4.5** The temporary construction planning application seeks permission for:
Part-demolition of podium deck on Dusseldorf Way and Queens Walk, amendments to existing retaining wall, excavation works and road and hardstanding re-alignment to create a temporary construction area related to proposed redevelopment works at Broad Street Mall.
- 4.6** **ES Volume 1, Chapter 5: Demolition and Construction** presents information associated with the temporary construction planning application. The temporary construction works consist of the part-demolition of the podium deck on Dusseldorf Way and Queens Walk, amendments to the existing retaining wall, excavation works and road and hardstanding re-alignment. This will subsequently allow for the public realm / landscaping to be brought forward as set out in the following sections. As such, the remainder of this ES chapter focusses on describing the final Proposed Development as sought for approval under the full (detailed) planning application and for ease of reference is referred to as the Proposed Development throughout the remainder of this chapter.

General Arrangement and Layout

- 4.7** The Proposed Development will comprise of four new buildings, and a replacement vehicle ramp, to access the existing multi-storey car park (MSCP). This includes the following buildings, as shown on Figure 4.1:
- Building A – located on the western part of the site;
 - Building B – located in the middle of the site, adjacent to Buildings A and C;
 - Building C – located in the centre of the site, adjacent to Buildings B and D; and
 - Building D – located in the eastern part of the site.
- 4.8** Access and egress routes to the site will be achieved via Castle Street to the south of the site and the Inner Distribution Road (IDR) to the west of the site.
- 4.9** Below each of the buildings is an existing basement, which will be reconfigured as part of the Proposed Development.
- 4.10** The Proposed Development will comprise 55,262m² gross internal floorspace (GIA) and 644 residential units (of a range of unit sizes and tenures) across the four buildings.
- 4.11** The ground floor of all buildings will include commercial (use class E) floorspace. Amongst the use class E floorspace on the ground floor includes building entrances, along with residential amenity spaces, which include a private gym and lounge space for residents.
- 4.12** The residential units are located above ground floor in each of the buildings.

- 4.13** Between Buildings A and B and Buildings B and C are private residential courtyards, at Level 1. At the rear of the private residential courtyards are a number of residential units, as well as connections between Buildings A, B and C providing safe circulation within the Proposed Development for residents. Refer to Figure 4.2 for the General Arrangement plans for Levels 1 and 3.
- 4.14** At Level Two the three Buildings begin to differentiate themselves as individual Buildings, with the three Buildings becoming fully separated at Level Three.
- 4.15** At Level Seventeen, an external roof terrace is located on Building C, with views over to Reading Minster. Building C reaches the roof level at Level Nineteen.
- 4.16** At Level Twenty-Four, an external roof terrace is located on Building B, with long distant views to the south of Reading town centre and also the (future) Minster Quarter Development. An internal residential amenity space is also located at this level within Building B. Building B reaches the roof level at Level Twenty-Six.
- 4.17** At Level Twenty-Seven, an external roof terrace is located on Building A, with long distant views to the south and east of Reading town centre and also the (future) Minster Quarter Development. Building A reaches the roof level at Level Thirty. Figure 4.3 provides the General Arrangement plans for Levels 17, 24 and 27.
- 4.18** Building D comprises of residential dwellings and an external amenity space at Level One. Residential dwellings continue up to Level Seven, after which an external roof terrace is present at Level Eight.
- 4.19** The existing vehicle ramp to access the MSCP from the west of the site will be demolished and replaced as part of the Proposed Development, providing continued access to the existing MSCP. The location of the vehicle ramp (at Levels 1 and 3) is shown on Figure 4.2.

Figure 4.1 The Proposed Development



¹ Corstorphine and Wright (2018) Broad Street Mall Design and Access Statement

Figure 4.2 Level 1 and Level 3 Floor Plan



Figure 4.3 Level 17, 24, and 27 Floor Plans Showing External Amenity Terraces



Height, Scale and Massing

Building Height and Scale

- 4.20 The Proposed Development will have a maximum height of 142.855m Above Ordinance Datum (AOD) at its tallest point, Building A (Figure 4.4). The heights of the Buildings is outlined in Table 4.1.
- 4.21 The height of the Proposed Development has been designed taking the surrounding local context into account, with the buildings stepping down in height to the east, to reflect the prevailing building line and respect the setting and heritage of Reading Minster and the St Mary's Butts / Castle Street conservation area (for further details see **ES Volume 1, Chapter 3: Alternatives and Design Evolution**).

Table 4.1 Building Heights

Building	Height in meters AOD	Storeys
A	142.855	30
B	130.355	26
C	106.180	19
D	71.655	8

Figure 4.4 Proposed Development Heights



- 4.22 Balconies for the residential units are provided on the southern façade of all buildings. For Building D the balconies start at Level 2, for Building C the balconies start at Level 3, and the balconies start at Level 4 for Buildings A and B.
- 4.23 Balconies are also present on the western façade of Buildings A, B and C. The balconies start at Level 2 for Building C, Level 3 for Building B, and Level 4 for Building A.
- 4.24 The balconies on both facades are designed in a continuous vertical line, for each level where residential units are provided for each building.

Quantum of Development

- 4.25 The Proposed Development comprises a residential-led, mixed-use development, providing a mixture of uses which fall within use class E. The total area provided within the Proposed Development is 55,262m² Gross Internal Area (GIA), which includes:
- Residential floorspace within Buildings A, B, C and D: 49,920 (Gross Internal Area (GIA)) and 39,469 Net Internal Area (NIA)) (use class C);
 - Non-residential floorspace within the ground floor of Buildings A, B, C and D: 1,737m² GIA and 1,364m² NIA (use class E).
- 4.26 For the purposes of the EIA, the non-residential floorspace has been assumed to comprise of food and beverage and retail uses. The potential for 464.5m² GIA of office floorspace has also been considered, falling within the overall 1,737m² of GIA non-residential floorspace.
- 4.27 The Proposed Development will provide a total of 644 residential units, within use class C3. The residential units are provided within the following tenures:
- 92.5% private units;
 - 7.5% Affordable rent units.
- 4.28 Table 4.2 provides an overview of the residential unit mix within the Proposed Development. A total of 5.12% of the residential units within the Proposed Development will be accessible units. Accessible units will be predominantly located within Building C, with two additional units provided in Building B.

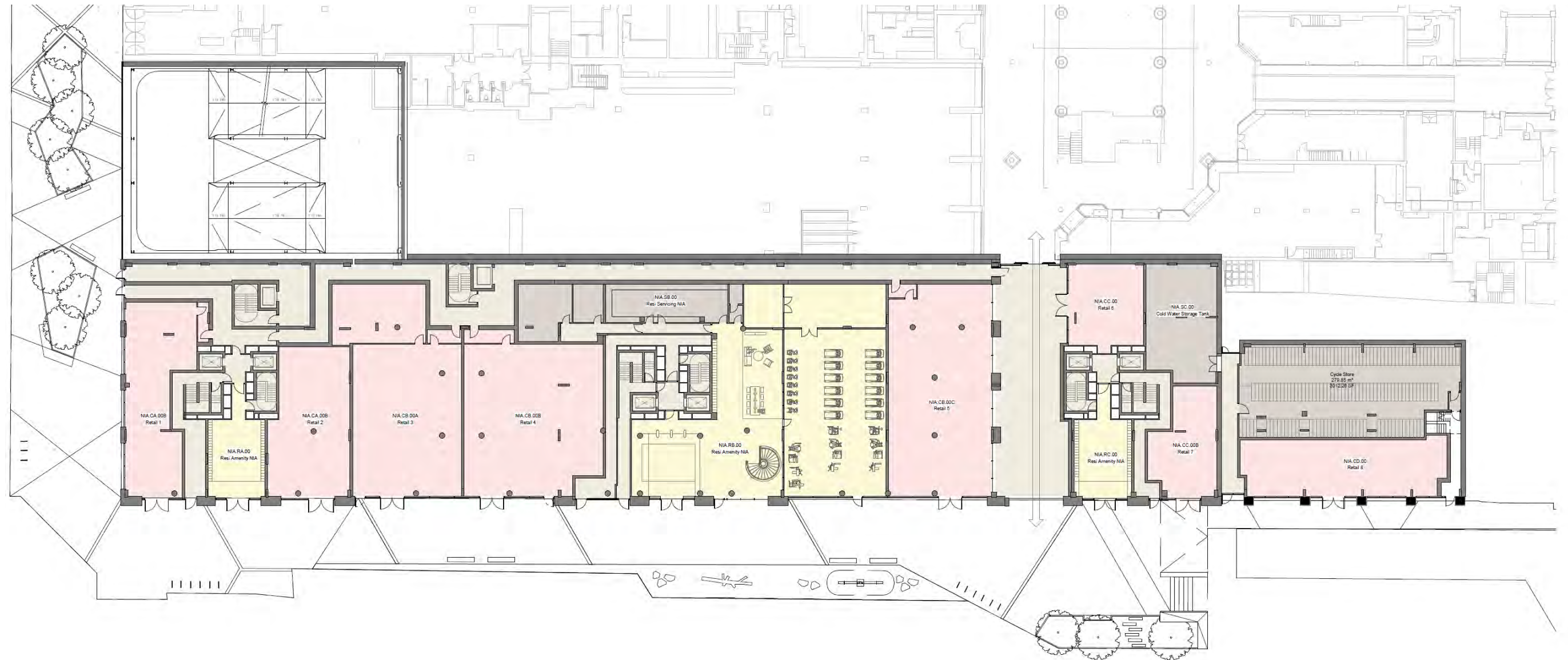
Table 4.2 Unit Mix by Building

Unit Size	Building A	Building B	Building C	Building D	Total
Studio	29	22	18	0	69
1	87	73	69	0	229
2	104	91	67	35	297
3	26	23	0	0	49
Total	246	209	154	35	644

Basement

- 4.29 The existing servicing arrangement for Broad Street Mall, with the main vehicular loop around the basement area, will be recreated.
- 4.30 A series of plant spaces, substations and refuse stores for each of the buildings above are accommodated by the basement level of the Proposed Development.
- 4.31 The basement level is connected with the ground level above and the upper floors of each of Buildings A, B and C by circulation staircases and lifts.
- 4.32 The Proposed Development does not propose the creation of any additional basement floorspace. However, some excavation may be required for reduced level areas such as plant rooms and lift pits in connection with the residential tower requirements.
- 4.33 The basement layout is shown on Figure 4.5.

Figure 4.5 Basement of the Proposed Development



Interface with Broad Street Mall Shopping Centre

- 4.34** The demolition of the southern section of the Broad Street Mall Shopping Centre down to basement level allows a clean interface to be created with the existing shopping centre (discussed in further detail in **ES Volume 1, Chapter 5: Demolition and Construction**). The interface creates a separation between the remaining part of the Broad Street Mall Shopping Centre, from the basement level upwards.

Vehicle Ramp

- 4.35** The new MSCP ramp will provide an enhanced customer experience with it being designed to the latest best practice guidelines for car parks.
- 4.36** The carpark extends from the basement level, up to the third level of the Proposed Development, providing access from the Broad Street Mall slip road (accessed from Castle Street) to the three levels of the existing MSCP which will remain within the wider Broad Street Mall footprint.

Appearance

- 4.37** The design of the Proposed Development presents a clear top, middle and bottom in a tripartite arrangement which responds directly to the context within which it sits.
- 4.38** A masonry frame has been used to create the elevation of each Building. This is arranged into three storey elements to provide a strong vertical proportion and emphasis. The appropriate glazed opening sizes are then created by inset panes that are inserted into the frame which further accentuates the vertical façade.
- 4.39** A 'crown' is included to refine the top of each Building. This is formed by extending the masonry frame up and inseting lightweight glazing. This crown becomes progressively taller in proportion from one to two to three to four storeys and rotate through ninety degrees on each Building to create a distinctive skyline.
- 4.40** The base of the Buildings are three storeys in height with greater scale columns to ground the towers onto Dusseldorf Way. This gives the buildings a clearly articulated base with feature soldier coursing within the brickwork to mark this transition from the base to the main body of the building.

- 4.41 Balconies are added to the southeast and southwest corners of Buildings A, B and C and to all the apartments within the lower element of Building C. The balconies are formed in metal railings expressing the vertical proportions of the design.
- 4.42 Between Buildings A and B and Buildings B and C lightweight glazed podiums are inserted to provide ground floor retail / leisure units with private landscaped courtyards above creating a new façade to the face of the existing Broad Street Mall retail units and MSCP. The landscaped courtyards have glazed balustrades which incorporate fritting patterns which reflect the concrete frieze of the existing MSCP elevations.
- 4.43 At roof level the plant area is set in from the edge of the roof which minimises their visual impact on the design of the building.
- 4.44 The red and grey building tones reflect Reading's distinctive local bricks for Buildings A, B and C. The concrete frieze pattern, as present on the existing MSCP, is reflected in the balustrading and public realm (see Figure 4.7).
- 4.45 The materiality of Building D relates to the Minster's flint and limestone checkerboard façade, and contrasts to the three main residential towers.

Figure 4.6 Materiality of the Proposed Development



Figure 4.7 Concrete Frieze



Figure 4.8 Building D Materiality



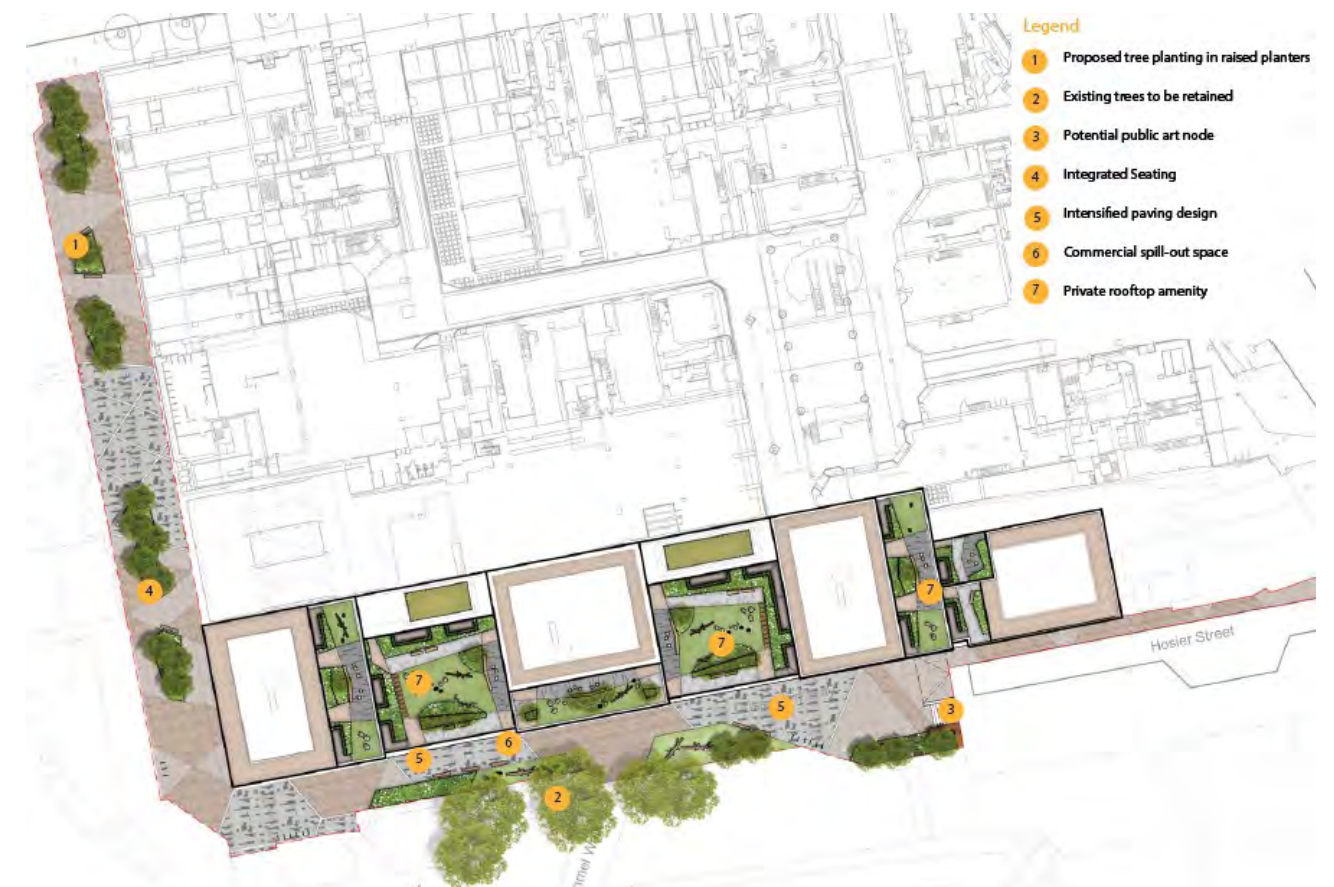
LANDSCAPING, PUBLIC REALM AND AMENITY SPACE

Landscaping and Public Realm

- 4.46** The existing site contains nearly no landscaping and planting, and the Proposed Development seeks to increase the planting and landscaping on-site. The landscape masterplan delivers a new high quality space that celebrates the heritage of this urban quarter and reinforces its identity as an arts and culture destination.
- 4.47** The Landscape Masterplan seeks to provide significantly improved public realm to this key site, with amenity space provided on the podium level and communal roof terraces for the new Buildings.
- 4.48** The landscaping design is designed around the following areas:
- Dusseldorf Way;
 - Queens's Walk; and
 - External terraces, including the external podium areas.
- 4.49** Dusseldorf Way has been designed to accommodate a range of uses. The series of spaces and integrated seating encourage social cohesion and promote activity. The predominately hard landscape area creates a flexible space that can be used for seating, meeting, and spill-out from ground floor commercial units.
- 4.50** With less exposure from the sun, Queens Walk is more of a transitional space. In spite of this it will likely remain active with the adjacency of student accommodation and learning facilities. Behaviours of these users has been considered in the design and ample seating provided to encourage dwelling.
- 4.51** The design of the podium and elevated terraces provides a series of spaces to meet the needs of residents. This includes lawn space, play space and seating areas.
- 4.52** Through varied planting palettes, landscape character areas around the site would be established with consideration to species rich mixes that are beneficial for biodiversity and pollinators as well as being low maintenance species with low water demand.

4.53 The Landscape Masterplan for the Proposed Development is shown on Figure 4.9.

Figure 4.9 Landscape Masterplan



Amenity Space

- 4.54** The Proposed Development will provide:
- 1,635m² of internal amenity space (residents lounge, gym, Wi-Fi lounge, private dining, cinema, etc.); and
 - 2,033m² of external amenity space (balconies, courtyard gardens and roof top terraces).
- 4.55** External amenity space will be provided at ground level, and will be publicly accessible.
- 4.56** Private external amenity spaces for use by occupants of the Proposed Development will be provided at podium level (Level One) between Buildings A and B, Buildings B and C, and Buildings C and D. Refer to Figure 4.10 and Figure 4.11 for the locations of external amenity spaces.
- 4.57** Further private external amenity for use by occupants of the Proposed Development will be provided at roof level (Level Eight) at Building D, at Level 17 at Building C, Level 24 and Building B and Level 27 and Building A.

Playspace

- 4.58** Provision of play is an integral focus of the external spaces throughout the Proposed Development. The play strategy ensures that play space is provided around the site with options that suit all ages and abilities.
- 4.59** Dusseldorf Way and Queens Walk feature incidental play-on-the-way so that children may create different paths and experience challenges in a series of spaces. They also include natural play elements, such as boulders, stepping stumps and fallen logs to offer multi-generational play.
- 4.60** Reading Borough Council (RBC) does not set out specific requirements for the amount of playspace provision, rather that a sufficient amount should be provided by a Proposed Development.
- 4.61** The Proposed Development will provide a total of 595.25m² of playspace. Of this, 420.95m² will be privately accessible for residents of the Proposed Development, and 174.30m² will be publicly accessible.

4.62 Play provision is located within the private amenity as well to offer maximum accessibility for all residents. Figure 4.11 below shows the location of playspace within the Proposed Development.

Figure 4.10 Amenity Space

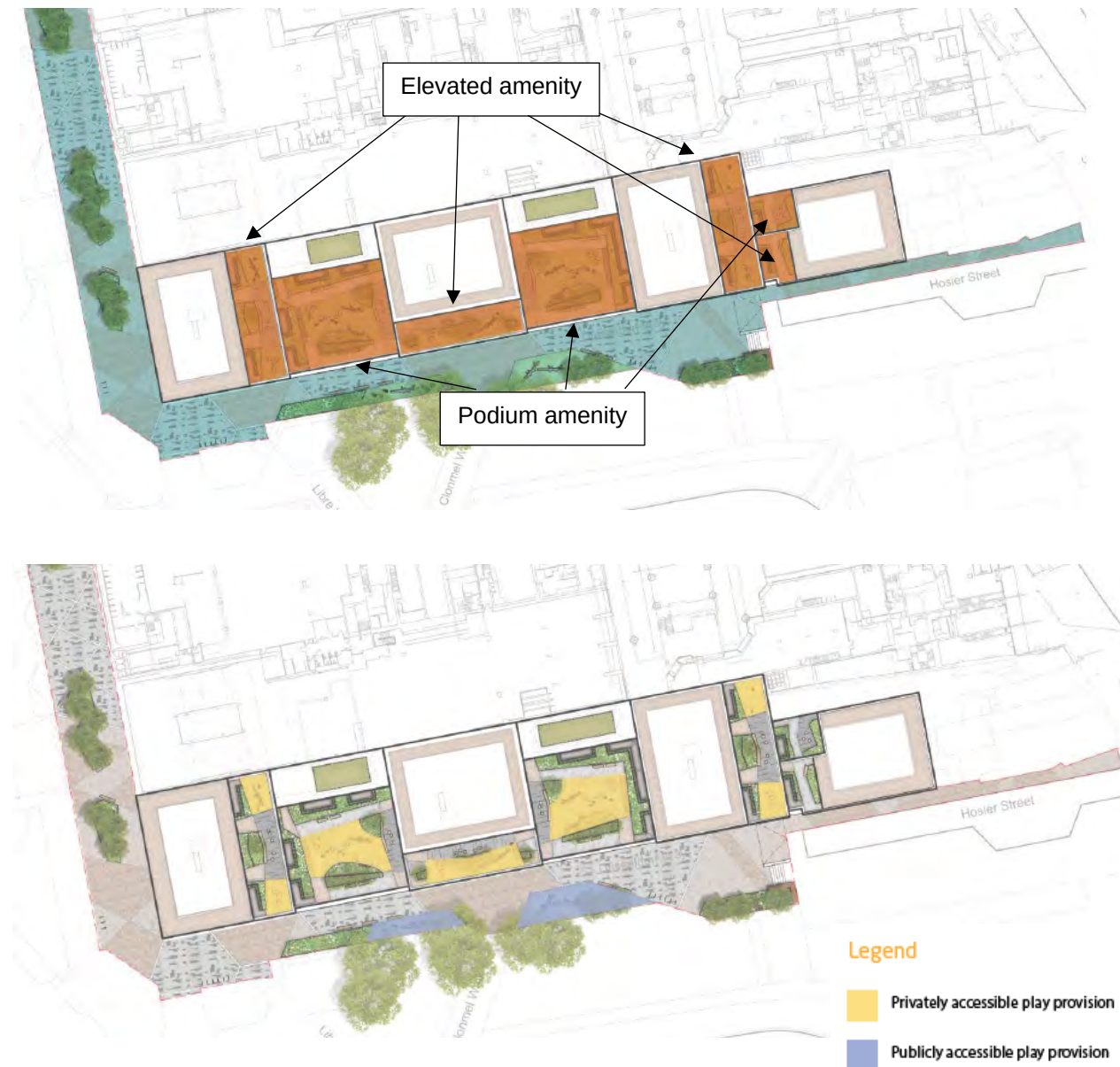


Figure 4.11 Playspace Locations

Planting Strategy

- 4.63 Trees have been selected due to sensitivities to location, seasonal colour, maintenance, aspect and appropriate micro-climate. Site trees are used to create focal features or to create gateways into the site. Size of the trees have been selected to create an attractive and human scale to facilitate well-used gardens in all seasons.
- 4.64 Ornamental tree planting has been divided to support the character of each of the landscape spaces.
- 4.65 The Proposed Development includes a total of 22 trees. The locations and species for these trees are shown on Figure 4.12.

Figure 4.12 Indicative Planting Strategy



Urban Greening Factor and Biodiversity Net Gain

- 4.66 The Proposed Development makes a significant contribution to urban greening over the building and within the public realm.
- 4.67 The Urban Greening Factor (UGF) promotes the delivery of green infrastructure through developments.
- 4.68 The current landscape proposals achieve UGF score of 0.367.
- 4.69 The Environment Act 2021 requires new developments to achieve a Biodiversity Net Gain of at least 10% on-site wherever possible. This approach considers the existing biodiversity value, or Biodiversity Units (BU), on-site and calculates the percentage increase in biodiversity value against the final design of a development. The existing site has 0.08 BU as its baseline.
- 4.70 As a result of the landscaping measures included in the design of the Proposed Development, the Proposed Development has a score of 0.58 BU. The subsequent Biodiversity Net Gain percentage is 727%, which significantly exceeds the 10% requirement.

Lighting

- 4.71 The final lighting design will be determined by an appointed lighting consultant, after the submission of the planning application. A lighting strategy has been prepared to determine the approach that the appointed lighting consultant should follow, as well as providing lighting related design measures to limit obtrusive light from the Proposed Development.
- 4.72 The primary circulation routes and pedestrian and cycle paths will be designed to direct light inwards towards the site and downwards to avoid unnecessary light spill. Warmer colour temperature is being considered for these areas to reduce the impact on natural surroundings.
- 4.73 The areas for cycle parking will be designed to create a well and uniformly lit environment for the safe parking, storage and retrieval of bikes.
- 4.74 The lighting design employed on terrace areas should provide enough lighting to make entrances and walkways visible.
- 4.75 To minimise potential obtrusive light from the Proposed Development, embedded design measures have been considered in the lighting design including:
 - Careful selection and consideration of placement of luminaires;
 - Careful selection and consideration of column heights to ensure lighting is focused on thoroughfares minimising light spill to existing and proposed ecology and vegetation;
 - Careful selection of luminaire control gear, to ensure light outputs can be dimmed; and
 - Adopting lamps/LEDs with similar correlated colour temperatures no greater than 3000K to reduce visual disturbance.

Access, Parking and Servicing

Vehicular Access and Parking

- 4.76 Vehicular access to the new Broad Street Mall MSCP ramp and to the basement service and plant level is provided from:
 - The Inner Distribution Road (IDR) to the north; and
 - Castle Street to the south.
- 4.77 From the basement, vehicular egress is via the IDR.
- 4.78 Hosier Street provides limited vehicular access from the east to service two of the retail units.
- 4.79 The Proposed Development will allocate a total of 100 car parking spaces, which will be located outside of the redline boundary and within the remaining part of the existing Broad Street Mall Shopping Centre carpark. These are existing spaces currently located within the MSCP. The realignment of existing car parking spaces within the MSCP will also be required to facilitate the construction of the Proposed Development.
- 4.80 The existing carpark provides 784 spaces. Overall, there will be a loss of 290 spaces, to provide a new total of 494 car parking spaces within the existing carpark (of which, 100 spaces will be allocated to the Proposed Development for private residential lease).
- 4.81 Vehicle access to the Proposed Development is shown on Figure 4.13.

Pedestrian Access

- 4.82 Pedestrian access to the retail units is provided along Dusseldorf Way. Pedestrian access to each of the residential buildings is also from Dusseldorf Way, with a main residential entrance in the centrally located Building B and secondary entrances to Buildings A, C and D. Pedestrian access is shown on Figure 4.14.

Cycle Access and Parking

- 4.83 The Proposed Development will provide cycle provision in line with planning requirements to promote sustainable modes of transport.
- 4.84 Cycle access for the Proposed Development is via Hosier Street from the east and Dusseldorf Way from the west to a combined cycle store within the Ground Level of Building D (see Figure 4.13) providing 347 cycle space provision for the residential uses and an additional 17 spaces associated with the retail units. In total there are 364 cycle spaces provided. Further to the cycle parking proposed for future residents and staff, as

part of the public realm package of works on Dusseldorf Way and Queens Walk there will be 15 new Sheffield stands (30 spaces) provides for public use

Figure 4.13 Proposed Development Basement Level Access

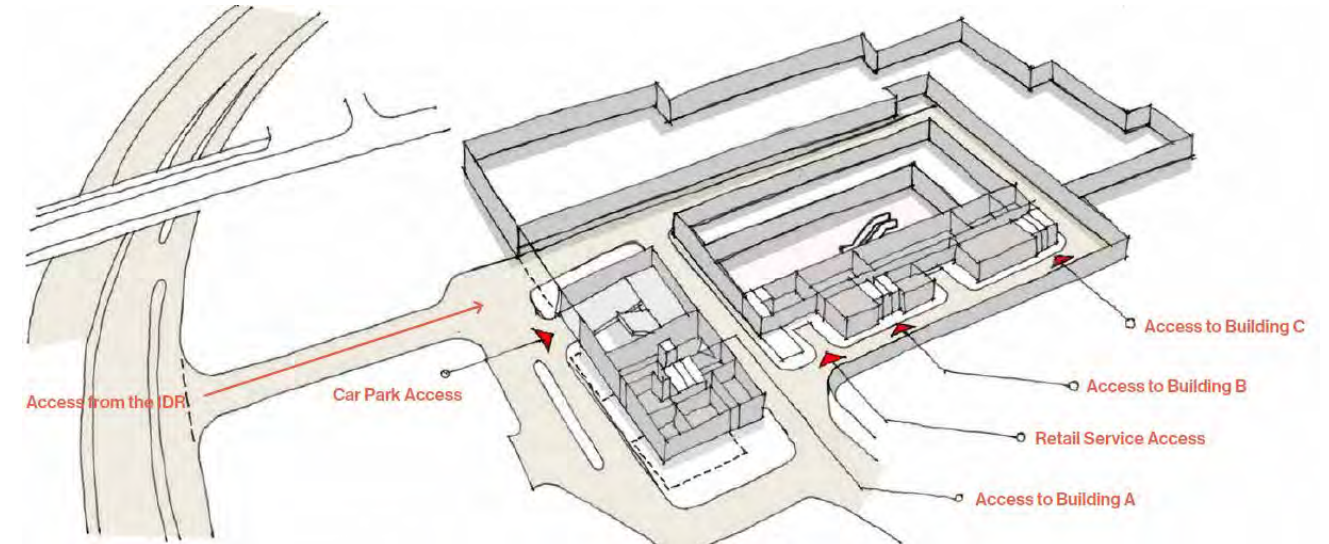
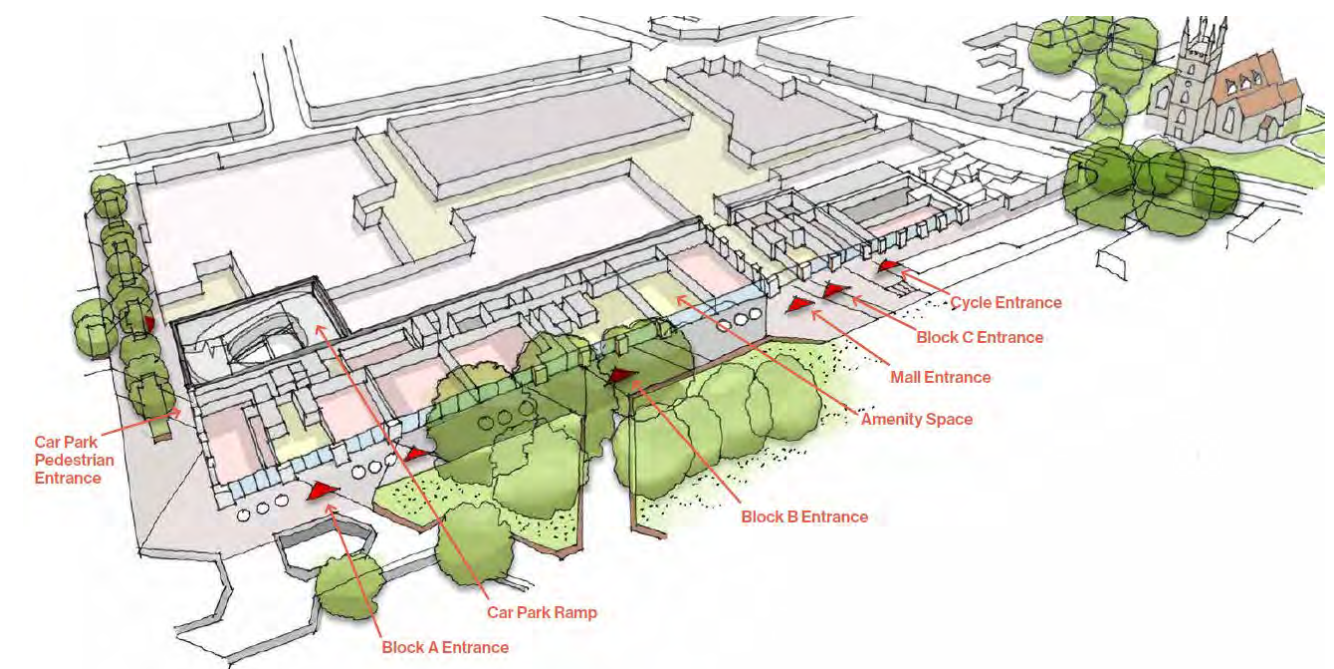


Figure 4.14 Proposed Development Ground Floor Access



Servicing

- 4.85 During the demolition and construction of the Proposed Development, temporary servicing arrangements for the existing retail tenants shall be put in place.
- 4.86 Once the Proposed Development is complete and operational, the current servicing arrangement for the Broad Street Mall Shopping Centre will be reinstated with the main vehicular loop around the basement area recreated.
- 4.87 All of the servicing, for both the residential and non-residential elements of the Proposed Development, will occur from the basement level to tie in with the existing Broad Street Mall Shopping Centre servicing strategy. Designated service bays have been designed for each Building to ensure the main vehicular circulation route is kept clear.

Waste Management

- 4.88** The residential waste management strategy involves the inclusion of separate waste and recycling storage within the individual residential apartments. Residents would then transport their waste and recycling to the basement of each building, where ventilated refuse and recycling rooms are located.
- 4.89** The residential waste and recycling storage requirements have been calculated for the 644 residential units. The total requirements per waste stream, and the corresponding waste storage bins are shown in Table 4.3 below.

Table 4.3 Residential Waste

Waste Stream	Residential Waste Storage Requirement (Total) (Litres)	Residential Waste Storage (Total) Bins
General Waste	90,160	41no. Eurobins
Food Waste	14,812	31no. 240 litre bins
Glass	14,812	31no. 240 litre bins
Recycling	154,560	70no. Eurobins

- 4.90** The amount of residential waste expected to be generated by the Proposed Development is approximately 483 tonnes per year. There is limited information on the commercial end users of the Proposed Development and therefore it is not possible to identify the specific quantities of commercial waste generated per year. However, the commercial end users of the Proposed Development are expected to adhere to the principles of the Waste Hierarchy, ensuring waste minimisation prior to reuse, recycling and recovery.
- 4.91** For all waste (both residential and non-residential), refuse vehicles will pull up in the parking bays provided located in the basement service area on collection days. These are located within 10m of individual refuse stores allowing direct collection from the refuse rooms.
- 4.92** The building management operative will be responsible for arranging appropriate security and access measures for collections. In addition, the management operative will also be responsible for the general upkeep of the refuse and recycling storage rooms with the various bin types clearly presented for tenants who will be responsible for placing their own refuse and recycling in the appropriate bins.
- 4.93** At ground floor, for the 8 commercial units that face onto Dusseldorf Way, refuse storage is provided in the basement service area within a dedicated retail ventilated and recycling room. Storage provision is based on weekly commercial collection and arisings calculated based on the waste management in buildings code of practice.
- 4.94** Typical weekly arisings for a shopping centre is as follows:
- Arisings / week – 10 litres/m² sales area
 - Total sales area of all retail units – 1,364m²
 - Weekly arisings – 13,550 litres
 - Weekly storage requirement – 13 Eurobins minimum provision
- 4.95** To give some flexibility, a provision of 2 Eurobins per retail unit (8no retail units / 16 Eurobins) has been allocated within the store.

Energy, Ventilation and Sustainability

Energy Strategy

- 4.96** The energy strategy responds to the Universal Challenges of the Climate Emergency facing humanity, in addition to national and local policy. It has considered the energy hierarchy 'Be Lean, Be Clean, Be Green', which utilises a fabric first approach to maximise reduction in energy through passive design measures. In order of priority, these steps are:
- Be lean, i.e., adopt energy efficient design construction,
 - Be clean, i.e., use low-carbon energy supply; and
 - Be green, i.e., use on-site renewable energy generation and storage.

- 4.97** A 'fabric first' approach has been taken in order to reduce the energy demand and CO₂ emissions from the Proposed Development. The Proposed Development will benefit from an efficient thermal envelope. Heat losses and gains will be controlled by the optimisation of the fabric, i.e. ensuring appropriate levels of glazing to control winter heat loss and summer heat gain.
- 4.98** Mechanical Heat Ventilation and Recovery (MHVR) units are employed throughout the Proposed Development to maintain good indoor air quality and efficiently circulate warm air, reducing heating demand and associated emissions.
- 4.99** To reduce emissions from lighting within the Proposed Development, energy efficient lighting will be supplied in the form of LED lighting or similar low-energy lamps.
- 4.100** Air Source Heat Pumps (ASHPs) have been adopted as part of the energy strategy, as they are considered an appropriate technology for use by the Proposed Development. These are used for heating and hot water production within the Proposed Development and will be roof mounted across Buildings A, B and D. The use of solar Photovoltaic (PV) panels could provide a significant reduction in operational CO₂ and will be considered for implementation at the detailed design stage.
- 4.101** Through the measures outlined above, it is anticipated that overall, up to a 69.3% reduction in CO₂ emissions can be achieved beyond the Building Regulations Part L 2021 baseline. It is proposed that the commitment to net zero will be achieved through appropriate Carbon Offset Levy contribution, secured through S106 Agreement.

Ventilation Strategy

- 4.102** The residential accommodation will be provided with a mixture of operable windows for purge ventilation, and domestic MVHR for primary supply and extract ventilation. Each apartment will be provided with its own dedicated MVHR unit. To mitigate overheating within the apartments, MVHR units will be fitted with tempering modules. The function of the tempering module is to cool the incoming air in high ambient conditions and where elevated flow rates would not sufficiently limit overheating of the occupied spaces.
- 4.103** All ground floor retail units have been designed for the provision of mechanical supply & extract ventilation.

Flood Risk and Drainage

- 4.104** The following sections of this chapter summarise the flood risk and drainage considerations relevant to the site. Further details and supporting information can be found within the **Flood Risk Assessment including Surface Water Strategy**², submitted in support of the planning application as a standalone report.

Surface Water Drainage

- 4.105** The surface water drainage strategy for the Proposed Development has been designed in line with the most recent Environment Agency (EA) guidance to consider and manage the impact of a 1 in 100 year plus climate change rainfall event. The solutions proposed through the surface water drainage strategy ensure that for the 1 in 100 year plus 40% climate change allowance event, surface water will be accommodated within the site, preventing potential exceedance flows off-site.
- 4.106** The surface water drainage strategy has been designed to restrict runoff rates as close as practicable to Greenfield run-off rates, whilst still maintaining a gravity led surface water drainage networks. The proposed drainage strategy includes five deep blue roofs, to a total area of 1,380m².
- 4.107** An attenuation tank will also be required below the building footprint to provide additional attenuation in order to reduce surface water and pick up ground level surface runoff.
- 4.108** Surface water from the roof areas will be routed to the manhole and ground attenuation tank beneath the site.
- 4.109** Surface water discharging from the site will be routed to a chamber containing a flow control device which will limit the surface water discharging from the site as a whole. Surface water from the site will discharge to the existing Thames Water surface water sewer running beneath Dusseldorf Way.

Groundwater Flooding

- 4.110** The risk of groundwater flooding across the Reading area is typically considered to be low, but it is noted that the historic records from the RBC identify some isolated records of groundwater flooding; these are typically low-lying areas in close proximity to the River Thames (and therefore where groundwater levels would

² BJB Consulting (2018) Flood Risk Assessment including Surface Water Strategy

potentially be at seasonal shallow depths). The probability of groundwater flooding impacting the site is considered to be Negligible.

Foul Water Drainage and Sewer Flooding

- 4.111** It is proposed that foul water from the site is directed to Thames Water manhole 2201.
- 4.112** Based on the information available the probability of sewer flooding impacting the site is unlikely.
- 4.113** The foul water and surface water generated on-site will be discharged into the Thames Water Utilities Limited (TWUL) network. A pre-planning enquiry was submitted to TWUL, who confirmed sufficient capacity for foul and surface water generated by the Proposed Development.
- 4.114** During the detailed design stage, TWUL will be contacted regarding connection to the sewer network. It is likely that TWUL will need to undertake an assessment to determine the capacity of the local network and the point of connection and will identify any requirement to upgrade the local network.

Water Resources

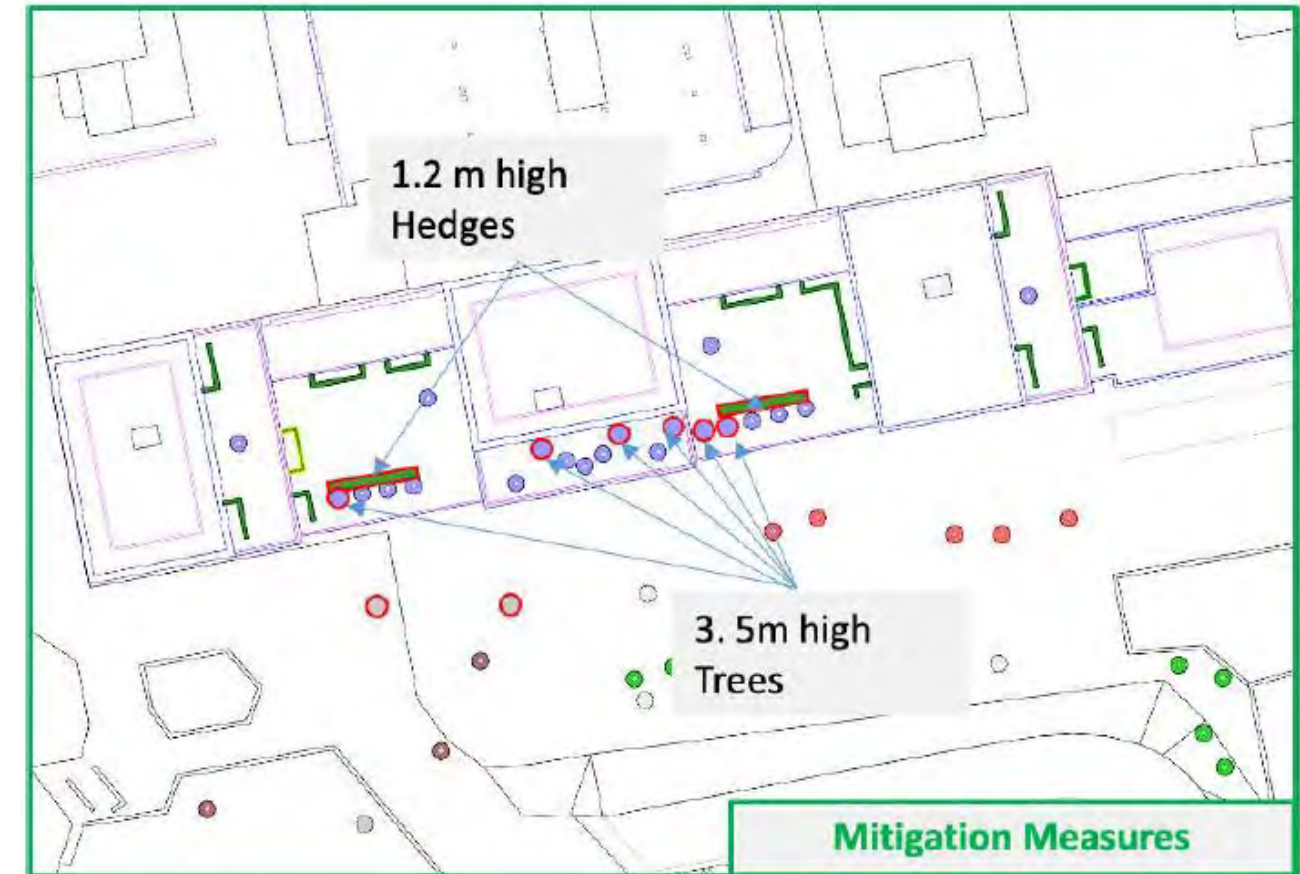
Water Demand

- 4.115** The site is currently occupied by existing retail provision in the form of Broad Street Mall, therefore there is an existing water demand and usage for the site.
- 4.116** At the detailed design stage for the Proposed Development, the final water demand will be determined. At this stage, the indicative water demand volumes for the Proposed Development are as follows:
- Residential: 11l/s for all buildings;
 - Commercial: 0.5l/s per unit; and
 - Amenity: 1l/s.
- 4.117** To inform the detailed design stage, TWUL may need to carry out flow and pressure tests for daily demand estimations when the planning application for the Proposed Development is submitted. This will assess the available capacity in the local supply network and determine whether any additional mains laying is necessary to support the Proposed Development and provide an indication of any cost of upgrades to the network. This would be undertaken as part of the detailed design stage if required.

Wind Microclimate Mitigation Measures

- 4.118** Wind tunnel and CFD testing has been undertaken extensively as part of the evolving design of the proposed Development to ensure appropriate comfort and safety criteria for wind conditions are met.
- 4.119** As detailed in **ES Volume 1, Chapter 10: Wind Microclimate**, various wind mitigation measures were developed to ensure appropriate comfort and safety criteria for wind conditions.
- 4.120** Additional trees and hedges were proposed on the podiums between Building A and B and Building B and C, and on the roof terrace of Building B. The layout of these mitigation measures can be seen in Figure 4.15.

Figure 4.15 Wind Microclimate Mitigation Measures



Climate Change Resilience and Adaptation Measures

- 4.121** Measures to ensure that the Proposed Development is resilient to, as well as able to adapt to, future environmental conditions as a result of climate change have been identified within this ES chapter, where relevant.
- 4.122** Paragraphs 4.97 to 4.102 have summarised the design measures embedded into the Proposed Development to reduce energy consumption as well as manage internal temperatures that will fluctuate even more under future climate conditions. In addition to this, measures to reduce the Proposed Development's Greenhouse Gas (GHG) emissions have been described, such as the use of all electrical power generation.
- 4.123** Paragraph 4.106 has described how the Proposed Development is resilient to future intense rainfall events as a result of climate change, accommodating a 40% increase above a 1 in 100 year rainfall event.

INTRODUCTION

- 5.1 This chapter of the Environmental Statement (ES) describes the proposed programme of demolition and construction works and the key activities that will be undertaken prior to the completion and occupation of the Proposed Development.
- 5.2 This chapter does not assess the magnitude of potential impacts, nor the scale and significance of likely effects during the demolition and construction works. The assessment of these impacts and effects is reported within each technical topic chapter of this ES (ES Volume 1, Chapters 6 to 11 and ES Volume 2) as appropriate. Accordingly, this chapter only presents those elements of the demolition / construction works that that are relevant to the topics scoped into this ES.
- 5.3 Planning for the demolition and construction of the development is broad at this stage of the planning process and may be subject to modification during the detailed planning of these works. The following construction programme, logistics and methodologies have been based on reasonable assumptions developed with the collective experience of the design and consultant team who have extensive experience on similar projects. This will be refined following consultation with the various project stakeholders and with the input of the selected Main Contractor.
- 5.4 This chapter of the ES has been based off information provided by Silver DCC Limited within a Construction Management Plan (CMP). Potential environmental effects identified within this chapter are discussed in more detail in each of the corresponding technical chapters of this ES (Volume 1 and Volume 2).

Programme of Works

- 5.5 The demolition and subsequent construction of the Proposed Development includes several components. Refer to Figure 5.1 below for the location of these key components.
- 5.6 The key activities that will be undertaken as part of the demolition and construction works include:
 - Pre-commencement surveys, investigations, consents / licences;
 - Site establishment and enabling works, including construction interface works to the remaining element of the existing Broad Street Mall Shopping Centre (hereafter referred to as the 'Existing Mall');
 - Demolition of part of the Existing Mall;
 - Demolition, excavation and temporary surfacing of Dusseldorf Way;
 - Demolition and construction of a New Ramp;
 - Construction;
 - Sub-structure;
 - Superstructure; and
 - Installation of the envelope and cladding);
 - Fit-out (internal works); and
 - Landscaping and public realm (external works).
- 5.7 The anticipated programme is presented in Figure 5.2 and summarised in Table 5.1.

Table 5.1 Indicative Demolition and Construction Programme

Construction Task / Activity	Duration (months)
Site Establishment and Enabling Works	12 months
Works to the Existing Shopping Centre	7 months
Demolition of Shopping Centre	8.5 months
Dusseldorf Way works	3 months
New Ramp	
Demolition of existing ramp	2.5 months
Excavation and substructure works	6 months
Superstructure construction	4.75 months

Construction Task / Activity	Duration (months)
Buildings A to D	
Substructure	18 months
Superstructure	30 months
Building Envelope	21 months
Fit-out	21 months
External Landscaping	12 months

- 5.8 As shown in Figure 5.2, there will be a staggered completion, spanning a period of 6 months. It is understood that upon completion, Buildings C and D will be occupied first, whilst construction of Buildings A and B are ongoing. This will be followed by occupation of Building B, and followed by Building A.
- 5.9 For the purposes of the EIA, the demolition and construction works are assumed to commence in 2024. The Proposed Development is assumed to be completed in 2029. Overall construction period is assumed to be 5 years (60 months).

Figure 5.1 Key Components of the Proposed Development for Demolition and Construction Purposes

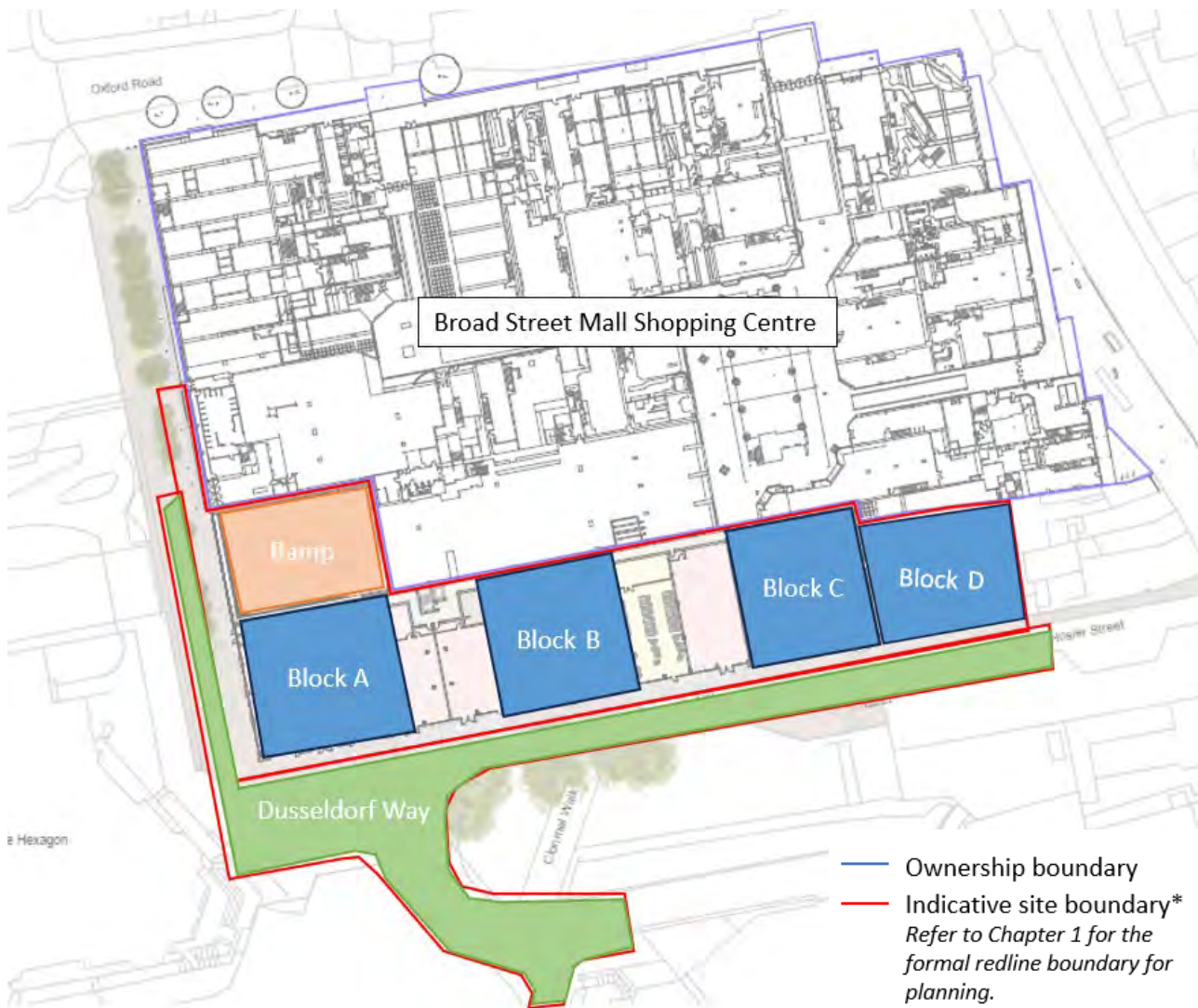


Figure 5.2 Indicative Demolition and Construction Programme

Year		Year 1				Year 2				Year 3				Year 4				Year 5				Year 6			
Quarter		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Whole Site	Presite Surveys																								
	Design																								
	Enabling works																								
Shopping Centre	Shopping Centre Works																								
	Shopping Centre Works (TK Maxx)																								
	Shopping Centre Demolition																								
Dusseldorf Way	Dusseldorf Way Demolition, Excavation and Temporary surfacing																								
	Dusseldorf Way Entrance Closed																								
	Dusseldorf Way Temporary Access open																								
New Ramp	Demolition of existing ramp																								
	Excavation and substructure works																								
	Piling																								
	Superstructure construction																								
Block A	Excavation and substructure works																								
	Breaking out the existing concrete slab preparation for piling operations																								
	Piling																								
	Superstructure construction																								
	(SFS) structural external rame																								
	Envelope																								
	Fitout																								
	External Works																								
	Occupation																								
Block B	Excavation and substructure works																								
	Breaking out the existing concrete slab preparation for piling operations																								
	Piling																								
	Superstructure construction																								
	(SFS) structural external rame																								
	Envelope																								
	Fitout																								
	External Works																								
	Occupation																								
Block C & D	Excavation and substructure works																								
	Breaking out the existing concrete slab preparation for piling operations																								
	Piling																								
	Superstructure construction																								
	(SFS) structural external rame																								
	Envelope																								
	Fitout																								
	External Works																								
	Occupation																								

DESCRIPTION OF THE WORKS

Sitewide Construction Approach (Excluding Car Park Ramp Installation)

Enabling Works

Pre-Commencement Surveys, Investigations, Consents/Licences

5.10 Prior to the demolition works, the enabling works and site set-up will involve utility diversions and the removal of any asbestos from the existing adjacent occupied buildings. Several surveys and investigations will need to be undertaken prior to the commencement of the works on-site. The following pre-commencement surveys and investigations are envisaged:

- Condition survey of any adjoining party walls and boundary walls;
- Structural surveys of existing buildings;
- Asbestos survey of existing buildings;
- Topographical survey to confirm existing site levels;
- Utility surveys to determine the position of any assets;
- CCTV survey of the surface water and foul water drainage to confirm size and condition;
- Utility Diversions / Removals; and
- Consultation with Thames Water Utilities Limited (TWUL) over the need for flow and pressure tests for daily water demand estimations. This will allow TWUL to assess as part of their statutory duty the available capacity in the local supply network and determine whether any additional mains laying is necessary to support the Proposed Development. TWUL will also be contacted regarding connection to the sewer network. Should upgrades or new connections be required, TWUL will discuss these with the Applicant and ascertain the costs for the works and the scheduling of the works to align with the Proposed Development's build programme.

5.11 In addition, to the surveys and investigations identified above, various consents and licenses will be required taking into to the consideration the necessary consents and licences required to commence an on-site activity will be applied for giving appropriate notice periods. These may include:

- Connections to existing statutory services and main sewer (see above);
- Licenses for discharge of water from the site into the public sewer, if required; and

Utility Diversions / Removals

5.12 Detailed discussion and reviews will be undertaken with all statutory utility companies in advance of the works on the areas of the site that may have utility services, as indicated by utility company record drawings. Any required diversions will be implemented in advance of the construction works, in compliance with all statutory notifications and required provisions.

Site Establishment

5.13 Following site possession by the Main Contractor, activities will include the installation of hoardings, traffic management provisions, set up of site accommodation and the installation of protective measures to ensure the safety of neighbours, pedestrians and operatives.

5.14 Modifications to internal areas within the Existing Mall will be required during the construction works and these will be explained to the retail tenants and the Mall Centre Manager prior to implementation (refer section 'Neighbour and Public Relations' of this ES chapter).

5.15 The live construction areas within the Existing Mall will be fully encapsulated and screened for the duration of the works, keeping the works fully segregated from the retained operating retail units and visitors to the Existing Mall.

Hoarding

5.16 The boundary of the site will be established both at basement level, ground level and at each car park/shopping centre level and 2400mm high hoarding will be constructed around the works (see Figure 5.3). The hoarding will stay fixed in position until handover and the progressive occupation of Buildings A, B and C&D in sequence.

5.17 The individual site areas will be hoarded and secured with acoustic Noise Reduction Hoarding panels.

5.18 Where scaffolding is erected Mona flex sheeting will be erected around the perimeter of the area, providing screening and protection to site users. Podium Hoarding Plan can be seen in Figure 5.5.

5.19 The basement hoarding plan can be found in Figure 5.3.

Figure 5.3 Hoarding Location at Car Park and Basement Level

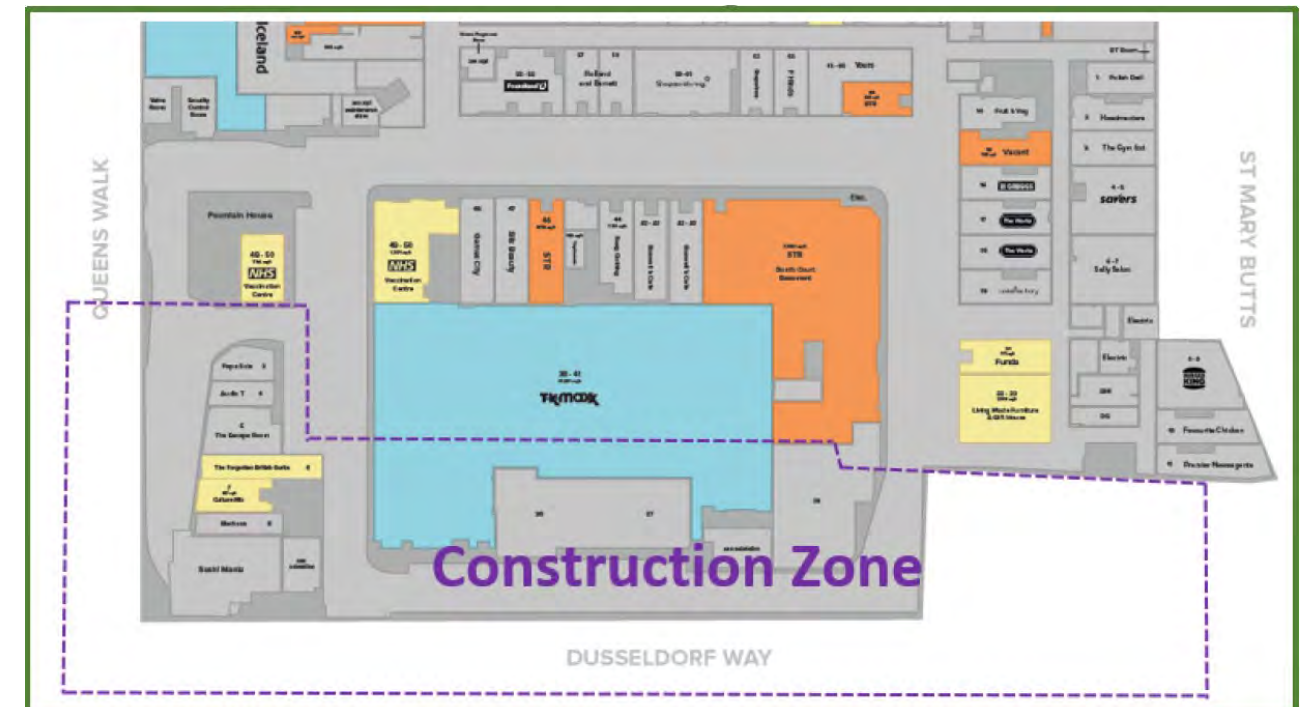


Figure 5.4 Hoarding Location at Car Park and Ground Level

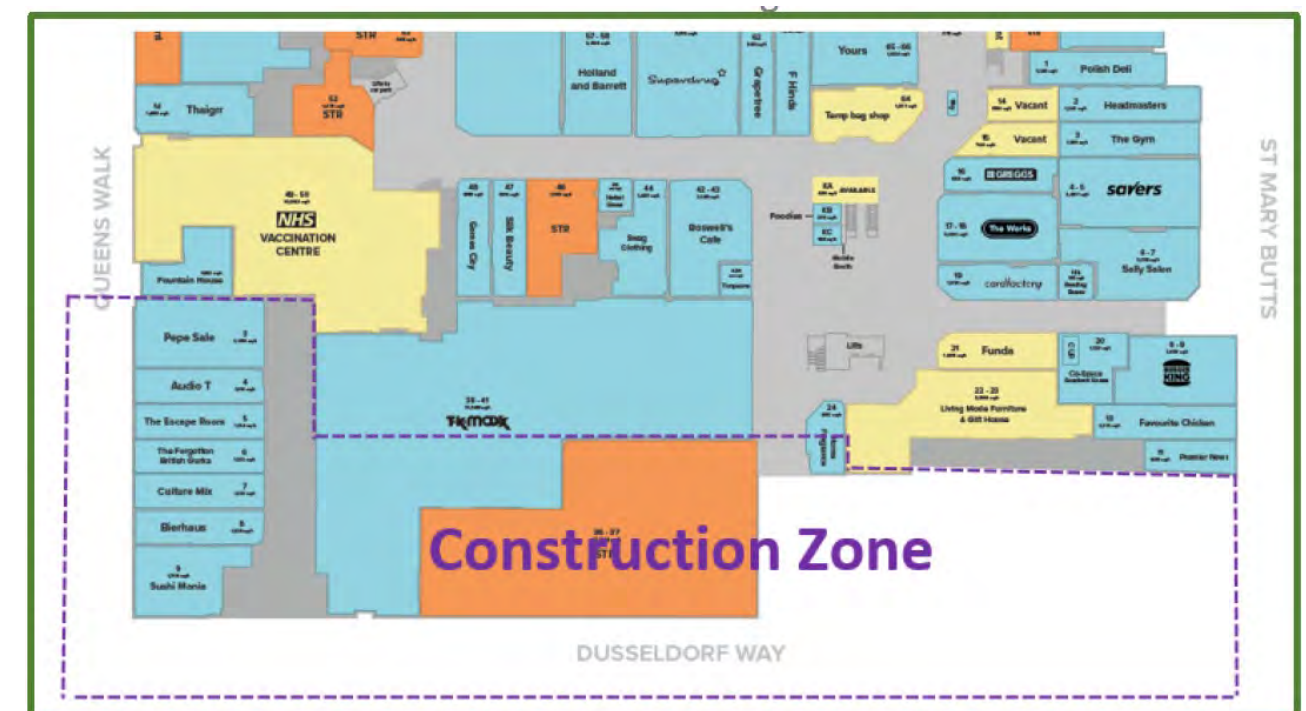


Figure 5.5 Podium Hoarding Plan (shown in green)



Site Office and Welfare Facilities

- 5.20** Site welfare facilities will be established at an agreed position with Reading Borough Council (RBC) prior to the commencement of works. These facilities will include a canteen, drying rooms, toilets and office facilities. The site office and welfare facilities will be strategically located in a position that is appropriate to serve the full construction period, and it is anticipated the site office will remain in the same location throughout the works.

Dusseldorf Way

- 5.21** A ramp running along Dusseldorf Way will be required to allow access to the lower existing exit road to the Existing Mall Multi-Storey Car Park (MSCP). This road will run parallel to the existing basement service road and provide a 'one way system' for vehicle deliveries entering site from Castle Street and exiting via the one way system using the same route as the current Existing Mall delivery vehicles.
- 5.22** The partial demolition of Dusseldorf Way is required to facilitate this, and will then see the formulation of a site traffic ramp and highway realignment works to create a construction traffic route.
- 5.23** The demolition will be undertaken using pneumatic breakers and jaw fitted to tracked 360 machinery. Height restrictions are evident in some areas, but the initial operations will be to decommission/remove high level services prior to the machinery arriving. Internally all of the 'light weight' materials – steel, plastics, bricks and Buildings – will be removed to clear areas and provide access to the open frame, using smaller mechanical bob-cats and mini-diggers. The concrete façade will also be removed as an initial demolition operation by the larger machines, and once the frame is exposed, they will 'munch' into the building from standings on the outside and reaching in.
- 5.24** Figure 5.6 and Figure 5.7 below show the location of the proposed construction access ramp. This is coloured pink in Figure 5.6, with the ramp gradient shown in Figure 5.7.

Figure 5.6 Proposed Construction Access Ramp Location

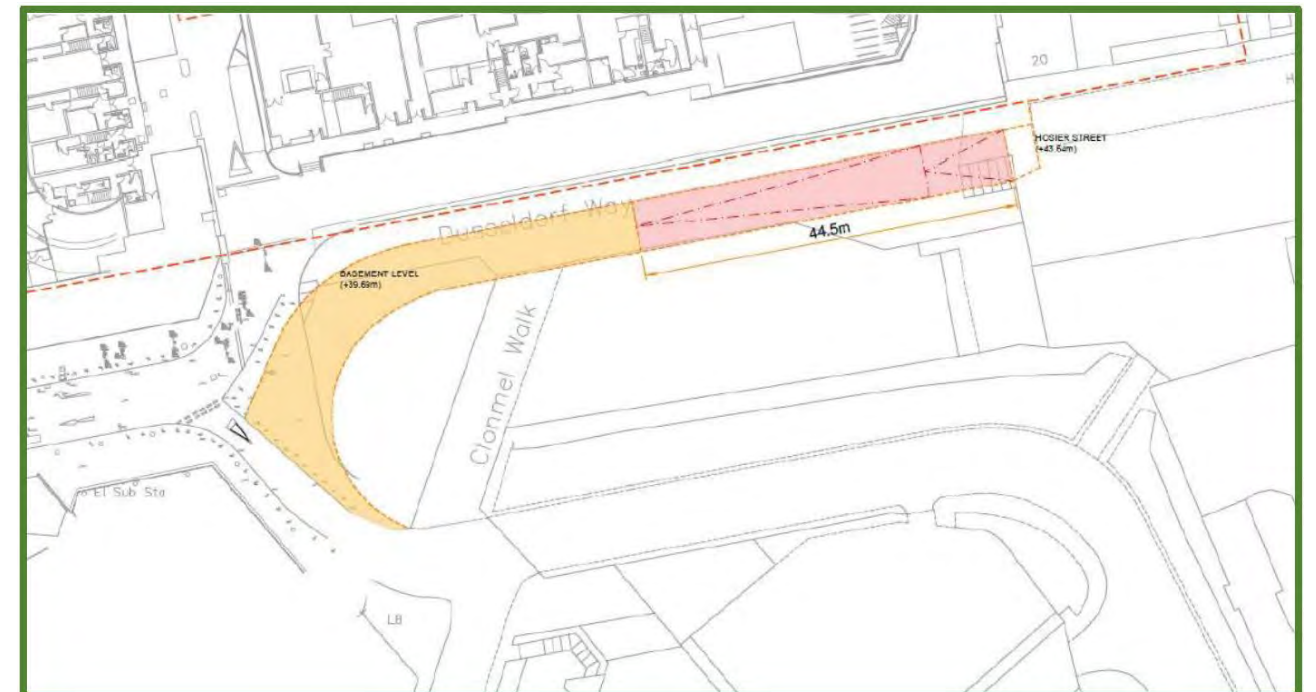
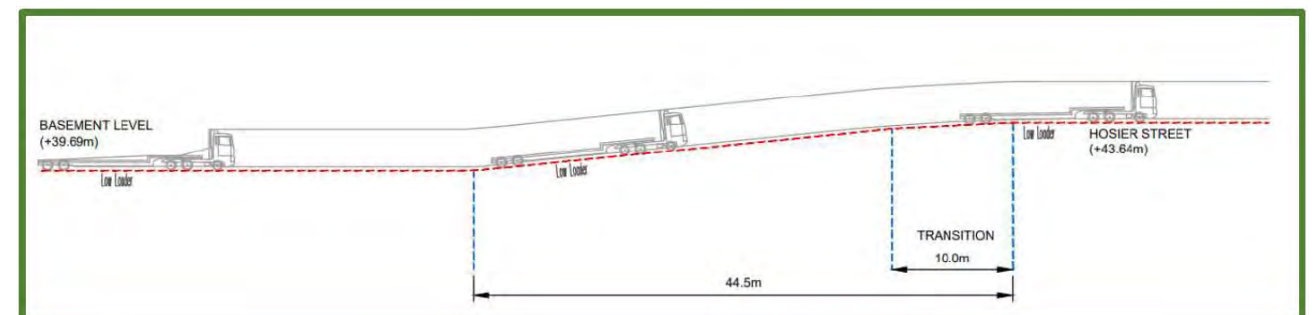


Figure 5.7 Proposed Construction Access Ramp – Vertical Section



Shopping Centre Works

- 5.25** There are a small number of retail units that fall within the demolition line, which require strengthening and the installation of a new separating wall. Alterations to these units is required prior to demolition. The demolition works extend partially into the retail units located on the Ground and First Floor. These units will be closed and vacated during the installation of strengthening works and the new separating wall. This also includes TK Maxx, with strengthening and the separating wall works to commence after vacant possession is achieved.
- 5.26** A temporary hoarding will need to close off the areas to enable new steel beams (for strengthening purposes) and new separating wall to be constructed. The demolition for the majority of retail units (except TK Maxx) will be by hand, given that the sections of the retail units to be removed will be demountable partitions and walls. These façades, flooring and ceiling finishes will be reinstated following the construction of the new separating wall.
- 5.27** For the TK Maxx unit, a saw cut will be made at all slab levels to allow the demolition to commence. Saw cutting with suitable diamond tipped cutting wheel, that operates on a pull along trolley will be used. These will commence a minimum of 150mm from the face for the existing columns. The cut edge of the existing and retained slab will be made good with suitable repair products. Mobile towers and scissor lifts will be used for access to high level areas. These works will be accessed from the area south of the TK Maxx new demise. The change to the demise of TK Maxx is shown in Figure 5.8 and Figure 5.9.
- 5.28** The separating wall between the retail and demolition extent will be insulated and weathered to ensure continued use of the retail spaces affected by the demolition works. The new separating wall will consist of a 140mm Buildingwork wall with suitable insulation to meet building regulations. Fire stopping and wind posts as

required. It will have the required thermal, acoustic, fire and structural integrity to comply with Building Regulations, including 120 minutes fire protection and 50Db sound reduction to meeting acoustic engineer requirements.

- 5.29 On completion of the construction of the separating wall the hoarding will be removed and floor and ceiling finishes reinstated.

Figure 5.8 Existing TK Maxx Demise (Ground Floor)

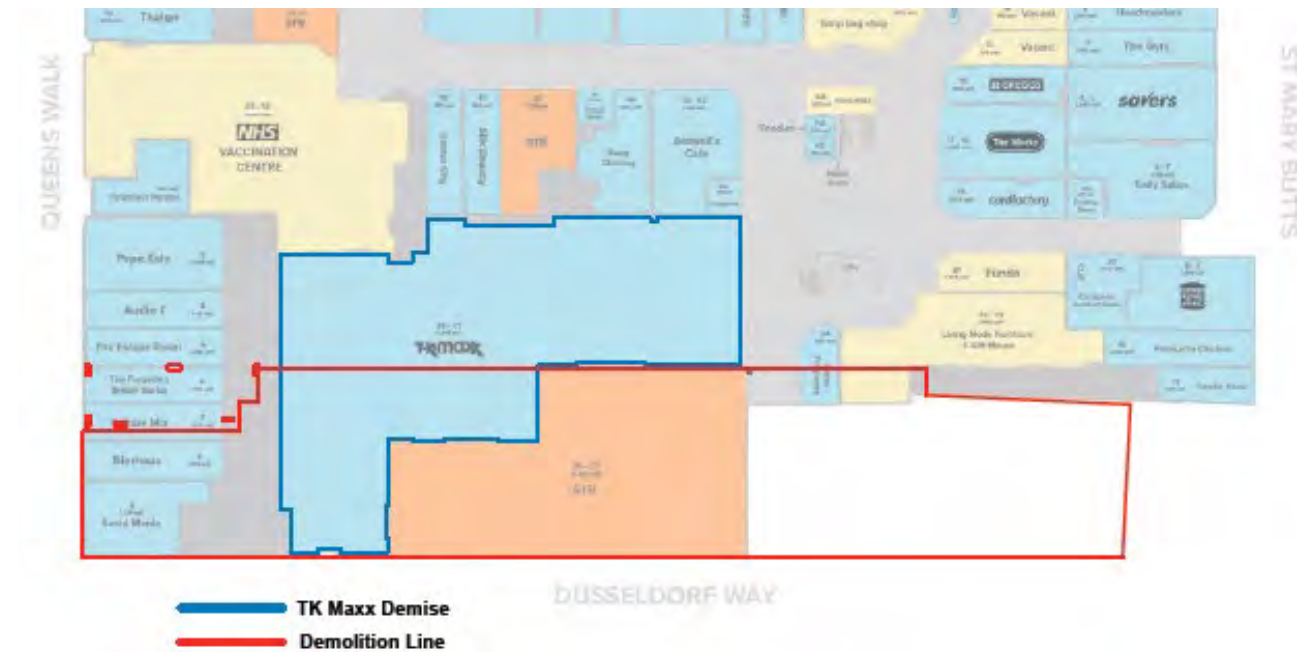
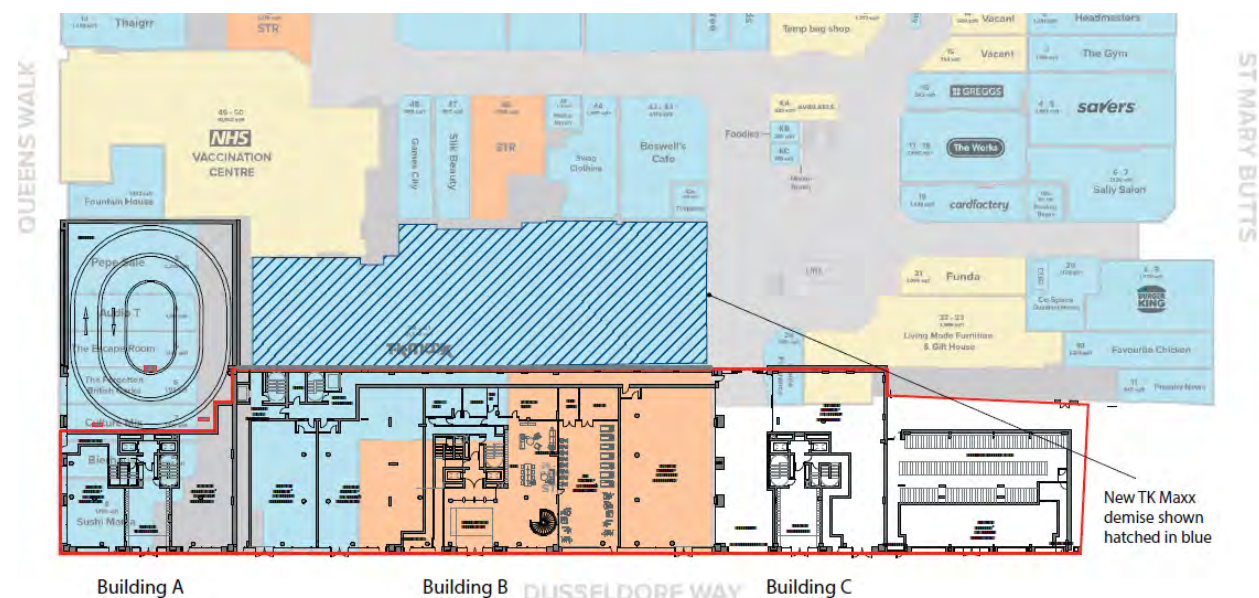


Figure 5.9 Revised TK Maxx Demise after Demolition Works (Ground Floor)



Demolition

- 5.30 The following demolition works will take place as part of the redevelopment of the site, and the existing uses will be removed or relocated as follows:
- Partial demolition of the shopping centre and MSCP, including the existing Multi-Storey Carpark (MSCP) ramp. This will include the relocation of substations, the relocation of shopping centre WC facilities, office management area and entrance from the MSCP to the shopping centre at first floor level, the relocation of the waste compactor at basement level, and alterations in the basement area to accommodate turning of retail delivery vehicles during the construction period;

- Breaking out all existing pad foundations under demolished columns;
- Localised strengthening and reinforcement where required; and
- Drainage alterations and service diversions.

- 5.31 During the demolition works, the access to the existing MSCP will be closed from Castle Street. Access will still be available from the A329 IDR only.

- 5.32 Demolition will be required within the Existing Mall to provide sufficient space for the central lift and stair cores serving the Proposed Development. Demolition of small areas of the basement will be necessary to create sufficient space for the cores for the towers which will be built through the podium deck. The foundation piles and piling caps will be present in the basement of the shopping centre, below the existing slab level.

- 5.33 The works required will be regularly reviewed with the retail owners and management company to ensure that all works are clearly identified with procedures agreed to ensure that the health and safety of all personnel (i.e. visitors, retail workers etc.) using the Existing Mall is maintained.

Substructure Works

- 5.34 Excavation and substructure works will be undertaken in the following order:

- Breaking out the existing concrete slab and formation excavation will be undertaken in preparation for piling operations;
- Piling will be undertaken via the Continuous Flight Auger (CFA) piling method, which is the quietest form of piling and is a cast in-situ process. Piling will be undertaken into and through the ground. Pile sleeves will be used where necessary to prevent collapse through any weak strata;
- The Piles will be progressively installed following the pile coring. The piles installed will include support for the tower cranes;
- Following the piling works, the installation of pile caps will be undertaken; and
- All substructure reinforced concrete works will be progressively installed following the installation of pile caps. This will include the lift pits, any sumps, pumps and reduced level plant rooms.

- 5.35 The Proposed Development does not propose the creation of any additional basement floorspace. However, some excavation may be required for reduced level areas such as plant rooms and lift pits in connection with the residential tower requirements. This will be undertaken through a combination of core drilling and mechanical breakers, to construct the basement structures through the existing concrete basement floor.

- 5.36 Where ground water is encountered during any piling operations within the basement to construct the foundations for the tower cores and tower crane bases, dewatering will be undertaken, pumping will be carried out using silently operated pumps. Ground water sediment/settlement tanks will be utilised with all necessary environmental controls implemented. Further details regarding measures to avoid or mitigate environmental impacts is presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**.

Superstructure

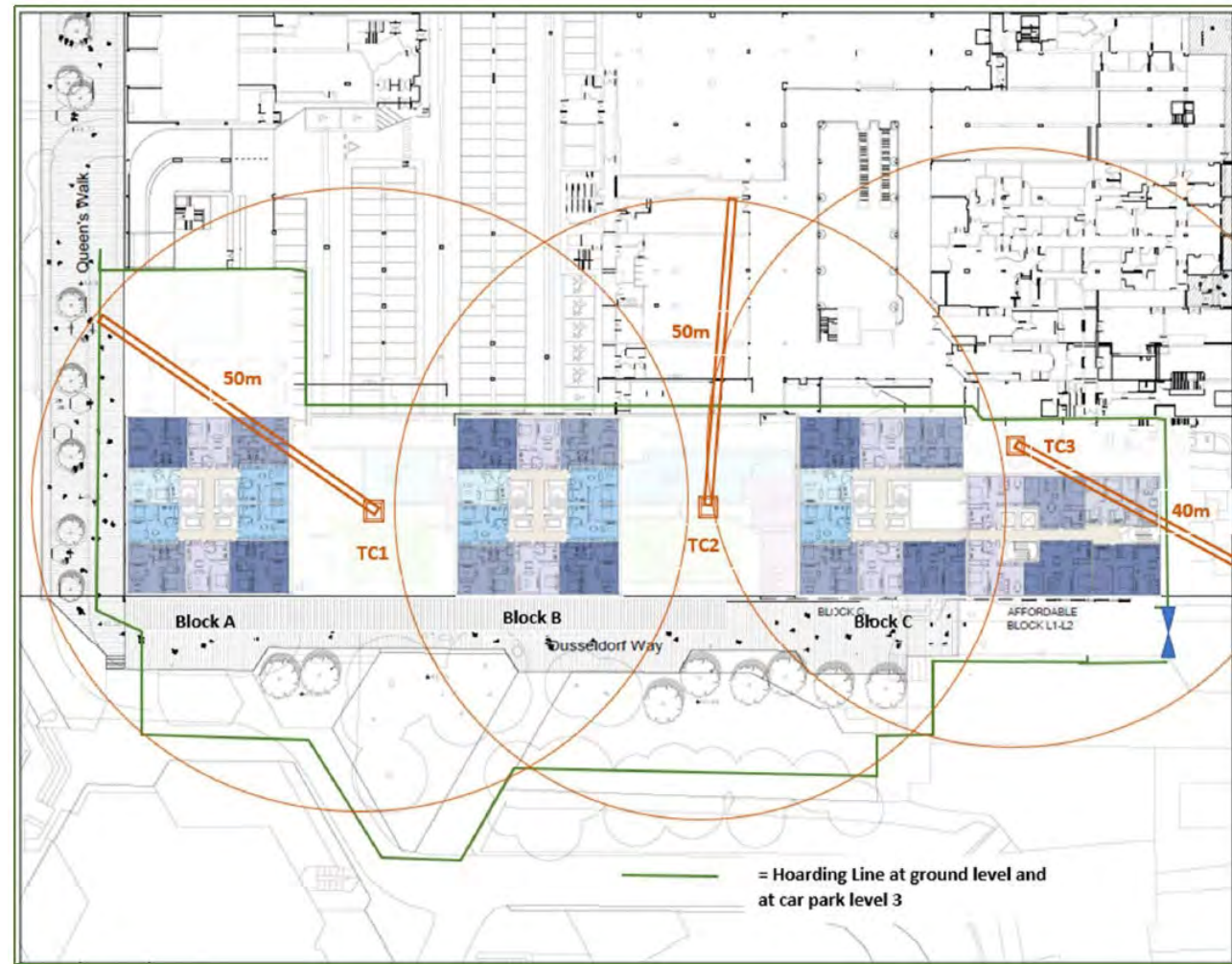
- 5.37 The frame to Buildings A, B and C&D will be constructed in reinforced concrete, cantilevered from the central vertical access core. The tower cranes will be utilised to hoist all components into place. Where practical, prefabricated elements (i.e. such as stairs) will be delivered to site: to minimise on-site labour required to erect the cladding; ease logistics; reduce number of vehicle trips; and to optimise/reduce the programme period.

- 5.38 The sequence of operations will be as follows:

- Complete the tower core structure;
- Install the structural floor components;
- Erect the lightweight steel framing systems (SFS) structural external frame;
- Install the windows from inside the Building;
- Fix the cementitious board to the SFS frame; and
- Install the cladding systems brackets and rails and then finally install the cladding panels / brickwork.

- 5.39 Access to allow the external cladding / brickwork components will be by mast climber and where necessary at height (set back) levels scaffolding platforms will be erected.
- 5.40 It is proposed to utilise the area of the amenity deck for the storage of materials once these have been off loaded by the crane from ground floor level (see Figure 5.7).
- 5.41 There will be a Luffing Jib Tower Crane used for Buildings A, B and C&D), with the cranes located in the area between Buildings A and B for TC1, in between Buildings B and C for TC2 and within the recess area to the rear of Building C for TC3. See Figure 5.10 below, indicating the locations of the tower cranes and the crane radius.
- 5.42 The temporary use of tower cranes for the demolition and construction works would not exceed a height of 60m above ordnance datum (AOD) and would not infringe any safeguarding obstacle limitation surface. Fixed red aeronautical obstacle lighting to the jibs of the tower cranes will be provided.
- 5.43 Crane arcs for the cranes will be controlled (SME system) to prevent over sail of the public realm, highways and neighbouring properties.

Figure 5.10 Proposed Tower Crane Location and Radius



Building Envelope

- 5.44 The building facades will constitute cladding panels or brickwork. It is envisaged that off-site manufacture of these panels will be utilised as far as reasonably practical with feasibility studies undertaken to test the benefits to programme of lifting in complete floor height units as the frame progresses.
- 5.45 Access mast climbers (or where necessary at higher set back levels scaffolding platforms) will be erected to facilitate installation of the external cladding panels. Access for all subsequent finishing required to the external envelope will be by mast climbers/scaffold.
- 5.46 The SFS internal structural framework and windows to all elevations of Buildings A, B and C&D will be installed from inside of the Tower Buildings. Internal partitioning will also be constructed with an SFS system.

Fit-Out

- 5.47 As the building structure progresses vertically, the installation of SFS mild steel internal sections of the external cavity wall can also proceed. This will be followed by the installation of the ventilation flat duct and soil and vent pipes.
- 5.48 In tandem to the SFS installation and once the building is water tight, the installation of internal partitions can commence with the plasterboard fix on to one side of the internal partitions, sections of the first fix mechanical and electrical (M+E) pipework and electrical wiring can be installed.
- 5.49 Following the completion of the dry lining, second fix, decorating and finishing can follow.
- 5.50 As many elements as possible of the internal fit out will be manufactured off-site and can include as an example, bathroom pods and kitchen components, to minimise on-site labour, ease logistics, reduce number of vehicle trips and optimise programme.
- 5.51 Temporary lighting and power systems will be installed at all levels where works are in progress.
- 5.52 Vertical transportation of personnel and materials during construction will be by several material and passenger hoists. On-site storage space will be restricted and will utilise the amenity deck for storage if provided by crane, alternatively delivery by hoist will adopt a 'just in time' delivery strategy (see section 'Traffic Management' of this ES chapter for further details).
- 5.53 The installation of mast climbers will commence when the core has been completed and overhead protection can be provided to those operatives working below.

External / Landscaping

- 5.54 Landscaping works at deck level will commence on completion of the construction of access and storage at podium deck level to facilitate these works. Landscaping will be fully completed and handed over by construction phase.
- 5.55 Landscaping works are likely to comprise the installation of walkways and paving, tree pits and raised beds, prior to planting.

Car Park Ramp Installation

- 5.56 It is anticipated that the new ramp will be installed as an independent structure with its own foundation installation. The construction of the ramp will be undertaken while the MSCP is temporarily closed, and will include the following:
- Constructing pile caps and piling for Building A;
 - Pad/piles for the ramp installation;
 - Building A core and columns to level 4m including a transfer deck above the new ramp; and
 - Ramp installation.

MATERIALS QUANTITIES

Demolition

- 5.57 Table 5.2 provides an estimate of the quantities of material likely to be generated as a result of the demolition works.

Table 5.2 Estimated Demolition Quantities.

Demolition Material Type	Estimated Demolition Quantities (m³)
Concrete (Total)	2,200
General (Ground Bearing Slab)	2,400
Excavation from pile arisings	2,500

Construction

5.58 Estimates of material quantities for key construction components are provided in Table 5.3.

Table 5.3 Estimated Construction Material Quantities

Materials	Building A	Building B	Building C&D
Arisings & Concrete in Piles (m³)	160	160	160
Concrete to foundations and substructures (m³)	480	480	480
Concrete in Superstructures (m³)	2000	1600	1400
Substructure Rebar (tonnes)	200	200	200
Superstructure rebar (tonnes)	400	340	360
Façade Cladding (incl. Brick) and Glazing (m³)	1760	1440	1600
Roof finishes (m²)	200	200	200
Buildingwork Walls (m²)	4000	3200	3500
Internal Walls (m²)	4000	3200	3500
Ceilings (m²)	1800	1700	1800
Wall Finishes (m²)	4000	3200	3500
Floor Finishes (m²)	1800	1700	1800
Hard and Soft Landscaping (m²)	400	400	400

Construction Waste Generation

- 5.59 Construction waste volumes have been estimated using Building Research Establishment (BRE) Waste Benchmarking data, which outlines likely construction waste arisings in tonnes for new build construction projects. The BRE Benchmark data identifies the average tonnes of construction waste per 100m² of floor area (GEA) for residential projects as 19.8m³ per 100m².
- 5.60 Based on this information, the Proposed Development is likely to generate approximately 21,800m³ construction waste, which equates to a total of approximately 26,000 tonnes when applying standard construction factors.
- 5.61 100% recycling of inert waste from demolition and construction is targeted to be crushed on-site and reused in piling mats and substrata to hardstanding's and concrete slabs. Excavation spoil/material will be 100% reused off-site unless contamination is identified, in which case the preferred course of action will be treatment and re-use. Landfill or incineration will be utilised as a last resort if necessary.

PLANT AND EQUIPMENT

- 5.62 Consideration has been given to the types of plant that are likely to be used during the demolition and excavation, construction of substructure, superstructure and fit out works. The plant and equipment associated with these work stages is set out in Table 5.4 below.

Table 5.4 Plant and Equipment Schedule – Substructure & Main Structure.

Item of Plan	Enabling and Demolition	Substructure and Basement Cores	Super-Structure	Envelope, Roof, Shell and Core	Fit Out and External Work)
Breaker/Cutter	✓	✗	✗	✗	✗
Mini skid-steer loader	✓	✗	✗	✗	✗
Mobile floodlights	✓	✓	✓	✓	✓
Tower Cranes	✓	✓	✓	✗	✗
Passenger/goods hoists	✓	✓	✓	✓	✓
Tipper lorries	✓	✗	✗	✗	✗
Mobile cranes	✗	✗	✗	✓	✓
Mobile access equipment	✓	✓	✓	✓	✓

Item of Plan	Enabling and Demolition	Substructure and Basement Cores	Super-Structure	Envelope, Roof, Shell and Core	Fit Out and External Work)
CFA piling rig	✗	✓	✗	✗	✗
Wheel wash	✓	✗	✗	✗	✗
Lorry mounted concrete pump	✗	✓	✓	✓	✓
Concrete vibrator	✗	✓	✓	✓	✓
Forklift	✓	✓	✓	✓	✓

HOURS OF WORK

5.63 The anticipated core working hours for demolition and construction works are:

- 08:00 – 18:00 hours on weekdays;
- 08:00 – 13:00 hours on Saturdays; and
- No working on Sundays, Bank or Public Holidays.

5.64 To maintain the above working hours, the Main Contractor may require at certain times a period of up to one hour before and after normal working hours to start and close activities (this will not include works that are likely to exceed any agreed maximum construction works noise levels). Specialist construction operations and deliveries may also be required to be carried outside of these core hours in agreement with RBC and other relevant parties.

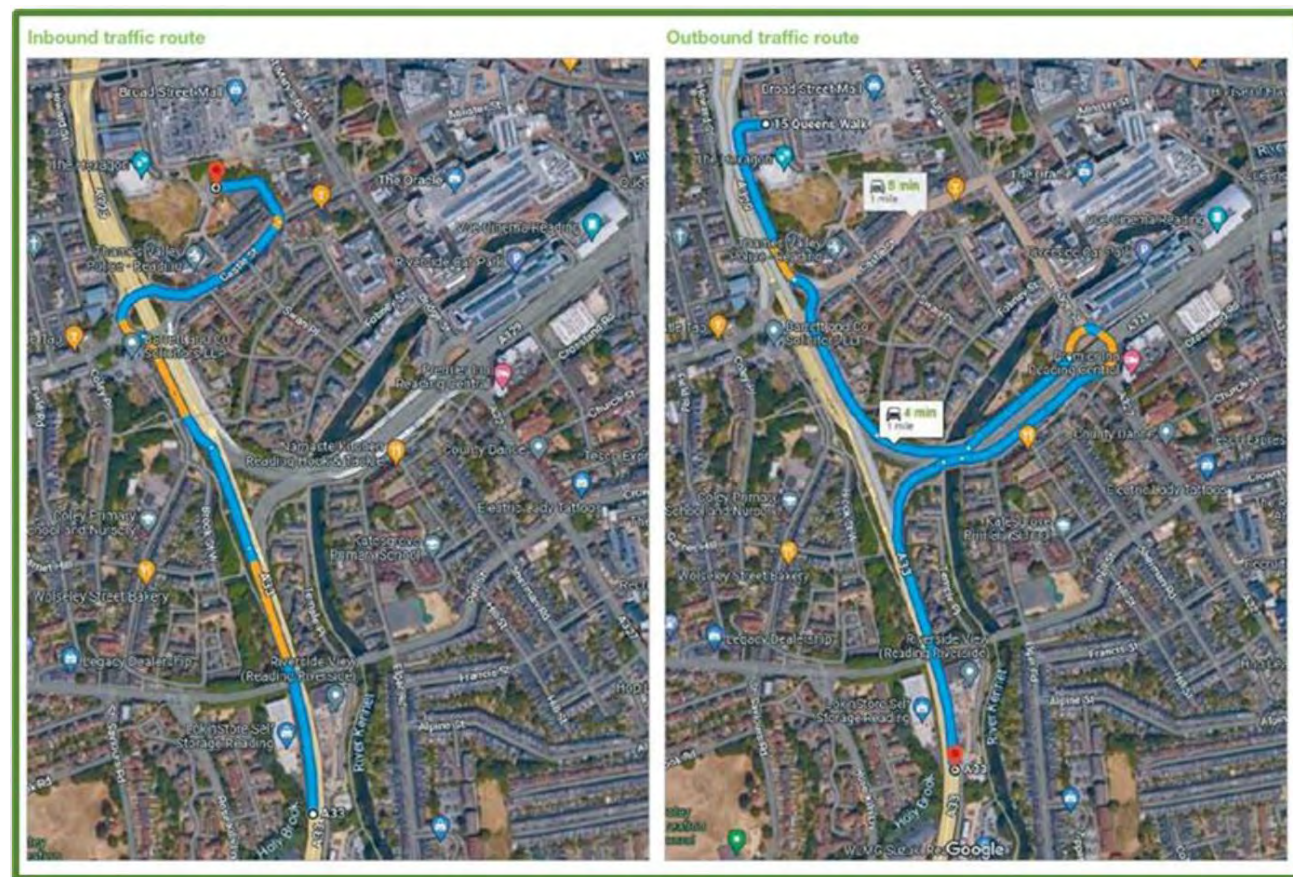
TRAFFIC MANAGEMENT

Site Access / Egress

- 5.65 All construction vehicles will access the site via the A329 then into Castle Street. Egress from the site will be from Queens Walk, along Broad Street Mall and connecting to the A329, heading south. This provides access to strategic arterial roads such as the M4. This will allow vehicles to avoid local residential roads. In the event that this egress route from the site is closed, vehicles would egress from the site via Castle Street but would require signals and/or a Marshall.
- 5.66 All construction routes will be agreed with RBC ahead of any construction activities and the agreed routes will be incorporated into the CMP.
- 5.67 An outline of the proposed site access and egress arrangement is presented within Figure 5.11.
- 5.68 The site entrances will have specific Health and Safety signage. Additional signage will be provided for pedestrians / visitors and vehicles to ensure they are segregated and use the correct gates. The required Considerate Constructors boards will also be displayed with the emergency contact information.

No car parking will be available on-site for construction staff as the assumption is that staff members will access the site via public transport.

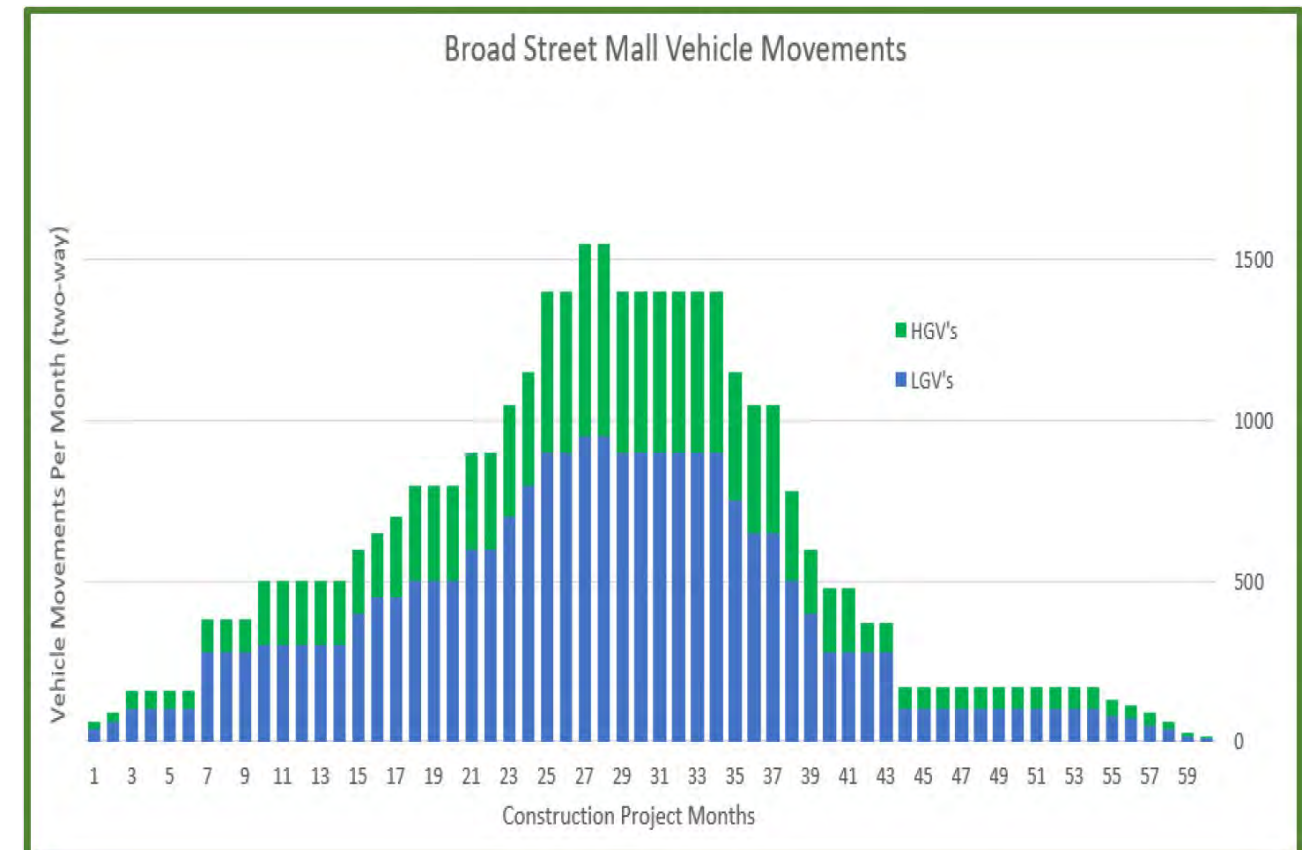
Figure 5.11 Access and Egress Traffic Routes – Wider Context



Vehicle Numbers

- 5.69 The estimates of demolition and construction material quantities, together with the outline demolition and construction programme, have been used to estimate the number of vehicle movements for the works programme.
- 5.70 Data relating to vehicle movements are presented in Figure 5.12 in terms of the estimated number of movements per month, (movements are 2-way, meaning one vehicle in and one out is equal to 2 movements).
- 5.71 The peak vehicle movements are anticipated to occur during months 27 and 28 (Year 3), associated with the excavation, substructure and superstructure of Building A, and the excavation and substructure works for Buildings B, C and D.
- 5.72 The peak vehicle movements are equivalent to 20 HGV movements per day, and this equates to a monthly peak of 600 HGV vehicle movements associated with the main construction works. When considering LGV movements, the peak is equivalent to 32 LGV movements per day, and this equates to a monthly peak of 960 LGV vehicle movements associated with the main construction works. Overall, there is a monthly peak of 1,560 vehicle movements.

Figure 5.12 Estimated Number of Vehicle Movements per Month (two-way)



Pedestrian Access

- 5.73 Safe site access and walking routes will be established and maintained for the duration of the works to segregate vehicles and pedestrians. This will be achieved by the installation of a separate fixed barrier. Designated pedestrian routes for construction personnel will also be established within the construction access routes on Hosier Street and Dusseldorf Way.
- 5.74 There will also be a designated protected walkway to the neighbouring Hexagon Theatre and Arts Venue from Hosier Street, maintaining this access route to the Hexagon for the duration of the construction works.
- 5.75 Within the Existing Mall and the construction interface works, pedestrian barriers will be required to protect the public, given the works can take place almost entirely within the demise of the retail units, other than the façade replacement works. Due to the localised nature of these works, it is envisaged that they can be carried out whilst the main entrance remains operational.
- 5.76 The entrance to the Existing Mall from car parking levels 1 and 2 is within the demolition zone. The new entrance will be created when the MSCP is closed to the public and will be in operation when the MSCP reopens following the installation of the new ramp. A temporary entrance to the Existing Mall will be provided off St Mary's Butts, until Buildings C and D are at a suitable level, after which access will be relocated to Hosier Street.

Construction Logistics Management

Closures and Diversions

- 5.77 Formal permissions will be obtained from the Local Authority in conjunction with the Highways Department, the local Police Traffic division and the bus companies prior to any construction operations as part of the planning of these construction works. However, should temporary closure or diversion of routes be required formal permissions will be obtained from RBC following consultation with the relevant stakeholders prior to the commencement of works as required, although closures or road restrictions are not anticipated for St Mary's Butts and Oxford Road.

- 5.78** All statutory public transport companies will be consulted as part of the preparation of the Construction Logistics Plan (CLP), to ensure all precautions and provisions for the safe implementation of the construction works are identified, and procedures listed to maintain a safe environment for the public and construction employees.

Loading / Unloading

- 5.79** A segregated area for the safe loading and unloading of road vehicles will be implemented on-site and traffic marshals will direct vehicles on to and off-site.
- 5.80** Loading and unloading of materials and equipment will occur within the site boundary as far as practicable, thereby minimising congestion on the adjacent highway network.
- 5.81** The current basement delivery road will be designed to ensure deliveries are maintained throughout construction, both for the project and for the Existing Mall deliveries.
- 5.82** Foundation designs will ensure that the construction of the towers are facilitated by transfer slabs at levels 3 and 4 that permit building loads to transfer into these design zones.

Existing Multi Storey Car Park

- 5.83** As set out above, the existing MSCP will remain partially operational throughout the construction of the development with the minimum number of parking bays suspended to facilitate the safe implementation of the works. The live construction areas within the MSCP will be fully encapsulated and screened for the duration of the demolition and construction works, keeping the works fully segregated from the MSCP. No construction loads will be allowed to traverse the MSCP.

Reading Bus Network

- 5.84** There are several bus terminals and bus stops on the roads surrounding the site. Detailed discussions with the bus operators will be required to review the access required for construction vehicles.
- 5.85** Formal permissions will be obtained from the Local Authority in conjunction with the Highways Department, the local Police Traffic division and the bus companies prior to any construction operations as part of the planning of these construction works. However, should temporary closure or relocation of any bus routes or stops be required formal permissions will be obtained from RBC following consultation with the relevant stakeholders prior to the commencement of works as required.
- 5.86** All statutory public transport companies will be consulted as part of the preparation of the Construction Logistics Plan (CLP), to ensure all precautions and provisions for the safe implementation of the construction works are identified, and procedures listed to maintain a safe environment for the public and construction employees.

Taxi Ranks

- 5.87** There are two taxi ranks located adjacent the site:
- On the north side of Oxford Road, located to the north of the site; and
 - On the east side of St. Mary's Butts, located to the east of the site.
- 5.88** Under the current construction logistic proposals, the taxi ranks are unlikely to be affected. Should temporary closure or relocation of these taxi ranks be required formal permissions will be obtained from RBC prior to the commencement of works as required. **Site Management**
- 5.89** The restrictive nature of the surrounding infrastructure will demand careful planning and control of deliveries to avoid congestion. A Construction Logistics and Interface Manager will manage all deliveries and ensure the coordinated flow of vehicles to and from the site. Deliveries will be managed by a system of timed / booked deliveries, which will be implemented and controlled by the Construction Logistics and Interface Manager. This will ensure that access and adjoining roads do not become congested. The intent with all deliveries is to unload them from within the site boundary (see section '*Loading / Unloading*').
- 5.90** To ensure the timely management of deliveries to the site, the following key considerations will be enforced:
- No stopping or parking on the adjoining roads to the site. Strict control to prevent temporary parking on kerbsides near the site will also be enforced;

- All deliveries are to be made during the stipulated site working hours. All deliveries must be booked in advance (i.e. at least a week) with the Construction Logistics and Interface Manager. Unscheduled deliveries will not be accepted; and
 - The size of and type of delivery vehicles will be stipulated where necessary to suit the construction process and access available.
- 5.91** To further minimise the likelihood of congestion, strict monitoring and control of all vehicles entering and exiting the site will be maintained, including the adoption of the following measures (where appropriate):
- Consolidation of deliveries wherever possible; and
 - A system of 'just in time' deliveries.
- 5.92** The opportunity to mitigate further the potential for congestion by delivery vehicles by providing parking off-site will be explored when detailed planning for the construction works and logistics is undertaken. The possibility of identifying a holding area will be investigated along the traffic routes. This would allow vehicles to be held until the time they are required on-site. Should delivery vehicles be managed by parking on-site, the details will be outlined within the CMP and approved prior to works commencing.
- 5.93** The Construction Logistics and Interface Manager will be assisted by trained traffic marshals / banks-men and entrance security personnel to ensure vehicles arriving and leaving the site are coordinated with the works on-site.

ENVIRONMENTAL MANAGEMENT AND MONITORING

- 5.94 ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring** presents the environmental management and mitigation measures that the Applicant is committed to implementing throughout the demolition and construction works to, either eliminate, or reduce the significance of any likely environmental effects.
- 5.95** The environmental management and mitigation measures will form the basis of the Construction Management Plan (CMP) that will be implemented during the works. The CMP will likely comprise a number of supporting management plans / documents, for example a Construction Logistics Plan (CLP). It is anticipated that the preparation and implementation of these plans will be secured through appropriately worded planning conditions. An outline of the CMP is presented below.

Construction Management Plan

- 5.96** The Applicant will develop and implement an CMP through which mitigation and compliance with the RBC Procedures and 'The Control of Dust and Emissions During Construction and Demolition SPG'¹ will be managed. The CMP will also refer to industry standards, best practice and guidance, such as the 'Considerate Constructors Scheme'². The CMP will include roles and responsibilities, details of control measures and activities to be undertaken to minimise environmental effects, and monitoring and record-keeping requirements.
- 5.97** The CMP will be periodically reviewed, and regular environmental audits of its implementation will be undertaken during the construction phase.
- 5.98** The CMP will include (and not limited to) the following matters listed below to minimise the environmental effects during the period of construction of the Proposed Development:
- Construction Method Statement (CMS);
 - Considerate Constructors Scheme;
 - Neighbour and public relations;
 - Management of effects from noise, vibration and air quality;
 - Waste management;
 - Ground conditions;
 - Protection of water resources; and

¹ Greater London Authority (2014); The Control of Dust and Emissions during Demolition and Construction SPG

² Considerate Contractors Scheme (1997); Considerate Contractors Scheme. Accessed at: <https://www.ccscheme.org.uk/ccs-ltd/what-is-the-ccs2/>

- Energy and water usage.

Construction Method Statement

5.99 Sitting within the CMP, the CMS will outline further detail for each of the different activities and procedures to be undertaken to complete the various construction works.

5.100 The CMS will include the following elements:

- Shorter term programmes of the construction works, highlighting the various stages and their context within the project, including a full schedule of materials and manpower resources, as well as plant and equipment schedules;
- Details (including plans) of enabling works, including provision of temporary services, utility diversions, and re-alignment / replacement of hoarding;
- Details of the transport routes for HGVs (see earlier comments within section 'Traffic Management' of this ES chapter);
- Detailed site layout and access arrangements, including plans for storage, site office set-up, vehicular movements, site access and egress;
- Prohibited or restricted operations (i.e. locations, site working hours, etc.);
- Details of operations that are likely to result in disturbance, with an indication of the expected duration of each phase with key dates, including a procedure for prior notification of the RBC and relevant statutory and non-statutory consultees (including neighbours) so that local arrangements can be agreed in advance;
- Procedures to ensure communication is maintained with the RBC and the local community to provide information on any operations likely to cause disturbance (e.g. through meetings and newsletters); and
- Provision for affected parties to register complaints and the procedures for responding to complaints and Considerate Constructors Scheme and the RBC Management Measures.

5.101 The site will be registered with the 'Considerate Constructors Scheme'. This scheme ensures that contractors carry out their operations in a safe and considerate manner with due regard to passing pedestrians and road users.

5.102 The Main Contractor will aim to exceed the minimum requirements of the Considerate Constructors Scheme.

5.103 In addition to the standard banner and information board erected as part of the Considerate Constructors Scheme, an additional information board will be displayed on the external hoarding around the site to enable it to be read by the general public. The additional board will contain project specific information relating to the progress of the Proposed Development. This will be periodically updated to include any changes to the site layout and access routes.

5.104 During the planning process the RBC will be consulted regarding the construction process and they will be able to raise any issues or queries they have regarding the construction plans put in place.

Neighbour and Public Relations

Existing Retail Tenants

5.105 A key aspect of the successful management of the project will be the maintenance of good relations with key Retail Tenants and Centre Management. Prior to the start of any construction works, all Retail Tenants will be consulted to ensure that there is no disruption to their stores' deliveries; and no interruption to the public access of their retail units. There will also be regular monthly stakeholder review meetings at which the tenants will be requested to raise any concerns they have during the construction works.

5.106 Modifications to internal areas within the Existing Mall will be required during the construction works and these will be explained to the retail tenants and the Mall Centre Manager prior to implementation. These modifications will be identified as part of the internal Construction Logistics sequencing.

General Public

5.107 The contractor will endeavour to communicate with adjoining neighbours within the vicinity of the site and the public who may be affected by the works, and wherever possible give notice of forthcoming activities on-site, particularly those that may have an impact on the aforementioned stakeholders.

5.108 Engagement with the community could be achieved by:

- Facilitating regular community group meetings;
- Providing specific notices, emails and warning letters regarding ad hoc construction activities, for example, wide loads to be delivered out of hours;
- Providing quarterly newsletters on progress and forthcoming activities; and
- Engaging with local schools or youth groups to promote joint activities for education on Health and Safety and also site-based learning activities and / or career advice.

5.109 To ensure that any comments or feedback from the public and neighbours are captured and effectively responded to, a complaints register will be implemented. The register will be held at the site office. All complaints will be recorded for action in the register. Complaints will be responded to in writing within prescribed timescales outlined in the CMP (unless alternatively agreed in writing) and following the appropriate action to mitigate against the causes of the complaint.

Waste Management

5.110 A key objective during the period of demolition and construction works will be to reduce the amount of waste generated and exported from site. This approach complies with the waste hierarchy of the Waste Management Plan for England (2021) whereby the intention is first to minimise, then to treat at source or compact and, finally, to dispose of off-site as necessary.

5.111 All contractors will be required to investigate opportunities to either avoid, minimise and reduce waste generation by means of appropriate measures either involving material selection or management of handling materials. Full details of the measures proposed are presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**.

5.112 If waste can be re-used at the site, exemption or permit forms will be obtained from the Environment Agency in advance for re use as required.

5.113 The disposal of waste or other materials removed from the site will be in accordance with the requirements of all relevant legislation, including:

- The Environmental Permitting (England and Wales) Regulations 2016³;
- The Waste (England and Wales) Regulations 2011 (as amended)⁴;
- Clean Neighbourhoods and Environment Act 2005⁵; and,
- Contractors would be encouraged to adopt the principals of the Site Waste Management Plans Regulations 2008 (repealed)⁶ as good working practice.

5.114 The potential risks associated with waste disposal would be adequately managed through industry recognised standards and best practice measures (full details of the measures proposed are presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**).

5.115 The detailed CMP prepared by the Main Contractor prior to the commencement of works will describe the measures required to manage and dispose of waste. The CMP, in terms of waste management, will contain:

- Classification of all wastes;
- Performance measures and target setting against estimated waste forecasts;
- Measures to minimise waste generation;
- Opportunities for reuse and recycling;

³ Statutory Instruments 2016 No. 1154; The Environmental Permitting (England and Wales) Regulations 2016

⁴ Environmental Protection, England and Wales, 2014. The Waste (England and Wales) (Amendment) Regulations 2014

⁵ HMSO, 2005. Clean Neighbourhoods and Environment Act

⁶ DEFRA, 2008. The Site Waste Management Plans Regulations, repealed

- Provision for the segregation of waste streams on-site that are clearly labelled;
- Recording of proposed carriers and licenses for disposal sites;
- An audit trail encompassing waste disposal activities and waste consignment notes;
- Measures to avoid fly tipping by others on land being used for construction;
- Measures to provide adequate training and awareness through toolbox talks; and
- Consider alternative means of removing waste other than by road.

Site Health & Safety

5.116 The Main Contractor will carry out their duties in accordance with the Construction Design Management Regulations (CDM). They will ensure that all site personnel have the correct training and qualifications, every site visitor will have a site induction. There will be a programme of toolbox talks for site operatives and the construction works will be tidy and be well maintained with all safety measures in place. Appropriate Personal Protective Equipment (PPE) will be worn by all operatives always when on the construction site.

Water Usage

- 5.117** Where existing pipes are likely to be disrupted by construction works, new potable water supply pipes will be installed.
- 5.118** Processes during the construction phases that require large volumes of water supply include mixing (especially relating to concrete), water for washing down and potable water for sanitary facilities for the construction workforce.
- 5.119** It is expected that the water supply to the construction site during the demolition and construction works will be provided from the existing Thames Water sources via an application to use an existing water supply for building purposes.
- 5.120** The CMP will outline the appropriate strategy for the sustainable management of water use across the site. The CMP will require relevant contractors during the period of works to investigate opportunities to sustainably manage the use of water. Full details of the measures for the management of water consumption on-site are presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**.

Energy Usage

- 5.121** All relevant contractors will be required to investigate opportunities to minimise and reduce the use of energy to avoid any likely significant adverse effects associated with excessive energy consumption and resulting greenhouse gas emissions.
- 5.122** Measures to minimise energy usage are presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**.

Monitoring, Inspection and Auditing

- 5.123** The CMP will define responsibilities and procedures for the management of the potential impacts on the environment arising during the demolition, enabling and construction. A monitoring programme of the environmental effects of demolition and construction will be implemented to agreed RBC requirements. This programme will:
- Evaluate the effectiveness of environmental mitigation, and identify environmental problems and appropriate responses at an early stage;
 - Ensure that the works are carried out in accordance with the provisions of the CMP; and
 - Identify and implement any environmental improvements that would contribute to the overall environmental performance of the Proposed Development.
- 5.124** To ensure that the contractors are adhering to the CMP, the Applicant will require that site inspections and more formal audits would be undertaken, and a checklist pro-forma would be used, which would cover the environmental issues addressed in the CMP.
- 5.125** Where a problem is identified, corrective action will be identified and implemented in conjunction with the Site Manager and Main Contractor.

5.126 It is envisaged that there will be a requirement for regular reporting of monitoring and auditing to RBC, and RBC would be asked to review implementation of the protective measures as necessary during demolition and construction and would have direct access to the monitoring representative to ensure that any non-compliances with the requirements of the CMP are speedily rectified.

Emergency Response and Environmental Incidences

- 5.127** Protocols to be implemented on-site in instances of emergencies and environmental incidences will be set out within the CMP for approval by RBC.
- 5.128** Before construction works commence on-site, emergency procedures and fire exit routes from the site would be identified within the fire safety plan. Throughout the course of the construction works, these would be regularly inspected and maintained. The fire safety plan would be updated regularly as construction works progress, particularly as areas are progressively completed, and as the means of escape from the evolving buildings change. Fire alarm points and extinguishers would be situated at each floor of the buildings at the stair cores and within main corridors.
- 5.129** Site management, operatives and any visitors to the site would undergo an induction to ensure they are briefed on what actions to take in case of an emergency and in case of an environmental incident.
- 5.130** There will be several specific health, safety and environmental aspects identified that will need assessing as the design develops. These are especially poignant given the nature of the Existing Mall and the need to keep construction impact away from the shops and shoppers.
- 5.131** Provision of welfare during construction including satellite facilities across the site will include:
- Separation of construction areas from public areas and separate pedestrian access to the site;
 - Site security;
 - Control of vehicle movement into and out of the surrounding streets;
 - Cleaning of site vehicles before they exit the site area;
 - Pedestrian routing around the site;
 - Public protection i.e. scaffolds, fans, crash decks;
 - Fire strategy and emergency escape routes including interface with the existing adjoining buildings;
 - Noise control and monitoring;
 - Vibration monitoring;
 - Identification of potential contaminants;
 - Materials delivery and storage; and
 - Workforce site travel plan.

General Site Management

- 5.132** Hoardings with an acceptable visual outlook will be erected around and within the site (see section 'Site Establishment and Enabling Works') to provide a clear and secure demarcation between operational activities and other areas with an acceptable visual outlook. The hoarding will be used to provide information regarding the Proposed Development and the progress of the construction works. Attention will be paid to locations supporting high volumes of pedestrian movement, demolition and construction routes, access gates and security arrangements.
- 5.133** A 'clean site' policy will be maintained to keep the site clean and tidy internally, and contractors and their subcontractors will be expected to maintain this policy. For example, materials will be stored with care, spills will be cleaned up immediately and various dust mitigation measures will be put in place and managed through the CMP. Measures to maintain the Site and avoid or reduce impacts on the surrounding area are presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring**.
- 5.134** Staff facilities would be kept clean and maintained in good working order. Waste would be collected regularly, with food waste removed from site daily. Smoking areas would be provided as necessary. They will be located away from sensitive boundaries and neighbouring residences and businesses.

5.135 Any damage incurred to the public realm and highway will be repaired in conjunction with RBC and Highways Agency requirements. A street sweeper will also be employed as and when required during the demolition, piling and excavation periods to ensure the surrounding streets remain clean during the works.

Chapter 6: Socio-Economics

SOCIO-ECONOMICS	
AUTHOR	Trium Environmental Consulting LLP
SUPPORTING APPENDIX	ES Volume 3, Appendix: Socio-Economics Annex 1: Planning Policy Context
KEY CONSIDERATIONS	This ES chapter presents an assessment of the socio-economic effects of the Proposed Development. In particular, this ES chapter presents an assessment of effects related to housing delivery, new residential populations (i.e., demand for social infrastructure including education, healthcare, and open and play space), employment generation during construction and operation, and indirect economic effects (i.e. household and employee expenditure).

ASSESSMENT METHODOLOGY

Defining the Baseline

- 6.1
- The Proposed Development is a residential-led, mixed-use scheme comprising 644 residential units (use class C3), 1,770m² gross internal area (GIA) of commercial space (use class E) and associated demolition and construction works. The assessment has therefore considered impacts on the following:
- Loss of existing employment on-site due to demolition and construction works and associated spending by this workforce;
 - Creation of temporary employment due to demolition and construction works and associated spending by this workforce;
 - Delivery of new homes contributing to local housing targets (including affordable housing);
 - Increased demand for social infrastructure as a result of the increase in the residential population, specifically GP surgeries, education and open space and play space;
 - Creation of permanent employment opportunities once operational (as net employment compared against existing employment); and
 - Spending effects associated with the residents and employees brought to the site by the Proposed Development.

Current Baseline Conditions

- 6.2
- Baseline socio-economic conditions that are of relevance to the assessment contained within this ES chapter have been established through analysis of nationally recognised research and survey information including:
- Office for National Statistics (ONS) and NOMIS;
 - Census 2021;
 - English Indices of Deprivation (IoD)¹;
 - NHS Choices and NHS Digital General Practice Workforce dashboard²;
 - Department for Education (DfE) and the Annual School Census³;
 - UK Government 'Get Information about Schools' data portal⁴;
 - Business Register and Employment Survey (BRES)⁵;
 - Labour Market Statistics ^{6, 7};
 - RBC, Berkshire County Council (BCC) and UK Government data (latest available); and
 - Open space information from Ordnance Survey (OS) data has been reviewed alongside desk-based analysis to identify existing open and play spaces in the area surrounding the site⁸.

¹ Ministry of Housing, Communities & Local Government (2019). English Indices of Deprivation.

² NHS Digital (2023). General Practice Workforce.

³ DoE (2022). Schools, pupils and their characteristics (Academic year 2022/23).

⁴ GOV.UK (2023). Get Information about Schools. Available at: <https://get-information-schools.service.gov.uk/>. Accessed 14/08/2023.

⁵ BRES (2022). UK Businesses Register and Employment Survey (BRES): provisional results 2022, revises results 2021.

⁶ ONS (2021). Labour Market Profile – Reading. Available at: <https://www.nomisweb.co.uk/reports/lmp/la/1946157272/report.aspx>

⁷ ONS (2021). Labour Market Profile – Reading. Available at: <https://www.nomisweb.co.uk/reports/lmp/la/1946157285/report.aspx?town=reading>. Accessed 14/11/2023.

Future Baseline Conditions

- 6.3
- Due to the current availability of reliable data, the assessment is based on the existing baseline rather than a future baseline. Wherever possible, data from 2023 has been used; however, in some instances earlier data has been used where more up-to-date information has not yet been published.

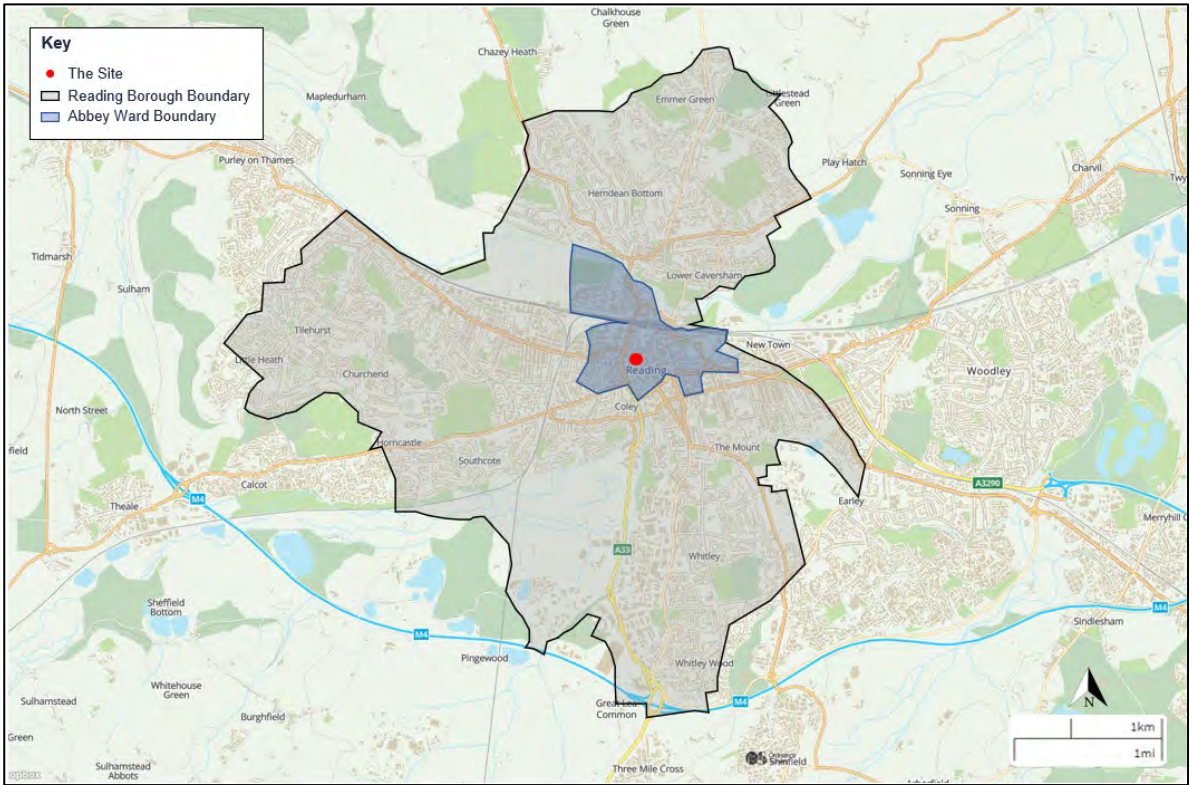
Evolution of the Baseline

- 6.4
- As it is not possible to definitively quantify future conditions for socio-economics, a qualitative rather than quantitative review has been presented to demonstrate how the socio-economic baseline may evolve in the future. This is based on a review of nearby cumulative schemes coming forward (as detailed within **ES Volume 1, Chapter 2: EIA Methodology**) and considers the potential change in the baseline conditions in the absence of the Proposed Development.

Geographical Study Areas

- 6.5
- Potential impacts of the Proposed Development on existing socio-economic conditions vary by spatial level. This is due to the sensitivity of conditions at differing scales, with more local scales typically being more sensitive to effects brought on by change, such as the introduction of the Proposed Development. The following spatial levels are included in this assessment, which are also shown on Figure 6.1:
- Site level – as defined by the redline boundaries (where data is available);
 - Local level – Abbey ward;
 - Borough level – Borough of Reading (Reading); and
 - Regional level – Royal County of Berkshire (Berkshire), including Bracknell Forest, Reading, Slough, West Berkshire, Windsor and Maidenhead, and Wokingham⁹.

Figure 6.1 Study Areas



Base Map Source: Ordnance Survey (2023)

⁷ ONS (2021). Labour Market Profile – Reading. Available at: <https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx?town=berkshire>. Accessed 14/11/2023.

⁸ OS (2023). OS Open Greenspace.

⁹ Upon further investigation in the baseline for this assessment, and in a deviation from the EIA Scoping Report, the South East of England has been removed as a geographical study area as it is unlikely that people will regularly travel from the far east of the region to Berkshire for work and other commercial activities, healthcare, education, and open and play space. Instead, Berkshire is a more accurate catchment area for these activities.

Impact Assessment Methodology

Geographic Scale of Assessment and Corresponding Baselines

6.6 An outline of the spatial scales at which the socio-economic conditions included in this assessment are most sensitive is provided in Table 6.1. It is unlikely the Proposed Development would result in significant effects beyond the spatial levels defined in this table.

Table 6.1 Spatial Sensitivity of Socio-Economic Conditions

Condition	Spatial Level	Justification
Local Economy		
Employment	Local, Borough, Region	The gross number of full-time equivalent (FTE) jobs that could be generated on-site by non-residential floorspace for local and borough-wide workers will be calculated by applying the standard job density ratios based on the Homes and Communities Agency (HCA) ¹⁰ Employment Density Guide ¹¹ . The HCA Additionality Guide ¹² will then be used to establish net employment, accounting for wider regional additionality factors such as displacement and economic multipliers. This also allows for the estimation of indirect and informal employment facilitated through the Proposed Development.
Additional Expenditure	Local, Borough, Region	Additional spending by employees of the Proposed Development will likely remain in the near vicinity of the site and be calculated based on thresholds set in the HM Revenue & Customs (HMRC) Employment Income Manual ¹³ . The impact of additional spending on the local economy by new households associated with the Proposed Development includes household expenditure on local goods and services. This assessment will be based on the average household expenditure derived from the Office for National Statistics (ONS) Family Spending Survey ¹⁴ for the South East of England, including Berkshire.
Housing		
Housing	Borough	Based on research published in the Berkshire Strategic Housing Market Assessment (SHMA) ¹⁵ , Reading Borough Council's (RBC) Local Plan ¹⁶ and Housing Strategy ¹⁷ identify an urgent need for more affordable and better-quality housing across the Borough.
Social Infrastructure		
Primary Healthcare	Local GP Surgeries (1.6km walking distance from the site boundary)	There is no set guidance regarding acceptable travel distances to a general practitioner (GP). Therefore, 1.6km has been used based on an initial review of the local area to ensure suitable data on GP capacity is presented within the ES chapter.
Education	Local, Borough Primary Schools (3.2km walking distance from the site boundary) Secondary Schools (Reading)	Catchment areas for schools likely to be attended by new residents of the Proposed Development are based on the Department for Transport (DfT) National Travel Survey ¹⁸ and statutory guidance on acceptable travel distances ¹⁹ .
Open and Play Space	Site, Local (1.2km travel distance from the site boundary)	Open and play space will be assessed within a 1.2km walking distance of the Proposed Development as specified in the RBC's Open Spaces Strategy (OSS) ²⁰ and confirmed in a 2018 OSS Update Note ²¹ .

¹⁰ HCA was replaced by Homes England in January 2018. However, its guidance remains the most up to date and relevant for UK figures and is therefore still used as part of standard practice.
¹¹ HCA (2015). Employment Density Guide 3rd Edition.
¹² HCA (2014). Additionality Guide 4th Edition.
¹³ HMRC (2023). Employment Income Manual.
¹⁴ ONS (2023). Table A33 – Household expenditure by countries and regions.
¹⁵ Berkshire Authorities and Thames Valley Berkshire Local Enterprise Partnership (2016). Berkshire (including South Bucks) Strategic Housing Market Assessment.
¹⁶ RBC (2019). Reading Borough Local Plan.
¹⁷ RBC (2020). Housing Strategy for Reading 2020-2025.

Demolition and Construction

Local Economy

Existing Employment

6.7 There are three metrics through which employment can be expressed:

- Full-time: employees typically working, or jobs typically requiring, approximately 35 to 40 hours per week;
- Part-time: employees typically working, or jobs typically requiring, less than 35 hours per week; and
- Full time equivalent (FTE): the equivalent total amount of full-time employment, with two part-time employees or jobs considered the equivalent of one full-time employee or job.

6.8 The site currently includes 18 commercial properties, 15 of which are in use and three of which are vacant. From data provided by the Applicant, these 15 operational units are estimated to employ 47 full-time and 123 part-time employees, or the equivalent of 108 FTE jobs²².

6.9 There is the potential for some of these roles to be retained given the partial rather than total demolition of some existing retail units on-site, as well as the relocation of some businesses to other local locations. However, 108 FTE has been used as a conservative estimate based on figures provided by the Applicant and calculations in line with HCA guidance.

Existing Additional Expenditure

6.10 An assessment of spending by existing employees has been undertaken based on an average spend per day of £10 per employee, as set out in the HMRC Employment Income Manual for daily meal allowance thresholds and based on a five day in-person work week²³.

Construction Employment

6.11 To estimate the number of jobs likely to be generated as a result of the demolition and construction phase of the Proposed Development, labour coefficients (i.e. person years of employment²⁴ per £1 million spend) from the HCA guidance have been applied to the forecasted costs associated with the construction and demolition programme²⁵. As the guidance is based on prices from 2011, the construction spend has been deflated to the 2011 value to ensure a more accurate employment level is calculated. Person years of employment have then been divided by the expected construction period of 5 years (60 months) to provide the average number of jobs supported each year. It should be noted that this methodology produces an estimate of construction employment and has been used for assessment purposes rather than formal construction requirements, which are not available at this stage.

Construction Additional Expenditure and Supply Chain

6.12 It is acknowledged that whilst some construction workers may live locally and thus their expenditure on household goods and services would support induced employment locally, others could be expected to be drawn from the wider region, depending on their role. On this basis, an estimate of construction supply chain effects, or indirect employment, and induced effects, or local expenditure, are considered at a high level, quantitative manner, through the use of an estimated additionality factor of 33%, as specified within the HCA Additionality Guide.

Phasing

6.13 Although occupation of the Proposed Development is likely to be phased over a period of six months, with Buildings C and D occupied first, under a worst-case scenario full occupation of the Proposed Development upon completion is assumed for the purposes of assessment.

¹⁸ DfT (2020). National Travel Survey.
¹⁹ DfT (2014). New home to school travel and transport guidance.
²⁰ RBC (2007). Reading Open Spaces Strategy.
²¹ RBC (2018). Reading Open Spaces Strategy Update Note 2018.
²² Existing FTE count is based on a combination of existing known employment (where available) and calculations applying the HCA Employment Density Guide to existing known GIA (where existing employment is not available).
²³ HelloSafe (2023). Working Days Calculator. Available at: <https://hellosafe.co.uk/business-insurance/tools/working-days-calculator>.
²⁴ A 'person year' is defined as the amount of work done by a person in one year on a specific project.
²⁵ HCA (2015). 'Calculating Cost Per Job – Best Practice Note, 3rd Edition'.

Completed Development

Housing

6.14 Delivery of housing is assessed as the effect of the Proposed Development's new residential units on existing house stock. The provision of new housing stock, taking into account the number, type and tenure of dwellings provided, will be measured against RBC Local Plan targets.

Social Infrastructure

- 6.15 This ES chapter includes an audit of the existing capacity of health, education, and open and play space facilities (set out in the 'Baseline Conditions' section) and an assessment of the potential level of demand for such facilities resulting from the introduction of a new residential population living in the Proposed Development.
- 6.16 An estimate of the Proposed Development's total population has been calculated based on RBC's average household size^{26, 27}, applied to the proposed residential unit mix.
- 6.17 An estimate of the child yield arising from the Proposed Development has been established based on the pupil product ratios produced by Cognisant, outlined in Table 6.2 below, which are consistent with the ratios used by 'Brighter Futures for Children' and endorsed by RBC²⁸.

Table 6.2 Cognisant Pupil Product Ratios

Age Group	1 Bedroom	2 Bedrooms	3 Bedrooms
Early Years	0.09	0.32	0.33
Primary School	0.02	0.19	0.35
Secondary School	0	0.05	0.2
Post 16	0	0.02	0.06

Primary Healthcare

6.18 To determine increased demand for public general practitioner (GP) services arising from the Proposed Development, the estimated number of new residents is added to the existing population, based on data from the NHS Digital General Practice Workforce dashboard. An average patient list size per FTE GP is then calculated and compared to the NHS London Health Urban Development Unit (HUDU) benchmark of 1,800 patients per FTE GP. Surgeries with more than 1,800 patients per FTE GP are considered over capacity.

Education

6.19 To determine increased demand for state-funded primary and secondary schools arising from the Proposed Development, the estimated number of new school-aged residents is added to existing school capacity, based on data from the 'Get Information about Schools' portal. In accordance with Audit Commission guidelines²⁹, spare capacity within existing primary and secondary schools is based on 95% of the total number of available school places. This is to accommodate the potential for students joining mid-year and to ensure schools do not go over-capacity, wherever possible.

Open Space and Play Space

- 6.20 There are no specific guidelines for open space requirements for RBC. Professional judgement has thus been used to assess the impact of the Proposed Development on the existing provision in the local area, informed by an understanding of the baseline position and the additional open space to be provided by the Proposed Development.
- 6.21 Likewise, in the absence of any formal guidance on quantitative play space requirements per child for RBC, a qualitative judgement has been made taking into account the estimated child yield, existing provision and any on-site provision as part of the Proposed Development.

Local Economy

Employment

- 6.22 The gross number of FTE jobs that would be lost or generated by non-residential floorspace have been calculated by applying the standard job density ratios based on the HCA's Employment Density Guide. This guidance is the latest available and as such, does not relate to the latest use classes (i.e., use class E) published in 2020. Therefore, although the Proposed Development includes the provision of use class E floorspace, the correlating previous use classes have been used for the purposes of assessing operational employment creation.
- 6.23 The HCA guidance sets out expected FTE employment created per m² of floorspace for varying use types, depending on how efficiently the floorspace can be used for various uses. For example, office use mainly requiring desktop work will allow for a higher density of employment than industrial use which requires floorspace for large machinery as well as space for employees. As well as considering spatial requirements, the employee density of other uses may be dependent on labour intensity. For example, a retail or other customer experience-oriented business would require more staff on-site than a gym or cinema requiring less employee oversight.
- 6.24 Net employment is calculated in part by subtracting the gross number of jobs lost or created by the Proposed Development by existing employment on-site. The HCA Additionality Guide has also been used to establish net employment from the Proposed Development by accounting for wider additionality factors such as displacement and economic multipliers. A low displacement level of 25% has been assumed in line with the HCA Additionality Guidance on retail uses. This is considered suitable for this assessment as the Proposed Development is expected to have "some displacement effects, although only to a limited extent". In addition, a composite ready reckoner local multiplier of 1.21 has been used. This is in line with the HCA Additionality Guidance for retail uses and is considered the most appropriate multiplier for the purposes of this assessment as it allows for the estimation of indirect and informal employment facilitated through the Proposed Development.
- 6.25 In line with the HCA Additionality Guide, a leakage value of 0 has been assumed for the net employment calculation as no specific groups are targeted by the employment floorspace at this stage, and it is therefore not possible to reliably predict this level of effect.
- 6.26 The Proposed Development includes the provision of 1,737m² GIA of use class E floorspace, or 1,364m² net internal area (NIA). Both the reasonable minimum (worst-case) and maximum (best-case) employment scenarios associated with the full range of likely Class E uses have been modelled and presented within this ES chapter. As agreed with the Applicant, the likely uses of the Proposed Development's commercial space are expected to comprise food and beverage (F&B), retail and office.
- 6.27 Although it is unlikely that proposed floorspace would come forward in these extremes (i.e. solely that which would generate the lowest number or the highest number of jobs), the assessment of effects has been based on the reasonable worst-case scenario to present a reasonable worst-case effect. The effect for the best-case scenario is also stated within the assessment but is not carried through to the residual effects.

Additional Expenditure

- 6.28 As with existing employment, an assessment of spending by net additional employees has also been undertaken. An average spend of £10 per employee per day has been applied, based on the thresholds set out within the HMRC Employment Income Manual for daily meal allowances, based on a five day in-person work week.
- 6.29 New households occupying residential units in the Proposed Development will likely buy goods and services locally, contributing to the local economy. The estimation of this additional expenditure is based on the ONS Family Spending Survey's South East of England average household expenditure of £344.80 per week, based on Trium calculations on what would likely constitute local expenditure.

Cumulative Effects

- 6.30 A cumulative scenario has also been considered whereby the effects of the identified cumulative schemes have been considered in combination with those concluded for the Proposed Development, with conclusions made with regards to the combined effects of these schemes. This section utilises information available for the

²⁶ RBC (2023). Borough Profile. Available at: <https://www.reading.gov.uk/about-reading/borough-profile/>.
²⁷ Census (2021). RM202 – Household size by number of rooms.
²⁸ RBC (2021). Adult Social Care, Children's Services and Education Committee 30 March 2021 (Question 1). Available at: <https://democracy.reading.gov.uk/documents/s16809/Item%205%20-%2020Questions.pdf>.

²⁹ Audit Commission for Local Authorities and the National Health Service in England and Wales (1996). Trading Places: The Supply and Allocation of School Places.

cumulative schemes to inform these effects, such as additional provisions for housing, social infrastructure or employment. Where schemes (or parts of schemes) have already been built out and are operational, these are considered within the baseline.

6.31 The assessment of cumulative effects will follow the same methodology as the assessments for ‘Demolition and Construction’ and for the ‘Completed Development’.

Assumptions and Limitations

6.32 There are no specific significance criteria relating to the assessment of socio-economic effects. Therefore, the assessment is made against a benchmark of current socio-economic baseline conditions prevailing at and within relevant study areas, using professional judgement and best available information, and are considered accurate at the time of writing.

6.33 As with any dataset, baseline data will change over time. The most recent published data sources have been used in this assessment wherever possible. However, it should be noted that in some instances this data may not be up-to-date or may be based on modelled forecasts. This is an unavoidable limitation, but it is not expected to affect the magnitude of impacts or significance of effects in any material way.

6.34 It is assumed that all existing retail units on-site will be lost during the demolition and construction phase, with some equivalent uses replacing these units once the Proposed Development is complete and operational. The exception to this is the existing TK Maxx, which will likely be relocated to the nearby Oracle shopping centre, although the final employment associated with this new unit has not been confirmed at the time of assessment.

6.35 The employment expected to be accommodated by the completed and operational commercial floorspace of the Proposed Development has been calculated by applying the standard job density ratios from the HCA Employment Density Guide. The Proposed Development includes provision of flexible Class E floorspace, which is likely to deliver a mix of uses including commercial and retail facilities. As the exact nature of the future occupiers is unknown, an assessment of the best- and worst-case employment densities has been applied to provide a reasonable range for potential employment generation. It is expected that once the final occupiers of this space are known, then the actual employment generated by the Proposed Development will fall within this range.

6.36 Data for household spending is for the period 2020-2022, which is influenced by the Covid-19 pandemic. However, as spending is lower than previous years, this therefore represents a worst-case and has been deemed suitable for assessment purposes. Household spending is likely to be higher than that noted within the assessment.

Methodology for Defining Effects

6.37 The scale of impact attributed to each socio-economic effect has been determined based on the receptor sensitivity and magnitude of change resulting from the Proposed Development. Professional judgement and experience have been drawn upon to assess the scale, and thus significance, of the socio-economic effects.

Receptor Sensitivity

6.38 Receptor sensitivity is based on a scale of:

- **High:** local population, employment and economy; social infrastructure with no surplus or a deficit in capacity; area housing targets not being achieved; high levels of unemployment;
- **Medium:** borough and regional populations, employment and economy; social infrastructure operating close to or with limited surplus capacity; GPs operating over capacity but mainly accepting new patients, area housing targets being met or close to this; average levels of unemployment; and
- **Low:** national population, employment and economy; social infrastructure with surplus capacity; housing targets being exceeded; lower than average unemployment.

Magnitude of Impact

6.39 The magnitude of impact is based on a scale of:

- **High:** substantial change to one or more of the following receptors: local economy, employment, housing provision, demand for social infrastructure;
- **Medium:** noticeable change to one or more of the following receptors: local economy, employment, housing provision, demand for social infrastructure;

- **Low:** little change to one or more of the following receptors: local economy, employment, housing provision, demand for social infrastructure; and
- **Negligible:** no perceptible change to one or more of the following receptors: local economy, employment, housing provision, demand for social infrastructure.

Defining the Effect

6.40 The significance of each effect has been determined by reference to the:

- Nature of effect; and
- Scale of effect.

Nature of Effect

6.41 In terms of effect nature, effects are defined as either:

- **Adverse:** detrimental effects on a socio-economic receptor within the defined study area; and
- **Beneficial:** advantageous effects on a socio-economic receptor within the defined study area.

Scale of Effect

6.42 The scale of each effect, which is based on the identified receptor sensitivity and magnitude of impact has been defined as:

- **Major:** considerable significant effects;
- **Moderate:** notable significant effects;
- **Minor:** slight or highly localised, but not significant, effects; and
- **Negligible:** effects which are largely beneath levels of perception.

6.43 Determining the scale of effects has been based on existing best practice guidance where available. Where not available, professional judgement has been applied, considering the receptor sensitivity and magnitude of impact. Table 6.3 presents the matrix which determines the scale of effect. Where two scales of effect have been provided within the table, this is to allow for professional judgement to be applied.

Table 6.3 Scale of Effects Matrix

Receptor Sensitivity	Magnitude of Impact			
	High	Medium	Low	Negligible
High	Major	Major or Moderate	Moderate or Minor	Negligible
Medium	Major or Moderate	Moderate	Minor	Negligible
Low	Moderate or Minor	Minor	Negligible	Negligible

Geographic Extent of Effect

6.44 The geographic extent of potential impacts is the same as the assessment area, as defined in Table 6.1 above.

Duration of Effect

6.45 Effects which are defined temporally, and generally occur during the construction of the Proposed Development, are classed as ‘short term’ (typically lasting less than three years) or ‘medium term’ (typically lasting three to five years), and ‘temporary’.

6.46 Effects which do not have a defined timeline, and generally occur once the Proposed Development is complete and operational, are classed as ‘long term’ (typically lasting more than five years), and ‘permanent’.

Direct and Indirect Effects

6.47 Effects resulting without any intervening factors are classed as ‘direct’.

6.48 Effects which are not directly caused by or resulting from something else are classed as ‘secondary’ or ‘indirect’.

Categorising Likely Significant Effects

- 6.49 Based on the above methodology, effects considered to be moderate or major in scale are classified as ‘significant’, whilst negligible or minor effects are considered as ‘not significant’.
- 6.50 Following identification of the significance of the likely effects, the requirement for any mitigation to either eliminate or reduce significant adverse effects is considered. Where mitigation measures have been identified to either eliminate or reduce significant adverse effects, these have been incorporated into the Proposed Development. This assessment then highlights the residual effects and clarifies whether these effects are significant or not.

BASELINE CONDITIONS

- 6.51 This section summarises the characteristics of the existing socio-economic conditions of the site and wider study areas (as shown in Figure 6.1 and defined in Table 6.1), providing a baseline against which the potential effects of the Proposed Development have been assessed. These baseline conditions are considered in the context of the site and the wider local, Borough and regional spatial levels.

Local Economy

- 6.52 The site currently accommodates 108 FTE across 15 occupied commercial units, including 47 full-time employees and 123 part-time employees.
- 6.53 Reading’s gross value added (GVA) is approximately £16.5 billion³⁰ and the Borough has one of the fastest growing economies in the UK^{31, 32}.
- 6.54 According to the ONS Labour Market Profiles for Reading and Berkshire, as well as the BRES, the majority of Reading residents are aged 16-64 (68.9%) and therefore considered of working age, which is somewhat higher than is typical for Berkshire (64.2%).
- 6.55 Within the working age population, 85.7% of Reading residents are economically active, which is again slightly higher than the level of economic activity seen across the rest of Berkshire (84.1%). However, of those who are economically active, 3.9% are unemployed in Reading, which is just lower than average for the region (4.0%).
- 6.56 Approximately 117,000 jobs exist within Reading, with 75.2% being full-time roles and 24.8% being part-time. This is largely consistent with Berkshire as a whole which has 73.1% full-time roles and only 26.9% part-time.
- 6.57 The most common Standard Occupational Classification (SOC) 2020 in Reading, and Berkshire, is Group 1-3, which includes managers, directors, senior officials, and professional occupations. 57.9% of workers in Reading are in this category, compared to 58.9% of workers in Berkshire.
- 6.58 The most common industry present in Reading is Information and Communication, with 17.1% of roles being classed as such, which is somewhat higher than across Berkshire (13.5%). The next most common industries in the Borough are Professional, Scientific and Technical Activities (15.4%), the Wholesale and Repair Trade, and the Repair of Motor Vehicles and Motorcycles (12.0%), Human Health and Social Work Activities (12.05), and Administrative and Support Service Activities (10.3%).
- 6.59 There are approximately 2,000 Construction industry jobs within Reading (1.7% of total jobs) and 19,250 Construction jobs across Berkshire (3.6%).
- 6.60 Gross weekly pay for full-time workers in Reading is £698.70, which is lower than is typical for workers across the entirety of Berkshire (£725.60). Likewise, hourly wages are lower in Reading at £18.37 per hour than across Berkshire at £18.95.
- 6.61 As well as data gathered from the ONS and its affiliates, the English IoD provides a picture of relative deprivation based on seven distinct domains of deprivation across small neighbourhood areas called Lower-layer Super Output Areas (LSOA). The scores for these domains (Income; Employment; Education, Skills and Training; Health Deprivation and Disability; Crime; Barriers to Housing and Services; and Living Environment) are then amalgamated to determine overall deprivation within a given LSOA, and average scores for LSOAs are consolidated still further to provide averages for individual Local Authorities. Local Authorities with higher

rankings are more deprived while Local authorities with lower rankings are less deprived, with the Local Authority ranking 1st being the most deprived Local Authority in the country.

- 6.62 Of the 317 Local Authorities included in the IoD 2019³³, on average Reading ranks 200th in the Employment domain. This suggests that residents of the Borough are generally able to hold stable work and is indicative of a relatively strong economy. This is also consistent with the levels of economic activity recorded in the Borough’s Labour Market Profile.
- 6.63 In addition, Reading ranks 141st in the Income domain. This is roughly in the middle of all Local Authorities included in the IoD and mirrors the range of industries present across the Borough, as opposed to dominance by a single high-paying or low-paying sector.

Housing

- 6.64 According to the 2021 Census, Reading has a population of 174,200 people living across 67,700 households, which is a population increase of 11.9% since 2011³⁴.
- 6.65 Based on the findings of the SHMA, and accounting for Reading’s land constraints, RBC’s Local Plan and its accompanying Housing Strategy have set a viable housing target of 15,847 new homes within the Borough between 2013 and 2026. This results in an annual target of 689 new dwellings.
- 6.66 The Ministry of Housing, Communities & Local Government’s (MHCLG) Housing Delivery Test estimates that 4,473 homes were constructed in Reading between 2015/2016 and 2020/2021, which is approximately 28.2% of the Borough’s 13-year target.
- 6.67 Based on Census 2021 data, overcrowding across all tenures³⁵ is higher in Abbey ward, at 9.8%, than across Reading, at 7.0%. Overcrowding is substantially more common amongst renters³⁶, with 90.0% of overcrowded dwellings in Abbey ward being rented and 10.0% being privately owned. The same trend holds across Reading, with 76.0% of overcrowded dwellings being rented and only 24.0% being owned.
- 6.68 Of the 317 Local Authorities included in the IoD 2019, on average Reading ranks 34th in the domain of Barriers to Housing and Services, which indicates that residents of the Borough face substantial challenges when it comes to accessing adequate affordable, quality housing.

Social Infrastructure

Primary Healthcare

- 6.69 There are seven GP surgeries within approximately 1.6km of the site, as detailed in Table 6.4 and shown in Figure 6.2, all of which are within the appropriate NHS catchment area. Although some GP surgeries may accept patients residing outside their catchment area, this is not guaranteed and can disrupt public health services.
- 6.70 NHS data³⁷ shows that all seven GP surgeries already substantially exceed the recommended GP to patient ratio provided by HUDU and are therefore considered over capacity. However, all seven surgeries are still accepting new patients.

Table 6.4 Local GP Surgery Capacity

Map Ref.	Surgery Name	Walking Distance	Registered Patients	GP FTEs	Patients per FTE GP	Above / Below Capacity	Accepting New Patients
1	Reading Walk-in Health Centre, RG1 7QA	150m NE	13,570	3.0	4,523	-2,723	Yes
2	Chatham Street Surgery, RG1 7JE	550m NW	7,621	2.7	2,823	-1,023	Yes
3	Abbey Medical Centre, RG1 7XD	650m W	2,539	1.0	2,539	-739	Yes
4	Russell Street Surgery, RG1 7XG	850km SW	8,750	3.1	2,823	-1,023	Yes
5	London Street Surgery, RG1 4SJ	900m SE	5,882	1.0	5882	-4,082	Yes

³⁰ Centre for Cities (2022). City factsheet: Reading. Available at: <https://www.centreforcities.org/city/reading/>.

³¹ Reading’s Economy & Destination Agency (REDA) (2023). Reading economy in numbers. Available at: <https://www.visit-reading.com/business/invest/why-reading/economy-key-facts>.

³² PWC (2023). Good growth for cities: Unlocking the potential of UK cities. Available at: https://www.pwc.co.uk/GoodGrowth?WT.mc_id=CT1-PL52-DM3-TR3-LS4-ND30-TTA9-CN_GoodGrowth-LaunchFeb2022.

³³ Ministry of Housing, Communities & Local Government (2019). English Indices of Deprivation 2019. Available at: <https://data.london.gov.uk/dataset/indices-of-deprivation>. Accessed 14/11/2023.

³⁴ RBC (2023). Borough Profile. Available at: <https://www.reading.gov.uk/about-reading/borough-profile/>.

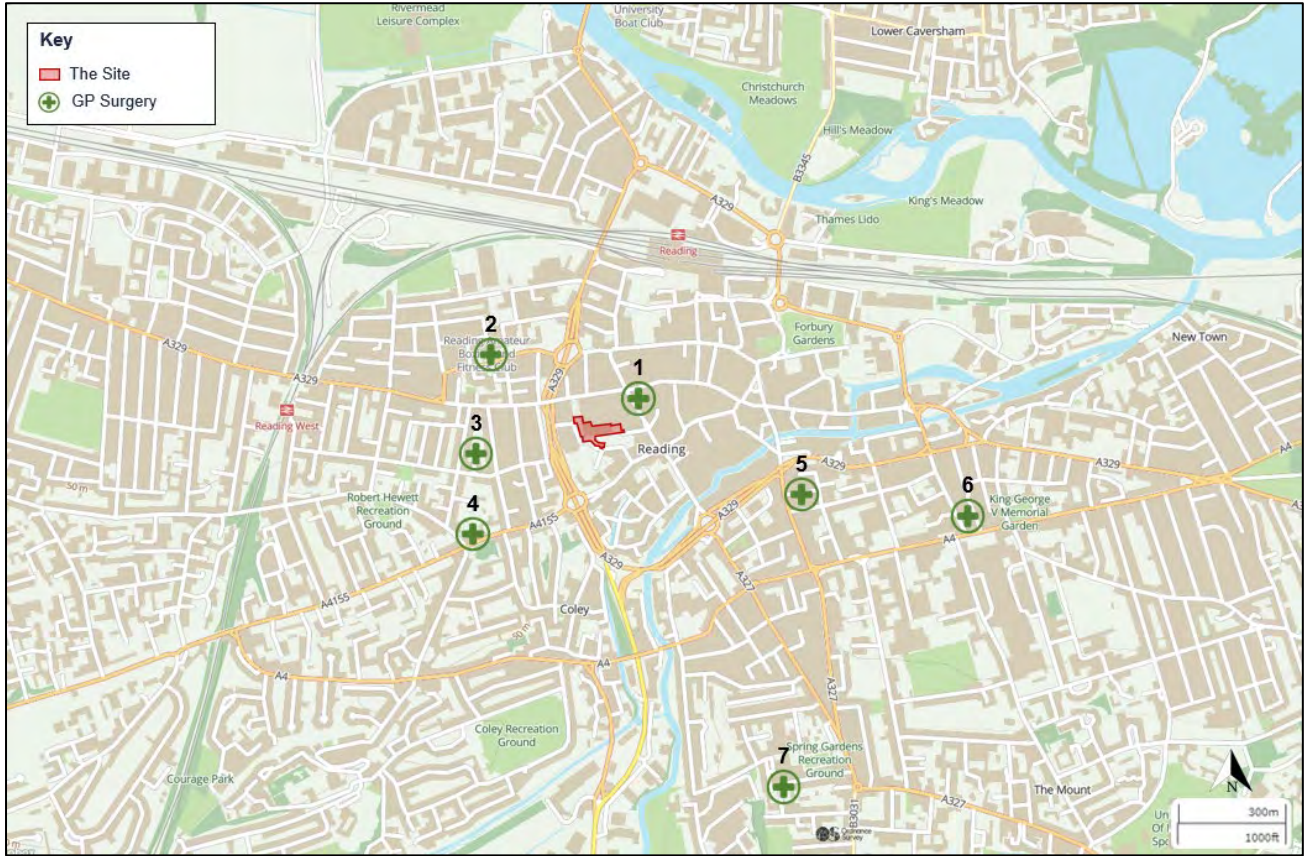
³⁵ ONS (2021). TS052 – Occupancy rating for bedrooms.

³⁶ ONS (2021). RM099 – Occupancy rating (bedrooms) by tenure.

³⁷ NHS (2023). General Practice Workforce: Selected Sub-ICB Location Information. Available at: <https://app.powerbi.com/view?r=eyJrIjoIYTMTM4ZTA3NGItMTM2Mi00NzAwLWEyY2QtdG9yZDkxOTk3MmFliiwidCI6IjUwZjYwNzFmLWJiZmUtNDUxYS00ODAzLTU3Mzc0OGU2MjllMiIsImMiOiJh9>. Accessed 08/11/2023.

Map Ref.	Surgery Name	Walking Distance	Registered Patients	GP FTEs	Patients per FTE GP	Above / Below Capacity	Accepting New Patients
6	Melrose Surgery, RG1 5BS	1.4km SE	15,435	2.0	7,718	-5,918	Yes
7	Milman & Kennet Surgery, RG2 0AR	1.6km S	20,211	8.4	2,406	-606	Yes
TOTAL			74,008	14.5	5,104	-3,304	-

Figure 6.2 GP Surgeries within 1.6km Walking Distance of the Site



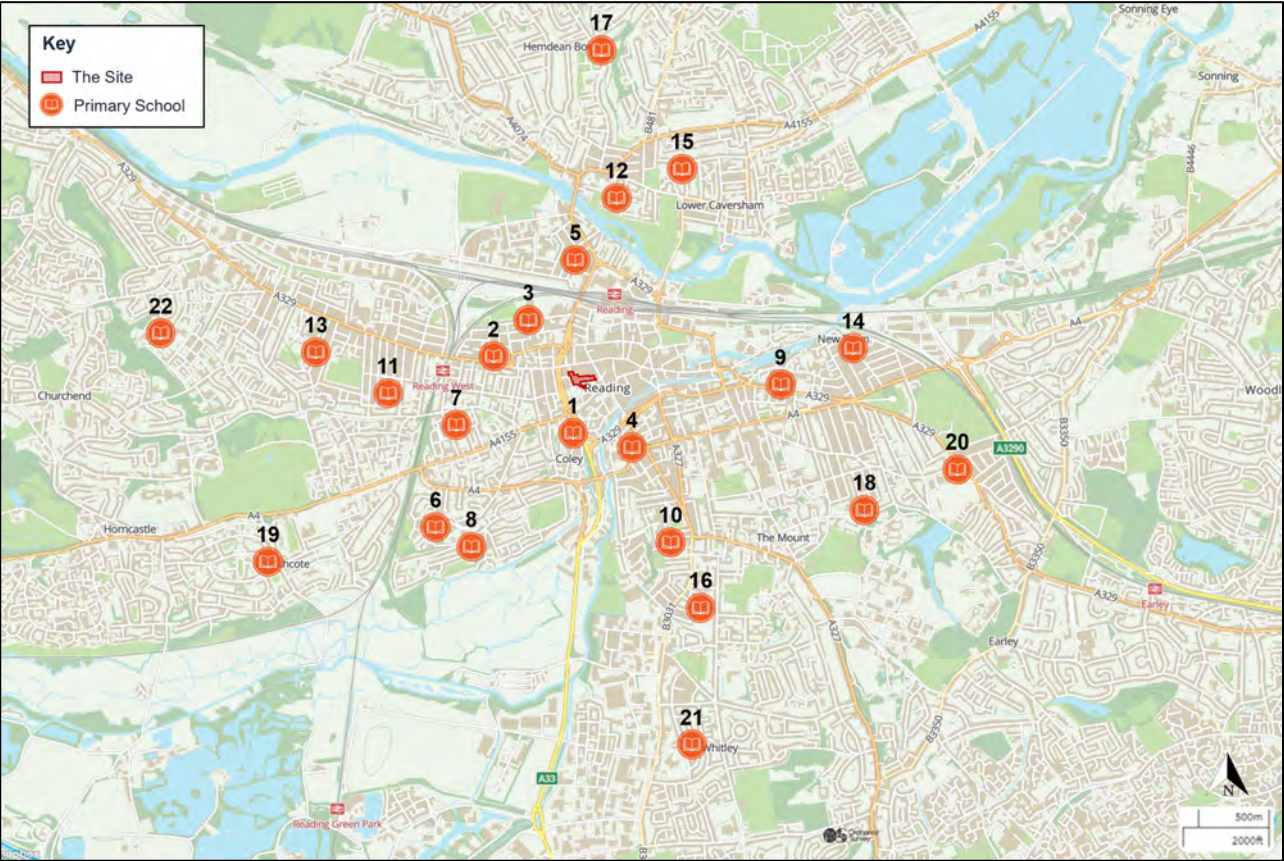
Base Map Source: Ordnance Survey (2023)

Education

Primary Schools

- 6.71
- There are 22 community or voluntary aided primary schools within 3.2km walking distance of the site, as shown in Table 6.5 and Figure 6.3. There are also a number of independent primary schools which are not included within the assessment due to these being 'paid for' rather than publicly accessible.
- 6.72
- Based on Audit Commission guidance regarding maintaining a 5% capacity buffer, there is a current deficit capacity of 38 places (0.5%) across local primary schools. This includes three of the five nearest primary schools to the site including Coley Primary School (2.9%), Civitas Academy (1.3%) and Katesgrove Primary School (2.3%).

Figure 6.3 Primary Schools within 3.2km Walking Distance of the Site³⁸



Base Map Source: Ordnance Survey (2023)

Table 6.5 Local Primary School Capacity

Map Ref.	School Name	Walking Distance	Capacity (Number of Pupils)	Capacity at 95% (Number of Pupils)	Number of Pupils on Roll	Surplus / Deficit Number at 95% Capacity	Surplus / Deficit % at 95% Capacity
1	Coley Primary School, RG1 6AZ	650m S	270	257	264	-8	-2.9
2	Oxford Road Primary School, RG1 7PJ	750m W	292	277	249	28	10.2
3	Civitas Academy, RG1 7HL	900m NW	420	399	404	-5	-1.3
4	Katesgrove Primary School, RG1 2NL	900m SE	708	673	688	-15	-2.3
5	E P Collier Primary School, RG1 8DZ	1.1km N	472	448	408	40	9.0
6	All Saints CoE Primary School, RG1 6NP	1.3km W	60	57	60	-3	-5.3
7	All Saints Junior School, RG1 6NP	1.3km W	100	95	98	-3	-3.2
8	St Mary & All Saints CoE Primary School, RG1 6DE	1.7km SW	420	399	319	80	20.1
9	St John's CoE Primary School, RG1 3JN	1.8km E	420	399	437	-38	-9.5
10	New Christ Church CoE Primary School, RG2 0AY	1.8km SE	210	200	198	2	0.8
11	Battle Primary Academy, RG30 2TD	1.8km W	472	448	458	-10	-2.1
12	Thameside Primary School, RG4 8DB	2.0km N	420	399	374	25	6.3
13	Wilson Primary School, RG30 2RW	2.1km W	477	453	455	-2	-0.4

³⁸ All figures included within this ES chapter show an indicative site boundary. Refer to **ES Volume, Chapter 1: Introduction** for the redline boundary sought for approval.

Map Ref.	School Name	Walking Distance	Capacity (Number of Pupils)	Capacity at 95% (Number of Pupils)	Number of Pupils on Roll	Surplus / Deficit Number at 95% Capacity	Surplus / Deficit % at 95% Capacity
14	New Town Primary School, RG1 3LS	2.1km E	420	399	423	-24	-6.0
15	St Anne's Catholic Primary School, RG4 5AA	2.2km N	210	200	207	-8	-3.8
16	The Palmer Primary Academy, RG2 7PP	2.3km S	420	399	443	-44	-11.0
17	Caversham Primary School, RG4 7RA	2.5km N	420	399	413	-14	-3.5
18	Redlands Primary School, RG1 5QH	2.7km SE	210	200	227	-28	-13.8
19	Southcote Primary School, RG30 3EJ	2.6km SW	630	599	585	14	2.3
20	Alfred Sutton Primary School, RG6 1JR	3.1km SE	687 *	653	687	-34	-5.3
21	Whitley Park Primary and Nursery School, RG2 7RB	3.2km S	630	599	577	22	3.6
22	Ranikhet Academy, RG30 4ED	3.2km W	236	224	238	-14	-6.2
TOTAL			8,604	8,174	8,212	-38	-0.5
*Note: The total capacity of Alfred Sutton School is not publicly available at the time of writing and thus, for the purposes of conducting a conservative assessment, the school is estimated to be at full capacity.							

Secondary Schools

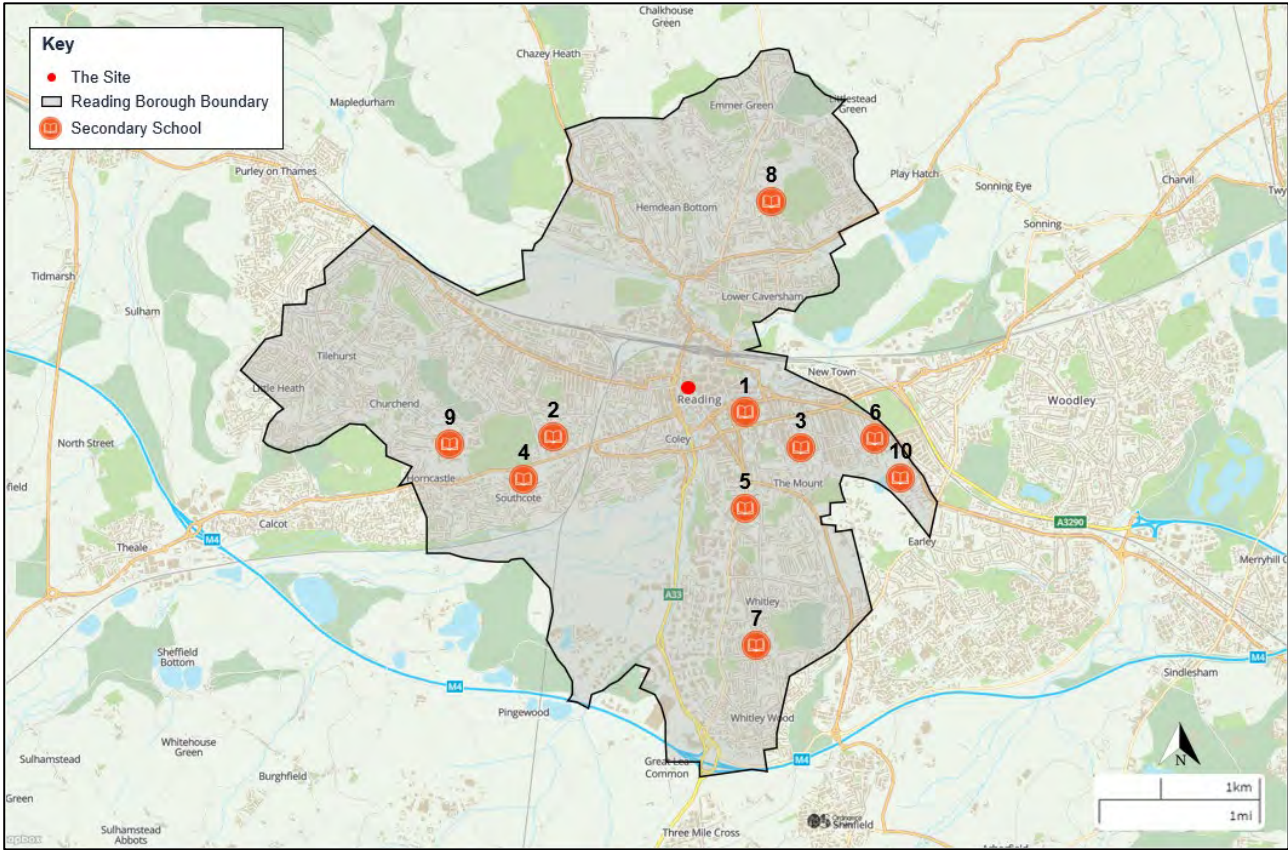
- 6.73 According to the Annual School Census Data there are ten secondary schools within Reading, as detailed in Table 6.6 and Figure 6.4. Analysis of secondary school capacity is carried out at the borough level to account for pupil preference and school specialisms, and to reflect secondary pupils' tendency to travel farther than primary pupils to attend school. There are also a number of independent secondary schools located in proximity to the site. These are not included within the assessment due to these being 'paid for' schools rather than those publicly accessible.
- 6.74 Taking the recommended 5% capacity buffer into consideration, Reading currently has a surplus capacity of 276 secondary school places (2.8%). The current surplus includes the two nearest secondary schools to the site, Kendrick School and The WREN School, which have surplus capacity for nine pupils (1.0%) and 123 pupils (11.0%) respectively. While Reading secondary schools overall have capacity to accommodate more students, a number of individual schools are above or very near full capacity, including two of the five nearest secondary schools to the site, Reading School and Blessed Hugh Faringdon Catholic School.
- 6.75 The above baseline does not account for the River Academy, which is due to open in September 2024, providing 240 places per year for 11-16 year olds and 150 sixth form places per year (1,200 pupils in total). Opening of the River Academy is central to the Borough's plans to meeting increased educational needs arising from new development and associated residential growth. However, as this school is not yet open and will not be at full capacity for a number of years, it is not included within the baseline in terms of additional capacity.

Table 6.6 Local Secondary School Capacity

Map Ref.	School Name	Walking Distance	Capacity (Number of Pupils)	Capacity at 95% (Number of Pupils)	Number of Pupils on Roll	Surplus / Deficit Number at 95% Capacity	Surplus / Deficit % at 95% Capacity
1	Kendrick School, RG1 5BN	1.2km SE	920	874	865	9	1.0
2	The WREN School, RG30 2BB	2.0km SW	1176	1117	994	123	11.0
3	Reading School, RG1 5LW	2.2km SE	1094	1039	1119	-80	-7.7
4	Blessed Hugh Faringdon Catholic School, RG30 3EP	2.5km SW	922	876	994	-118	-13.5
5	Reading Girls' School, RG2 7PY	2.7km S	947	900	795	105	11.6
6	UTC Reading, RG1 5RQ	3.1km E	600	570	489	81	14.2
7	John Madejski Academy, RG2 8AF	3.7km S	950	903	891	12	1.3

Map Ref.	School Name	Walking Distance	Capacity (Number of Pupils)	Capacity at 95% (Number of Pupils)	Number of Pupils on Roll	Surplus / Deficit Number at 95% Capacity	Surplus / Deficit % at 95% Capacity
8	Highdown School and Sixth Form Centre, RG4 8LR	3.7km N	1440	1368	1575	-207	-15.1
9	King's Academy Prospect, RG30 4EX	3.7km SW	1500	1425	1037	388	27.2
10	Maiden Erlegh School in Reading, RG1 5SL	4.7km SE	900	855	892	-37	-4.3
TOTAL			10,449	9,927	9,651	276	2.8

Figure 6.4 Secondary Schools within Reading



Base Map Source: Ordnance Survey (2023)

Open and Play Space

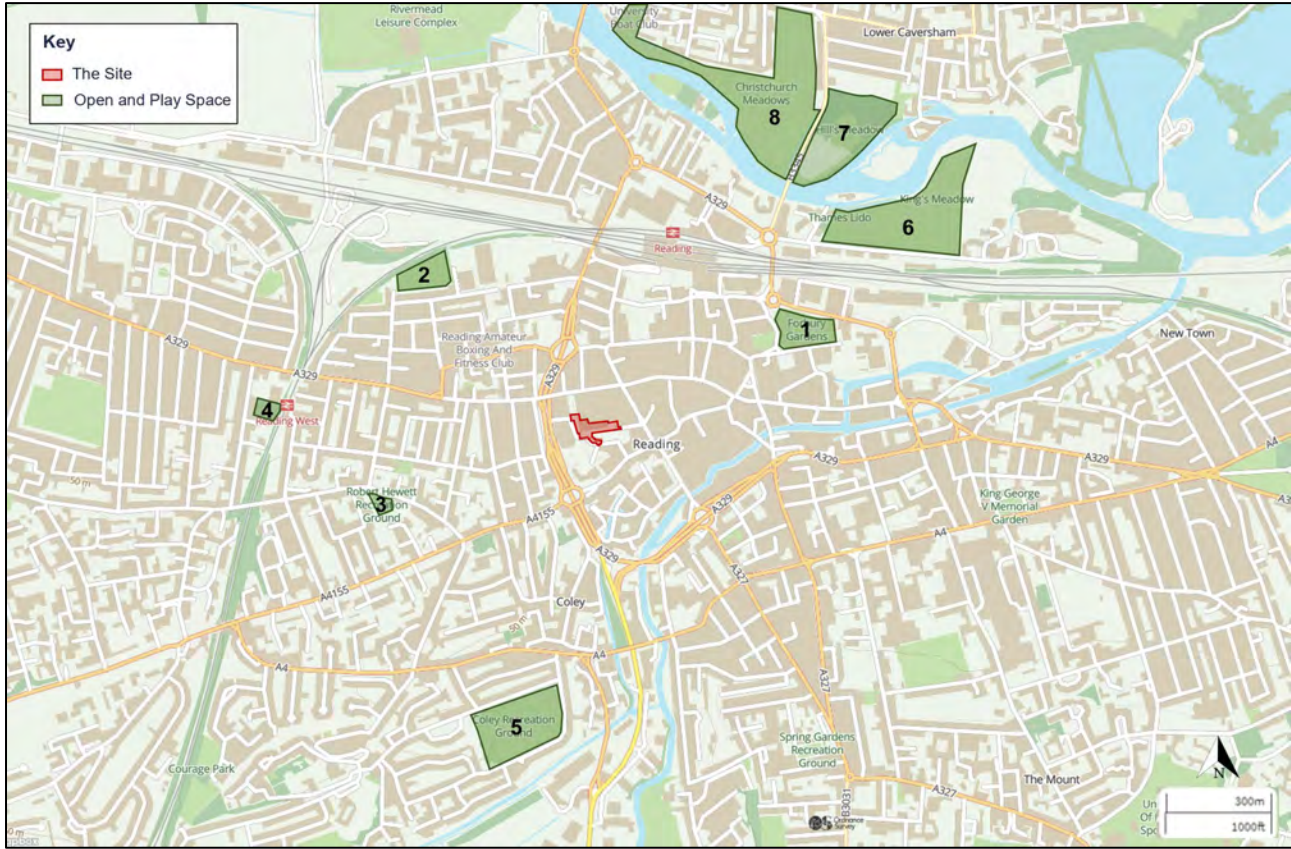
- 6.76 An assessment of existing open space and play space facilities has been undertaken for a 1.2km walking distance from the site, in line with RBC's benchmark for public parks. Eight areas of open and play space have been identified offering a range of facilities for leisure and exercise, as well as more general community use. There are laid out in Table 6.7 and Figure 6.5 below.

Table 6.7 Public Open and Play Space

Map Ref.	Facility Name	Walking Distance	Facilities
1	Forbury Gardens Public Park	800m NE	Public park and formal gardens with a bandstand and café
2	Victoria Park Playground	1.0km NW	Public park with a playground and paved sports pitches
3	Robert Hewitt Recreation Ground	950m SW	Public playground

Map Ref.	Facility Name	Walking Distance	Facilities
4	Oxford Road Community Garden	1.0km W	A semi-private community garden with a small playground
5	Coley Recreation Ground	1.1km S	Public park with a playground, sports pitches, tennis court, basketball court and outdoor gym
6	King's Meadow	1.1km NE	Public park with a playground, sports pitches, riverside walking path, and lido
7	Hill's Meadow	1.2km NE	Public park and skate park
8	Christchurch Meadows	1.2km NE	Public park with a playground, tennis courts, riverside walking path, and paddling pool

Figure 6.5 Public Open and Play Space within 1.2km Walking Distance of the Site



Base Map Source: Ordnance Survey (2023)

RECEPTORS AND RECEPTOR SENSITIVITY

6.77 Table 6.8 below sets out receptors likely to be impacted by the Proposed Development, as well as their corresponding sensitivity, in line with the sensitivities set out in paragraph 6.38.

Table 6.8 Receptors and Receptor Sensitivity

Receptor		Sensitivity
Availability of Housing (including affordable housing)		Medium
Capacity of Social Infrastructure	Primary Healthcare	Medium
	Primary Schools	High
	Secondary Schools	Medium
	Open Space	Medium
	Play Space	Medium
Strength of the Local Economy	Employment	Low
	Employee Expenditure	Low

Receptor		Sensitivity
Household Expenditure		Low

POTENTIAL EFFECTS

Demolition and Construction

Local Economy

Existing Employment

6.78 It is assumed that all existing retail units on-site, and their associated 108 FTE roles, will be lost during the demolition and construction phase. The exception to this is the TK Maxx, which employs 33 FTE employees (including 6 full-time and 54 part-time employees). This retailer will likely be relocated to the nearby Oracle shopping centre, although the final employment associated with this new unit has not been confirmed at the time of assessment. Therefore, 108 FTE has been used as a conservative estimate under a worst-case scenario.

6.79 The loss of 108 FTE jobs on-site during the demolition and construction programme within the context of 117,200 existing roles across Reading is expected to have a low magnitude of impact on the local economy (low sensitivity receptor). This results in a direct, long term Negligible (not significant) effect at the local and Borough level.

Existing Additional Expenditure

6.80 Assuming all 108 FTE currently on-site are lost during demolition and construction, this phase of the programme will also result in a net loss of £275,000 annually in employee expenditure.

6.81 The loss of £275,000 in additional expenditure during the demolition and construction programme within the context of Reading's £16.5 billion GVA is expected to have a negligible magnitude of impact on the local economy (low sensitivity receptor). This results in an indirect, long term Negligible (not significant) effect at the local and Borough level.

Construction Employment

6.82 It is anticipated that 2,512-person years of employment could be supported by the construction and demolition period, including a broad range of job types and occupations for roles both on- and off-site. With an anticipated 60-month programme (5 years), an average of 502 jobs could be supported each year.

6.83 Construction employment is highly mobile and therefore consideration of the demolition and construction works is best considered at the regional level. As set out in the baseline, the construction industry currently supports about 19,250 jobs across Berkshire, so annual employment supported by the Proposed Development during the demolition and construction phase would be approximately 2.6% of annual employment in this sector in the region.

6.84 The introduction of 502 direct jobs each year during the demolition and construction programme is expected to have a low magnitude of impact on the construction industry and wider economy (low sensitivity receptor) in Berkshire. This results in a direct, short term, Negligible (not significant) effect at the regional level.

Construction Additional Expenditure and Supply Chain

6.85 The Proposed Development would result in indirect benefits including supply chain effects and spending by construction workers in retail outlets near to the site. However, as the number of construction workers on-site will fluctuate over the course of the construction programme, it is not possible to quantify the precise level of spending captured locally.

6.86 The HCA Additionality Guide provides an additionality ratio of 33% for Construction employment to estimate the number of indirect and informal jobs associated with the demolition and construction works. This results in an additional 166 jobs per year employed as result of the Proposed Development. However, this is an estimate, and actual supply chain and procurement effects can vary widely, even affecting international spatial levels, depending on the supply and sourcing of construction materials and other supplies. A more detailed assessment would require more information not available (or required) at this stage.

6.87 The introduction of an estimated 166 indirect and induced FTE roles each year during the demolition and construction programme is expected to have a negligible magnitude of impact on the construction industry and wider economy (low sensitivity receptor) in Berkshire. This results in an indirect, short term, Negligible (not significant) effect at the regional level.

Completed Development

Housing

- 6.88 RBC’s Local Plan sets a target of 15,847 new homes in the Borough by 2026. The Proposed Development includes 644 dwellings, which is approximately 4.1% of this overall target.
- 6.89 The residential accommodation for the Proposed Development is arranged as shown in Table 6.9.

Table 6.9 Proposed Development Residential Unit Mix

Unit Size	Number of Units	Percentage of Units
Studio	69	11%
1 bed	229	35%
2 bed	297	46%
3 bed	49	8%
TOTAL	644	100%

- 6.90 As displayed above, the Proposed Development will provide a total of 644 residential units comprised of studio and one- to three-bed units, which will be suitable for a range of household sizes and types. Of these units, 7.5% are currently proposed as affordable housing and, in accordance with Policy H5 of the RBC Local Plan, 5% of dwellings are wheelchair accessible (compliant with M4(3) standards) and 95% are adaptable (compliant with M4(2) standards). The current makeup of the affordable provision is 18 1-bedroom units, 25 2-bedroom units and five 3-bedroom units, with a total of 48 affordable units.
- 6.91 The Proposed Development is expected to have a medium magnitude of impact on the provision of housing (medium sensitivity receptor) in Reading. This results in a direct, long term, Moderate Beneficial (significant) effect at the Borough level, in relation to RBC housing targets.

Social Infrastructure

Population

With 174,200 people living in Reading across 67,700 households, the Borough’s average household size is 2.6 occupants. When applied to the proposed residential unit mix of the Proposed Development (644 units), this results in an estimated residential population of 1,674.

- 6.92 Using Cognisant’s pupil product ratios, total population estimates for school-aged children within the Proposed Development are set out in Table 6.10.

Table 6.10 Proposed Development Residential Population by Age

Age Group	Population Distribution
Early Years	132
Primary School	78
Secondary School	25
Post 16	9
18+	1,431
TOTAL	243

- 6.93 With 243 new school-aged children coming forward as part of the Proposed Development, the remainder of the residential population (1,431) would be comprised of adults, to a total of 1,674.
- 6.94 This new residential population would create demand for social infrastructure, particularly primary healthcare, primary and secondary schools, and open and play space, all of which are considered below.

Primary Healthcare

- 6.95 There are seven GP surgeries within 1.6km of the site which fall within the practice catchment area for the site. While these surgeries are accepting new patients, they are all already exceed capacity, with 14.5 FTE GPs serving an estimated 74,008 patients (1 FTE GP per 5.1704 patients).

- 6.96 Given the current condition of GP surgeries in the surrounding area, the introduction of 1,674 residents (requiring the equivalent of an additional 0.93 GP) is expected to have a medium magnitude of impact on the capacity of primary healthcare services (medium sensitivity receptor) in the study area. This results in a direct, long term, Moderate Adverse (significant) effect at the local level.
- 6.97 It should be noted that the above assessment represents a worst-case scenario as it is considered likely that a number of the residents accommodated within the Proposed Development will already be registered with a GP in the local area or beyond and will therefore not be relocated. They may also use private health care, which is not considered within this assessment.

Education

Primary Schools

- 6.98 The 22 primary schools within a reasonable walking distance of the site (3.2km) are currently over capacity by 38 pupils (0.5%), allowing for 95% of actual school capacity. Table 6.10 indicates that the Proposed Development could generate demand for 78 primary school places (ages 5-11), which would result in these schools being over capacity by 116 pupils (1.4%).
- 6.99 The introduction of 78 new primary school students is expected to have a low magnitude of impact on the capacity of primary schools (high sensitivity receptor) in the study area. This results in a direct, long term Moderate Adverse (significant) effect at the local level.

- 6.100 It should be noted that the above assessment represents a worst-case scenario. It is reasonable to assume that the majority of children living in the Proposed Development will already occupy school places within the study area or beyond and will therefore not be relocated. They may also attend private schools, which are not considered within this assessment.

Secondary Schools

- 6.101 There are currently approximately 276 places (2.8%) available in the ten secondary schools within RBC, allowing for a 5% buffer on actual capacity. Table 6.10 indicates that the Proposed Development could generate demand for 34 secondary school places (including sixth form), which would reduce surplus in the Borough to 242 spaces (2.4%).
- 6.102 The introduction of 34 new secondary school students is expected to have a low magnitude of impact on the capacity of secondary schools (medium sensitivity receptor) in the study area. This results in a direct, long term Minor Adverse (not significant) effect at the Borough level.
- 6.103 As is the case with primary schools, it should be noted that the above assessment represents a worst-case scenario. It is reasonable to assume that the majority of children living in the Proposed Development will already occupy school places within the study area or beyond and will therefore not be relocated. They may also attend private schools, which are not considered within this assessment.
- 6.104 Further to this, given the opening of the River Academy in September 2024 (providing spaces for 1,200 pupils in total), there is expected to be sufficient secondary school capacity within the Borough. As stated within the ‘Baseline’ section, opening of the River Academy is central to the Borough’s plans to meeting increased educational needs arising from new development and associated residential growth. However, this additional capacity has not been factored into the assessment conclusion as a worst-case and to represent the current baseline conditions.

Open Space

- 6.105 The site does not currently offer any public green space, however, there is a wide range of open and green space within a reasonable walking distance (1.2km) of the site, which offer a variety of good quality and well-maintained sport, play and other recreation facilities. The site does provide publicly accessible spaces both within and around the shopping centre.
- 6.106 The Proposed Development will provide 2,346m² of outdoor amenity space, which is approximately 3.6m² per dwelling, as well as improvements to the surrounding public realm. This is expected to meet the needs of new residents within the Proposed Development, but not substantially contribute to wider open and green infrastructure across Abbey ward.
- 6.107 The addition of new open and amenity space is expected to have a low magnitude of impact on the availability of public open space (medium sensitivity receptor) in the study area. This results in a direct, long term Minor Beneficial (not significant) effect at the site and local level.

Play Space

- 6.108 The Proposed Development will provide approximately 595m² of play space consisting of 420.95m² of private play space and 174.3m² of publicly accessible play space. This is the equivalent of approximately 1.7m² of play space per child aged 16 and under, based on the estimated 243 children who will inhabit the Proposed Development.
- 6.109 The addition of new play space is expected to meet but not exceed the needs of the new residential population. This will have a low magnitude of impact on the availability of play space (medium sensitivity receptor) in the study area. This results in a direct, long term Minor Beneficial (not significant) effect at the site and local level.

Local Economy

Employment

- 6.110 The Proposed Development includes the provision of 1,737m² GIA (1,364m² NIA) of use class E floorspace, which would generate employment opportunities. As the precise end use of these spaces is not yet known, the anticipated employment generation figures set out below have been based on the reasonable highest (Table 6.11) and reasonable worst case (Table 6.12) employment densities falling under use class E³⁹.
- 6.111 As agreed with the Applicant, the likely uses of the Proposed Development’s commercial space are expected to comprise F&B, retail and office, with no more than 465m² GIA (372m² NIA) being allocated to office. It is considered unlikely that this space would be used for very low employment density categories such as industrial, storage, distribution, cultural or entertainment uses.

Table 6.11 Proposed Development Employment Generation (Best-Case Scenario)

Anticipated Use	HCA Classification	Type	Floorspace (GIA)	Floorspace (NIA)	Jobs Created (FTE)
Office	B1a Offices – General Office	12m² NIA per FTE	465m²	372m²	31
Retail, Food and Beverage	A1 – Retail; A3 – Restaurants and Cafes	20m² NIA per FTE	1,272m²	992m²	50
Gross Employment			81		
Less Existing FTE (108)					
Net Employment			-27		
Displacement (25%)					
Total Direct Employment			-21		
Economic Multiplier (1.21)					
Total Indirect and Induced Employment			-4		
TOTAL Net FTE Employment			-25		

Source: Trium Calculations

- 6.112 Under a best-case scenario, the Proposed Development would result in a net employment loss of 25 FTE roles. This includes 21 roles resulting from direct employment and four roles resulting from indirect and induced employment.

Table 6.12 Proposed Development Employment Generation (Reasonable Worst-Case Scenario)

Anticipated Use	HCA Classification	Type	Floorspace (GIA)	Floorspace (NIA)	Jobs Created (FTE)
Retail, Food and Beverage	A1 – Retail; A3 – Restaurants and Cafes	20m² NIA per FTE	1,737m²	1,364m²	68
Gross Employment			68		
Less Existing FTE (108)					
Net Employment			-40		

³⁹ Formerly use classes A1, A2, A3, B1, D1(a-b) and ‘indoor sport’ from D2(e).
⁴⁰ Without a more localised figure available, the South East is considered a suitable stand-in for Berkshire for the purposes of this calculation.

Anticipated Use	HCA Classification	Type	Floorspace (GIA)	Floorspace (NIA)	Jobs Created (FTE)
Displacement (25%)					
Total Direct Employment			-30		
Economic Multiplier (1.21)					
Total Indirect and Induced Employment			-6		
TOTAL Net FTE Employment			-36		

Source: Trium Calculations

- 6.113 Under a worst-case scenario, the Proposed Development would result in a net employment loss of 36 FTE roles. This includes 30 roles resulting from direct employment and 6 roles resulting from indirect and induced employment.
- 6.114 As such, the worst-case loss of 36 net FTE roles within the context of 117,200 existing roles across Reading is expected to have a negligible magnitude of impact on the local economy (low sensitivity receptor). This results in a direct and indirect, long term Negligible (not significant) effect at the local and Borough level. As set out above, this does not consider the potential for relocation of existing employment to other locations, which is understood to be a potential consideration subject to agreement with the Applicant.

Employee Expenditure

- 6.115 Under the best-case scenario, the direct employment loss of 21 FTE at the Proposed Development is expected to result in a loss of approximately £53,000 annually, based on a five day in-person working week, which is 0.003% of Reading’s £16.5 billion GVA. Under the worst-case scenario, the direct employment loss of 30 FTE at the Proposed Development is expected to result in a loss of approximately £78,000 annually, based on a five day in-person working week, which is 0.004% of Reading’s GVA.
- 6.116 The spending impact of the loss of employment on-site is expected to have a negligible magnitude of impact on the local economy (low sensitivity receptor). This results in an indirect, long term Negligible (not significant) effect at the local and Borough level.

Household Expenditure

- 6.117 The 644 new dwellings in the Proposed Development are estimated to generate approximately £8.7 million per annum in additional spending, based on the ONS Average Weekly Household Spending of £344.80 within the South East of England⁴⁰ and accounting for 25% displacement and no leakage. This is approximately 0.05% of Reading’s annual GVA of £16.5 billion.
- 6.118 The spending impact of new residents as introduced by the Proposed Development is expected to have a negligible magnitude of impact on the local economy (low sensitivity receptor). This results in an indirect, long term Negligible (not significant) effect at the local and Borough level.

MITIGATION, MONITORING AND RESIDUAL EFFECTS

Demolition and Construction Mitigation

- 6.119 No significant socio-economic effects have been identified within the assessment during demolition and construction. As such, no additional mitigation is required.

Completed Development Mitigation

- 6.120 Significant adverse socio-economic effects identified within the assessment during operation include Moderate Adverse effects on primary healthcare facilities and Moderate Adverse effects on primary schools. All other effects are not significant and/ or beneficial, and therefore do not require additional mitigation.
- 6.121 To mitigate against these significant adverse effects, it is recommended that the Applicant and RBC agree to Community Infrastructure Levies (CIL) to offset the impact of future residents’ demand for healthcare and educational services. Under RBC policy⁴¹, any development greater than 100m² or providing at least one new dwelling is potentially liable to pay CIL, with charge rates and charging zones varying depending on the use classes of the Proposed Development.
- 6.122 However, given the nature and potential scope for such agreements, it is not possible at this time to determine how S106 payments or CILs may alter residual effects on these receptors. Therefore, to provide a conservative

⁴¹ RBC (2023). Community Infrastructure Levy. Available at: <https://www.reading.gov.uk/planning-and-building-control/planning-applications/community-infrastructure-levy/>.

assessment, the residual effects are unchanged and still classified as Moderate Adverse (**significant**) for the capacity of primary healthcare and primary schools.

Residual Effects

6.123 All of the residual effects resulting from the Proposed Development are presented in Table 6.13, identifying whether the effect is significant or not.

Table 6.13 Residual Effects

Receptor	Description of the Residual Effect	Scale and Nature	Significant / Not Significant	Geo	D I	P T	St Mt Lt
Demolition and Construction							
Existing Employment	Loss of 108 FTE (net direct roles, worst-case)	Negligible	Not Significant	S, L, B	D	P	Lt
Existing Additional Expenditure	Loss of £275,000 annual employee spend (worst-case)	Negligible	Not Significant	L, B	I	P	Lt
Construction Employment	502 direct FTE roles created in the construction sector annually	Negligible	Not Significant	R	D	T	St
Construction Additional Expenditure and Supply Chain	166 indirect FTE roles created in the construction sector annually	Negligible	Not Significant	R	I	T	St
Completed Development							
Availability of housing	Provision of 644 new dwellings, of which a percentage will be affordable	Moderate Beneficial	Significant	B	D	P	Lt
Capacity of primary healthcare	Addition of 1,674 new residents	Moderate Adverse	Significant	L	D	P	Lt
Capacity of primary schools	Addition of 78 new primary school pupils	Moderate Adverse	Significant	L	D	P	Lt
Capacity of secondary schools	Addition of 34 new secondary school pupils	Minor Adverse	Not Significant	B	D	P	Lt
Capacity of open space	Provision of 2,346m ² of open and amenity space	Minor Beneficial	Not Significant	S, L	D	P	Lt
Capacity of play space	Provision of 595m ² of play space	Minor Beneficial	Not Significant	S, L	D	P	Lt
Availability of employment	Loss of 36 FTE (net direct and indirect roles, worst-case)	Negligible	Not Significant	L, B	D / I	P	Lt
Employee expenditure	Loss of £78,000 annual employee spend (worst-case)	Negligible	Not Significant	L, B	I	P	Lt
Household expenditure	£8.7 million annual household spend (worst-case)	Negligible	Not Significant	L, B	I	P	Lt
Notes: Residual Effect - Scale = Major / Moderate / Minor / Negligible - Nature = Beneficial or Adverse Geo (Geographic Extent) = Site (S), Local (L), Borough (B), Regional (R) D = Direct / I = Indirect P = Permanent / T = Temporary St = Short Term / Mt = Medium Term / Lt = Long Term N/A = not applicable / not assessed							

ASSESSMENT OF THE FUTURE ENVIRONMENT

Evolution of the Baseline Scenario

6.124 If the Proposed Development is not delivered, the site will remain in its existing use and the opportunity to deliver new homes, office and commercial floor space, and public realm will not be realised.

6.125 The future baseline of the surrounding area will continue to evolve, with a range of uses including residential, commercial and office floorspace coming forward, particularly from consented cumulative schemes. Taking into account these schemes, the future baseline of the surrounding area is expected to experience a rise in population due to increased housing provision, which could result in additional demand for social infrastructure and community facilities and a rise in employment given the additional employment generating floorspace. New schools and open/ play spaces are also proposed as part of the cumulative schemes identified in **ES Volume 3, Appendix: EIA Methodology – Annex 2**. Further detailed analysis of these changes is provided in the 'Cumulative Effects Assessment' section below.

Cumulative Effects Assessment

6.126 The ES considers 12 cumulative schemes within 1km from Proposed Development as set out within **ES Volume 1, Chapter 2: EIA Methodology**. See **ES Volume 3, Appendix: EIA Methodology – Annex 2** for full details of the identified cumulative schemes.

6.127 These cumulative schemes include a range of residential, commercial and mixed-use developments, with varying information available for each. All 12 schemes have been considered in the cumulative assessment for this ES chapter with all residential components considered in terms of effects on housing, the capacity of social infrastructure and the local economy, and all commercial components considered in terms of effects on the local economy.

6.128 Wherever possible, socio-economic information is pulled directly from assessments or reports included in the relevant planning application documents. However, in some cases, limited or no socio-economic information is provided, or calculations are based on outdated data, such as the Census 2011. In these cases, estimates have been made where possible, such as estimated residential populations based on proposed unit mixes and tenures or estimates of potential employment from proposed floorspaces. However, estimates of demand for community services and infrastructure are considered qualitatively only as detailed breakdowns of population yields cannot be obtained for every scheme.

6.129 Construction employment is typically seen as a mobile resource with construction workers able to be pooled from a wide, even regional, area depending on the scale of the project at hand. Given the mobility of this industry, it is not considered likely that the cumulative effects to the construction industry would significantly exceed the effects concluded for the Proposed Development. The exception for this would be in the unlikely scenario of all the cumulative schemes coming forward at the same time with similar lengths of programme. Given this is highly unlikely, this scenario has not been considered within this ES chapter.

6.130 The 11 cumulative schemes considered within this assessment are listed in Table 6.14.

Table 6.14 Cumulative Schemes

Ref	Name	Planning Application Ref	Relevant Scheme Details	Reasons for Inclusion/ Exclusion
0	Proposed Development		Partial demolition of existing structure and provision of 644 residential units and 1,770m ² GIA of flexible commercial (use class E)	Included - residential units and commercial space
1	52-55 Friar Street Reading and 12 Greyfriars Road, RG1 1DX	162210	Demolition of existing structures and provision of 137 residential units and flexible retail (use class A1-A5) or gym (use class D2)	Included - residential units and commercial space
2	Station Hill, Reading including Plot E, F and Telecom House	192032, 201532, 201536	Demolition of existing structures and provision of residential units, flexible retail (use class A1-A5), office (use class B1), and assembly and leisure uses (use class D1/D2)	Included - residential units and commercial space
3	Land between Weldale Street and Chatham Street Reading	170326	Demolition of existing structures and provision of 429 residential units and flexible retail (use class A1/A3)	Included - residential units and commercial space
4	Former Sorting Office, Caversham Road / Vastern Road	110024	Provision of 401 residential units, flexible retail (use class A1-A5), offices (use class B1), a hotel (use class C1), and leisure uses (use class D2)	Included - residential units and commercial space
5	29 Station Road, Reading, RG1 1LG	181930	Demolition of existing structures and provision of flexible retail (use class A1-A3), office (use class B1a), and a 135-bedroom hotel (use class C1)	Included - commercial space
6	Bristol & West Arcade Market Place Reading RG1 1JL	180358	Demolition of existing structures and provision of 43 residential units, flexible retail use class A1-A3), and office (use class B1)	Included - residential units and commercial space

Ref	Name	Planning Application Ref	Relevant Scheme Details	Reasons for Inclusion/Exclusion
7	Former Car Park East Street Reading RG1 4QH	181849	Provision of 135 Purpose Built Student Accommodation (PBSA) units and associated facilities (Sui Generis)	Included - commercial space
8	55 Vastern Road Reading RG1 8BU	200188	Demolition of existing structures and provision of 100 residential units and flexible retail (use class A3)	Included - residential units and commercial space
9	Existing Vue Cinema Complex Land West of Yield Hall Place / London Road The Oracle Reading RG1 2AG	221917	Demolition of existing structures and provision of 449 residential units and flexible commercial space including a cinema (use class E / Sui Generis)	Included - residential units and commercial space
10	Former Debenhams Department Store West of Yield Hall Place The Oracle RG1 2AS	221916	Demolition of existing structures and provision of 202 residential units and flexible commercial space (use class E / Sui Generis Use)	Included - residential units and commercial space
11	Vastern Court Caversham Road Reading	200328 ⁴²	Demolition of existing structures and provision of residential units, flexible retail (use class A1-A5), office (use class B1a), and leisure space (use class D1/D2)	Included - commercial space

Demolition and Construction

Construction Employment

- 6.131 As stated within paragraph 6.129, the construction industry is typically mobile with resources pooled from a wide geographic area. As such, it is considered that the employment generated through the cumulative demolition and construction phases would only have a marginally higher impact than the Proposed Development alone. Thus, the cumulative schemes are expected to have a medium magnitude of impact on the construction industry and wider economy (low sensitivity receptor) in Berkshire.
- 6.132 This results in a direct, short term, Minor Beneficial (not significant) effect at the regional level, greater than for the Proposed Development alone.

Construction Additional Expenditure and Supply Chain

- 6.133 As stated above, it is considered that the additional expenditure and supply chain effects resulting from the cumulative demolition and construction phases would only have a marginally higher impact than the Proposed Development alone. Thus, the cumulative schemes are expected to have a low magnitude of impact on the construction industry and wider economy (low sensitivity receptor) in Berkshire.
- 6.134 This results in an indirect, short term, Negligible (not significant) effect at the regional level, the same as for the Proposed Development alone.

Completed Development

Housing

- 6.135 The cumulative schemes are expected to bring forward approximately 3,630 residential units within Reading, based on secured units included in detailed planning applications and minimum potential units included in outline planning applications. These new homes would make a beneficial contribution to the availability of housing within RBC, contributing approximately 23% towards the Borough's housing target of 15,847 new homes by 2026.
- 6.136 This is expected to have a high magnitude of impact on the provision of housing (medium sensitivity receptor) in Reading. Through professional judgement, this results in a direct, long term, Major Beneficial (**significant**) effect at the Borough level, in relation to RBC housing targets, an increase in significance from the Proposed Development alone.

Social Infrastructure

- 6.137 The breakdown of unit tenure and size for some but not all cumulative schemes where residential uses are proposed is included in available application documents. Using these available figures and estimates found in

⁴² Planning Application 200328 proposes nearly total flexibility of the site, including residential units (0m² to 100,000m²), office (0m² to 113,000m²), hotel (0m² to 8,000m²), and leisure (2,000m² to 7,000m²).

supporting documents, the total population expected to be accommodated within the cumulative schemes, based on the average Reading household size of 2.6 people per dwelling, is approximately 10,000 people.

- 6.138 Without more detailed information on the unit tenure and mix of dwellings across the cumulative schemes, it is not possible to accurately capture the likely number of primary and secondary pupils to be accommodated within these developments. Thus, a qualitative assessment based on indicative estimates has been undertaken for educational receptors.

Primary Healthcare

- 6.139 The '*Baseline Conditions*' section of this ES chapter illustrates that there are few public GP practices in the study area and that these GPs are operating over the recommended HUDU guidance, although they are all still accepting new patient registrations.
- 6.140 The population of at least 10,000 residents generated by the cumulative schemes, which would require 5.6 FTE GPs (an increase of approximately 33% on the existing baseline, although noted the other schemes would likely fall within the catchment of additional GP surgeries), will likely result in a high magnitude of impact on the capacity of existing GP surgeries (medium sensitivity receptor) in Reading. Through professional judgement, this results in a direct, long term, Major Adverse (**significant**) effect at the Borough level, an increase in significance from the Proposed Development alone.

- 6.141 It should be noted that the above assessment represents a worst-case scenario as it is considered likely that some residents accommodated within the Proposed Development will already be registered with a GP in the local area or beyond and will therefore not be relocated. They also may use private health care, which is not considered within this assessment. Furthermore, the cumulative schemes include plans for two health centres and flexible community spaces which could provide health services. Although the precise nature and capacity of these facilities is not known at this time, their construction will help to lessen adverse effects associated with this receptor.

Primary Schools

- 6.142 Taking into account the recommended 5% buffer used to assess school capacity, there is an existing surplus of 558 primary school places within RBC (3.8%).
- 6.143 The introduction of at least (and likely more than) 293 primary school pupils, and the absence of any committed new schools in the cumulative schemes, is expected to have a medium magnitude of impact on the capacity of primary schools (low sensitivity receptor⁴³). Through professional judgement, this results in a direct, long term, Minor Adverse (not significant) effect at the Borough level, a better effect than for the Proposed Development alone, due to the reduced sensitivity of the receptor at the Borough level.

- 6.144 It should be noted that the above assessment represents a worst-case scenario which does not account for anticipated S106 agreements and the understanding that many children living in the cumulative schemes will already occupy school places within the study area or beyond.

Secondary Schools

- 6.145 Taking into account the recommended 5% buffer used to assess school capacity, there is an existing surplus of 276 secondary school places within RBC (2.8%).
- 6.146 The introduction of at least (and likely more than) 92 secondary school pupils, and the absence of any committed new schools in the cumulative schemes, is expected to have a medium magnitude of impact on the capacity of secondary schools (medium sensitivity receptor). Through professional judgement, this results in a direct, long term, Moderate Adverse (significant) effect at the Borough level, an increase in significance from the Proposed Development alone.
- 6.147 It should be noted that the above assessment represents a worst-case scenario which does not account for anticipated S106 agreements and the understanding that many children living in the cumulative schemes will already occupy school places within the study area or beyond.

Open Space

- 6.148 The cumulative schemes will create an additional demand for open space. However, based on other schemes' available socio-economic ES chapters and local and regional planning policy, it is expected that each cumulative scheme would either provide the required provision of open space within individual design plans, or provide a financial contribution in the form of S106 agreements or CILs in lieu of this. As such, the cumulative

⁴³ It should be noted that for the cumulative assessment the study area has been expanded to cover all primary schools within Reading given the locations of the cumulative schemes and to ensure suitable coverage. Within Reading there is surplus capacity within primary schools, unlike the study area used for the Proposed Development, hence the differences in sensitivity and the assessed effect.

schemes are expected to have a low magnitude of impact on open space (medium sensitivity receptor) in Reading. This results in a direct, long term Minor Beneficial (not significant) effect at Borough level, the same as for the Proposed Development alone.

Play Space

- 6.149** As with open space, the cumulative schemes will create an additional demand for play space. However, based on other schemes' available socio-economic ES chapters and local and regional planning policy, it is expected that each cumulative scheme would either provide the required provision of play space within individual design plans, or provide a financial contribution in the form of S106 agreements or CILs in lieu of this. As such, the cumulative schemes are expected to have a low magnitude of impact on play space (medium sensitivity receptor) in Reading. This results in a direct, long term Minor Beneficial (not significant) effect at Borough level, the same as for the Proposed Development alone.

Local Economy

- 6.150** For many of the cumulative schemes considered, employment figures are not included in available application documents. Therefore, an estimate of employment has been made to assess the potential FTE jobs created from these developments. Where employment types and floorspace are provided, a worst-case assumption of FTE per m² has been made for a worst-case assessment. This is based on the HCA Employment Density Guide, in line with the assessment of the Proposed Development. Where employment figures are available for an application these have been used within this cumulative assessment, with a worst-case assumed if a range of possible employment was outlined.

Employment

- 6.151** Under a worst-case scenario, and based on the assumptions made above, approximately 8,826 net FTE jobs will be created through the cumulative schemes. As there are approximately 117,200 FTE jobs currently located within Reading, this equates to an increase of about 7.5%, which is expected to have a medium magnitude of impact on the local economy (low sensitivity receptor). This results in a direct and indirect, long term Minor Beneficial (not significant) effect at the Borough level, an increase in significance from the Proposed Development alone.

Employee Expenditure

- 6.152** The net addition of approximately 8,826 FTE jobs across the cumulative schemes will generate approximately £22.5 million annually, in line with the assessment of the Proposed Development. The spending impact of new employees as introduced by the cumulative schemes is expected to have a low magnitude of impact on the local economy (low sensitivity receptor). This results in an indirect, long term Negligible (not significant) effect at the Borough level, the same effect as for the Proposed Development alone.

Household Expenditure

- 6.153** The addition of approximately 3,630 new residential dwellings across the cumulative schemes will generate approximately £48.8 million per annum in additional spending, based on the ONS Average Weekly Household Spending of £344.80 within the South East and accounting for 25% displacement and no leakage, in line with the assessment of the Proposed Development. The spending impact of new residents as introduced by the cumulative schemes is expected to have a medium magnitude of impact on the local economy (low sensitivity receptor). This results in an indirect, long term Minor Beneficial (not significant) effect at the Borough level, the same effect as for the Proposed Development alone.

Minster Quarter Development Framework

- 6.154** RBC have adopted a detailed framework for the Hosier Street area (the 'Minster Quarter Area Development Framework' (MQADF) (2018)) to guide and co-ordinate future developments coming forward. Given the status of the MQADF and its strategic framework for development coming forward, it is considered qualitatively as an alternative scenario, in addition to the list of other cumulative schemes, on the assumption that the strategic development envisaged as part of the MQADF would be built and completed.
- 6.155** Any additional population generated as part of the MQADF will likely increase demand for social infrastructure including healthcare and education services. It is assumed any mitigation required to meet the needs of this additional demand will be subject to negotiations to provide adequate on or off-site provisions or financial contributions such as S106 payments or CILs.
- 6.156** Overall, the impact of the MQADF will likely bring about a range of beneficial socio-economic effects such as additional employment opportunities, both temporary and long term, as well as additional local expenditure and improvements to local open space.

LIKELY SIGNIFICANT EFFECTS

- 6.157** The provision of 644 residential units accommodating 1,674 residents within the Proposed Development is expected to have a medium magnitude of impact on the provision of housing (medium sensitivity receptor) in Reading. This results in a direct, long term, Moderate Beneficial (**significant**) effect at the Borough level, in relation to RBC housing targets.
- 6.158** The introduction of 1,674 residents from the Proposed Development is expected to have a medium magnitude of impact on the capacity of GP surgeries (medium sensitivity receptor) in the study area. This results in a direct, long term, Moderate Adverse (**significant**) effect at the local level.
- 6.159** The introduction of 78 primary school students through the residential elements of the Proposed Development is expected to have a low magnitude of impact on the capacity of primary schools (high sensitivity receptor) in the study area. This results in a direct, long term, Moderate Adverse (**significant**) effect at the local level.
- 6.160** The provision of approximately 3,630 residential units accommodating approximately 10,000 residents across the cumulative schemes is expected to have a high magnitude of impact on the provision of housing (medium sensitivity receptor) in Reading. This results in a direct, long term, Major Beneficial (**significant**) effect at the Borough level, in relation to RBC housing targets, an increase in significance from the Proposed Development alone.
- 6.161** The introduction of approximately 10,000 residents across the cumulative schemes is expected to have high magnitude of impact on the capacity of existing GP surgeries (medium sensitivity receptor) in Reading. This results in a direct, long term, Major Adverse (**significant**) effect at the local level, an increase in significance from the Proposed Development alone.
- 6.162** The introduction of at least 92 secondary school students through the cumulative schemes is expected to have a medium magnitude of impact on the capacity of secondary schools (medium sensitivity receptor) at the Borough level. This results in a direct, long term, Moderate Adverse (**significant**) effect at Borough level, an increase in significance from the Proposed Development alone.
- 6.163** All other effects identified are not considered to be significant.

Chapter 7: Air Quality

AIR QUALITY	
AUTHOR	Air Pollution Services (APS)
SUPPORTING APPENDIX	ES Volume 3, Appendix: Air Quality Annex 1: Professional Experience Annex 2: Air Quality Policy/Legislation Context Annex 3: Baseline Air Quality Review Annex 4: Construction Dust Risk Assessment Annex 5: Dispersion Modelling Approach Annex 6: Air Quality Site Suitability
KEY CONSIDERATIONS	The Proposed Development lies within Reading Borough, which currently has an Air Quality Management Area (AQMA) occupying the centre of Reading and the main arterial roads. The Proposed Development sits approximately within this area. The main concerns relating to air quality are the impacts that the Proposed Development might have on sensitive receptors in the local area and the air quality conditions for future occupants and users of the Proposed Development. During the construction phase, emissions of dust can occur. Emissions will vary substantially from day to day throughout this phase, depending on the level of activity and the specific operations being undertaken, along with the influence of the weather conditions. The scale of these impacts depends on the dust suppression and other mitigation measures applied. This assessment considers these emissions, impacts and any necessary mitigation. During the construction phase, emissions may also arise from Non-Road Mobile Machinery (NRMM) and construction related traffic on local roads. This assessment considers these emissions, impacts and any necessary mitigation. When operational, the Proposed Development will include a life safety system, emissions from which may lead to changes in local air quality. During operation, the Proposed Development may lead to changes in local air quality due to emissions from road traffic generated by the Proposed Development. However, the Proposed Development estimates a net reduction in vehicle trips. As a result of the Proposed Development, there will be a net reduction of 290 parking spaces in the existing MSCP (which currently provides 784 parking spaces). The total car parking spaces within the MSCP will comprise 494 spaces. Of these 494 spaces, 100 will have the potential to be allocated to future residents of the Proposed Development. The Proposed Development will be subject to the impacts of road traffic emissions from the adjacent road network and the existing/proposed car parking at Broad Street Mall. Consideration has therefore been given to whether air quality will be acceptable for future users of the Proposed Development. This assessment describes the existing and future air quality at the Proposed Development and in the local area. Consideration has been given to nitrogen dioxide (NO₂) and particulate matter (both PM₁₀ and PM_{2.5}) as these are the pollutants of most concern. Consideration has also been given to potential cumulative impacts on air quality of the Proposed Development in combination with the cumulative schemes identified in the local area. Where appropriate, mitigation measures which have been incorporated into the design of the Proposed Development and are required to minimise air quality impacts are discussed.

ASSESSMENT METHODOLOGY

Defining the Baseline

- 7.1
- Consideration of the existing baseline conditions within the site and local area have been made based on the following:
- Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authorities (Reading Borough Council (RBC) in this instance) and where available other monitoring networks. This covers both the local and wider area, the latter being used to provide context to the assessment. Air quality data for 2020 and 2021 have not been relied upon within this assessment due to implications associated with the COVID-19 pandemic making it unrepresentative of typical conditions, and 2019 has been used as the base year of modelling due to availability of monitoring data. Data for 2022 is not yet available;

- Background concentrations of nitrogen dioxide (NO₂), particulate matter (PM₁₀ and PM_{2.5}) have been defined using the national pollution maps published by Defra¹. These cover the whole of the country on a 1 km x 1 km grid of average concentrations for the years of 2018 to 2030;
- Predicted roadside concentrations of NO₂ in the local area have been identified using the maps of roadside concentrations published by Defra² as part of its 2017 Air Quality Plan for the baseline year 2017 and for the years 2019 to 2030. These maps are used by the UK Government, to report exceedances of the Limit Value. The national maps of roadside PM₁₀ and PM_{2.5} concentrations³, which are available for the years 2017, 2020, 2025 and 2030, show no exceedances of the Limit Values anywhere in the UK in any of these years;
- Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register⁴. Local sources have also been identified through examination of maps and the Council's Air Quality Review and Assessment reports; and
- Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted for the baseline year of 2019, (the most recent monitoring data year not affected by COVID-19), based on modelling the local road traffic network using the methodology described in **ES Volume 3: Appendix Air Quality – Annex 5**.

Evolution of the Baseline

- 7.2
- If the Proposed Development does not come forward, it is expected that the site would remain in its current state. Air quality is expected to improve into the future, as:
- Improvements in technology result in reduced pollutant exhaust emissions,
 - The UK moves away from fossil fuel power to renewable technologies, and
 - Research into the health effects of air pollution leads to more stringent air quality legislation.
- 7.3
- Measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation (which has been transposed into UK law). Furthermore, the Government and the local authority are working on improving air quality under the relevant air quality strategies and the Local Air Quality Management (LAQM) regime.
- 7.4
- The UK Government has committed to stopping sales of fossil fuel powered vehicles by 2030 (albeit the current government has proposed this be delayed until 2035), and it is likely that electric and hydrogen powered vehicles will be progressively taken up by the UK transport market over the next two decades. While electric vehicles do not produce any exhaust emissions of air pollution, they still create PM₁₀ and PM_{2.5} emissions from brake wear, tyre wear, road abrasion, and the resuspension of dust. Hydrogen vehicles will similarly still lead to PM₁₀ and PM_{2.5} emissions from break wear, tyre wear, road surface abrasion and resuspension of particles. Overall, there is likely to be a reduction in baseline concentrations of NO₂, PM₁₀ and PM_{2.5}. These trends are included within the predictions for the future years of 2026 and 2029 (for which the impacts of the Proposed Development have been assessed), although it should be noted that the assessment was undertaken prior to Defra updating their vehicle emission factors to take account of the Government's delay until 2035 and changes due to COVID-19; there is therefore some uncertainty in the assessment.
- 7.5
- The likely evolution of the baseline conditions if the Proposed Development did not come forward has been considered in this assessment and is hereafter referred to as 'Without Development'.
- 7.6
- On a local scale, a qualitative assessment of any non-road traffic sources of pollution that may arise from cumulative schemes in the vicinity of the Proposed Development have been carried out, assuming that all will be potential sources by the time the Proposed Development is operational. Road traffic emissions are considered with the traffic flows modelled for the Without Development scenario.
- 7.7
- Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted for the future years of 2026 (peak construction year) and 2029 (future completion year) based on modelling the local road traffic network using the methodology described in **ES Volume 3: Appendix Air Quality –Annex 5** accounting quantitatively for the

¹ Defra. (2020). Background Mapping data for local authorities. Retrieved from UK AIR Air Information Resource: <https://uk-air.defra.gov.uk/data/laqm-background-home>
² Defra. (2019b). 2019 NO₂ projections data (2017 reference year). Retrieved from UK AIR Air Information Resource: <https://uk-air.defra.gov.uk/library/no2ten/2019-no2-projections-from-2017-data>

³ Defra. (2020c). UK Ambient Air Quality Interactive Map. Retrieved from UK AIR Air Information Resource: <https://uk-air.defra.gov.uk/data/gis-mapping>
⁴ Defra's Pollutant Release and Transfer Register (PRTR) data sets [accessed on 30.11.2023]

additional road traffic due to the Proposed Development but allowing for natural evolution and the inclusion of all cumulative schemes.

Impact Assessment Methodology

Assessment Criteria

7.8 The Environment Act 1995⁵ sets out the requirements of the LAQM regime and the requirement for the Government to produce an Air Quality Strategy, setting out the Air Quality Standards (AQSs), which consider the effects on human health and ecosystems, and the national Air Quality Objectives (AQOs), which are policy targets for ambient pollution. The AQOs, for use by local authorities when considering human health impacts, were incorporated into UK legislation within the Air Quality (England) Regulations, 2000, Statutory Instrument 928⁶ and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043⁷.

7.9 In addition to the AQOs, the European Union (EU) has set limit and target values for the protection of human health and critical levels for the protection of ecosystems. These were transposed into UK legislation by the 2010 Regulations and the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020. Like the AQOs, the limit values, target values and critical levels are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year (if any) and a date by which it must be achieved. Some pollutants have more than one value covering different dates or averaging times. The 2019 Clean Air Strategy⁸ includes a commitment to set a “new, ambitious, long-term target to reduce people’s exposure to PM_{2.5}” which the Environment Act 2021⁹ commits the Secretary of State to setting. The UK Government will decide on the PM_{2.5} guideline as result from the Environment Act⁹ in the future. The WHO acknowledges that current evidence suggests there is no safe level for PM_{2.5}. The WHO set a previous guideline, which was 10 µg/m³ as an annual mean and more stringent than the current AQOs, to reflect the level at which increased mortality from exposure to PM_{2.5} is likely. However, the WHO guidelines were updated in September 2021 and now include more stringent levels to reflect updated evidence of health effects (5 µg/m³ for PM_{2.5}), since the previous guidelines were published in 2005. Following the UK leaving the EU the Government have published the Environment Act 2021, which put a duty on the Secretary of State to lay before Parliament an annual mean target for PM_{2.5} in ambient air. The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 (SI 2023/96) set an annual mean target of 10 µg/m³ by 2040 together with a 35% exposure reduction target by 2040 compared to 2018. The Secretary of State must prepare an Environmental Improvement Programme (EIP) and produce an annual report on the implementation of the EIP, including progress towards meeting the targets. Every five years the EIP must be reviewed. The current EIP was published in 2023. This includes two interim targets to be achieved by the end of January 2028. These are an annual mean of 12 µg/m³ and an exposure reduction target of 22% compared to 2018.

7.10 In addition, the recent coroners court case investigating a young girls’ death in 2013 concluded that air pollution was a significant contributing factor to both the induction of her asthma and the exacerbation of her symptoms, due to exposure in exceedance of WHO guidelines for pollutants. This set a precedent to consider WHO guidelines when determining the significance of air quality on health and has thus been considered when undertaking this assessment.

Air Quality Assessment Levels

7.11 The Air Quality Assessment Levels (AQALs) for human health and ecology are made up of the AQOs, Limit Values, Critical Levels (CLE) and Critical Loads (CLO). The AQALs for pollutants relevant to this project are detailed in Table 7.1.

Table 7.1 AQALs

Pollutant	Time Period	Type	Concentration, and the number of exceedances allowed per year (if any)	Date AQO / Limit Value to be Achieved from and Maintained After
Nitrogen Dioxide (NO ₂)	1-hour Mean	AQO / Limit Value	200 µg/m ³ not to be exceeded more than 18 times a year	31 st December 2005 / 1 st January 2010
	Annual Mean	AQO / Limit Value	40 µg/m ³	31 st December 2005 / 1 st January 2010
Fine Particles (PM ₁₀)	24-hour Mean	AQO / Limit Value	50 µg/m ³ not to be exceeded more than 35 times a year	31 st December 2004
	Annual Mean	AQO / Limit Value	40 µg/m ³	31 st December 2004
Fine Particles (PM _{2.5}) ^a	Annual Mean	AQO / Target Value	20 / 20 µg/m ³	2020 / 2020
Nitrogen Oxides (NO _x) expressed as NO ₂	24-hour Mean	Proxy CLe ^b	75 / 200 µg/m ³ ^c (not to be exceeded)	-
	Annual Mean	AQO / LV / CLe ^b	30 µg/m ³ (not to be exceeded)	31 st December 2000 / 19 th July 2001
Notes: ^a The PM _{2.5} AQO is not in Regulations and there is no legal requirement for local authorities to meet it. ^b CLEs are provided from the Air Quality Standards Regulations and EA EALs from the Environmental Agency Air emissions risk assessment for your environmental permit guidance. ^c CLEs are: “concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge”. ^d The IAQM guidance ¹⁷ explains that a CLe for short-term NO _x has been defined by the World Health Organization and is dependent on the O ₃ and SO ₂ concentrations. The WHO, explain that: “Experimental evidence exists that the CLE [critical level] decreases from around 200 µg/m ³ to 75 µg/m ³ when in combination with O ₃ or SO ₂ at or above their critical levels. In the knowledge that short-term episodes of elevated NO _x concentrations are generally combined with elevated concentrations of O ₃ or SO ₂ , 75 µg/m ³ is proposed for the 24 h mean”. Based on this, where O ₃ and SO ₂ are not elevated above their critical levels, a value of 200 µg/m ³ is recommended for assessments. No CLOs are presented as the only relevant ecological site is a SINC which is locally designated and not sensitive enough to be afforded the protection of CLOs.				

7.12 Measurements across the UK have shown that the 1-hour NO₂ AQO is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m³, based on Defra’s LAQM TG22 guidance¹⁰. Measurements have also shown that the 24-hour PM₁₀ AQO could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m³. These values have been used as an indication of the likelihood of the 1-hour mean NO₂ and the 24-hour mean PM₁₀ AQOs to be exceeded in the study area.

WHO Guidelines

7.13 The WHO has recently revised its air quality guidelines (AQGs)¹¹ for six pollutants including small particles (PM_{2.5}) and nitrogen dioxide (NO₂). The air quality guidelines for these pollutants have become more stringent. Table 7.2 presents the WHO Guidelines and Interim Targets for the pollutants of concerns. For particulate matter, the Guidelines are lower, although it is noted that there is no safe level of PM_{2.5}.

7.14 In recognition of the difficulty of meeting the AQGs, a series of Interim Targets have been proposed by the WHO and these should be considered steps towards ultimately achieving the AQGs, rather than as end targets. The WHO document aims to provide quantitative health-based recommendations for air quality management.

7.15 The guidelines are not legally binding standards; however, these should be used to inform legislation and policy. Ultimately, the goal of the guidelines is to help reduce the health burden resulting from exposure to air pollution. Air pollution increases morbidity and mortality from cardiovascular and respiratory disease and from lung cancer and there is increasing evidence of effects on all other organ systems.

⁵ HMSO. (1995). Environment Act. HMSO.

⁶ HMSO. (2000). The Air Quality Regulations, 2000, Statutory Instrument 928. HMSO.

⁷ HMSO. (2002). The Air Quality (England) (Amendment) Regulations, 2002, Statutory Instrument 3043. HMSO.

⁸ Defra (2019). Clean Air Strategy.

⁹ HMSO. (2021). Environment Act. HMSO.

¹⁰ Defra. (2022). Local Air Quality Management Technical Guidance (TG22).

¹¹ World Health Organisation. (2021). World Health Organization, 2021, WHO Global Air Quality guidelines: particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Retrieved from <https://apps.who.int/iris/handle/10665/345329>

- 7.16** The WHO AQGs are based solely on the latest epidemiological evidence, whereas the AQOs and limit values were based on health evidence from the 1990s. These also take account of other factors such as the technical and economic feasibility of meeting the standard by a defined date.
- 7.17** It is more than 15 years since WHO published its last AQGs (2006)¹² and over that period there has been a large increase in the evidence of health effects of air pollution. New epidemiological studies have shown adverse effects at much lower levels than had previously been studied.
- 7.18** The WHO guidelines are not currently in the form of regulations and there is no legal requirement for local authorities to meet them.
- 7.19** WHO guidelines for NO₂ are the same as those presented in Table 7.1, however, for the short-term there are no permissible exceedances. For PM, the guidelines are lower, although it is noted that there is no safe level of PM. The WHO guidelines are set out in Table 7.2.

Table 7.2 WHO Guidelines

Pollutant	Time Period	Criteria Type	Interim Target (µg/m ³)				AQG Level (µg/m ³)
			1	2	3	4	
Nitrogen Dioxide (NO ₂)	1-hour	WHO Guideline	-	-	-	-	200
	24-hour Mean	WHO Guideline	120	50	-	-	25
	Annual Mean	WHO Guideline	40	30	20	-	10
Fine Particles (PM ₁₀)	24-hour Mean	WHO Guideline	150	100	75	50	45
	Annual Mean	WHO Guideline	70	50	30	20	15
Fine Particles (PM _{2.5})	24-hour Mean	WHO Guideline	75	50	37.5	25	15
	Annual Mean	WHO Guideline	35	25	15	10	5

Health Effects

- 7.20** Air pollution has a significant effect on public health. Long-term exposure (over years) reduces life expectancy, mainly due to cardiovascular and respiratory diseases and lung cancer. Recent evidence suggests that air pollution can also adversely affect cognitive ability, and is associated with dementia, diabetes, obesity, and low birth weight¹³.
- 7.21** Short-term exposure (over hours or days) to elevated levels of air pollution can also cause a range of health effects, including on lung function and exacerbation of asthma, resulting in respiratory and cardiovascular hospital admissions and mortality.
- 7.22** It has been estimated that exposure to man-made air pollution in the UK gives rise to 28,000 to 36,000 deaths a year¹⁴.
- 7.23** There is no evidence of a safe level of exposure to PM below which there is no risk of adverse health effects. The UK Health Security Agency (UKHSA) believe that reductions of both PM and NO₂ concentrations below the current standards is likely to bring health benefits.

Study Area

- 7.24** The study area of the assessment is determined by the Proposed Development, on-site receptors, off-site receptors (construction route receptors) and air quality monitoring stations. The size of the study area is determined by the screening criteria and local air quality monitoring sites. The study area for human health receptors is decided by the change in traffic flows on roads local to the Proposed Development. The IAQM guidance¹⁶ sets out criteria for changes in traffic flows, if this criterion is exceeded receptors should be modelled on the roads to predict the impact of increased traffic flows. The IAQM guidance¹⁷ sets out screening criteria for determining the impacts on ecological sites states that the impacts are likely to be Negligible where changes in AADT flow is less than 1,000 along roads within 200 m of an ecological site.

Screening Criteria

Demolition and Construction

- 7.25** The Institute of Air Quality Management (IAQM) guidance document¹⁵ on the assessment of dust from demolition and construction, provides distance-based screening criterion which states that a detailed assessment will be required where there is:
- a 'human receptor' within:
 - 250 m of the boundary of the site; or
 - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).
 - an 'ecological receptor' within:
 - 50 m of the boundary of the site; or
 - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).
- 7.26** With regards to traffic related impacts on human health, the second stage of the Environmental Protection UK (EPUK) and the IAQM guidance¹⁶ compares the changes in vehicle flows on local roads against specified screening criteria. Where these criteria are exceeded, a detailed assessment is required. The screening criteria set out in the EPUK/IAQM guidance relating to road traffic are:
- A change of Light Duty Vehicle (LDV) flows of:
 - more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an Air Quality Management Area (AQMA)
 - more than 500 AADT elsewhere.
 - A change of Heavy-Duty Vehicle (HDV) flows of:
 - more than 25 AADT within or adjacent to an AQMA
 - more than 100 AADT elsewhere.
 - Where roads are realigned near to sensitive receptors and the change in alignment is 5 m or more and the road is within an AQMA. Applies to junctions that cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights, or roundabouts.
 - Where bus flows will change by:
 - more than 25 AADT within or adjacent to an AQMA
 - more than 100 AADT elsewhere.
- 7.27** The trip generation and road alignment associated with the demolition and construction phase of the Proposed Development will be above the threshold and therefore impacts cannot be screened out and a detailed assessment is required.
- 7.28** The IAQM guidance for assessing air quality impacts on designated nature conservation sites¹⁷ sets out a set of screening criterion, taken from the Design Manual for Roads and Bridges (DMRB)¹⁸ and Natural England guidance¹⁹, which are commonly used for considering when impacts from traffic emissions are potentially significant. This states a quantitative assessment is required if there is a change in Annual Average Daily Traffic (AADT) flows on a given road within 200 m of a designated site of 1,000 vehicles or 200 heavy duty vehicles (HDVs). The IAQM Guidance explains that this threshold should be considered in relation to "in-combination impacts as well as the project/plan alone".
- Operational Impacts**
- 7.29** EPUK and IAQM¹⁹ recommend a staged screening approach to determine whether changes in emissions from a development (e.g. road traffic emissions or combustion plant emissions) and changes in the

¹² World Health Organization. (2006). Air Quality Guidelines Global Update 2005: particulate matter, ozone, nitrogen dioxide, and sulfur dioxide.

¹³ Royal College of Physicians. (2016). The lifelong impact of air pollution. London: Royal College of Physicians.

¹⁴ Public Health England. (2018). Associations of long-term average concentrations of nitrogen dioxide with mortality. London: Public Health England.

¹⁵ IAQM. (2023). Guidance on the assessment of dust from demolition and construction.

¹⁶ EPUK and IAQM (2017) Guidance on land-use planning and development control: Planning for air quality 2017 v1.2

¹⁷ IAQM (2020) A guide to the assessment of air quality impacts on designated nature conservation sites., Available:

<https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf>

¹⁸ DMRB (2020). DMRB Volume 11 Section 4 LA 115 Revision 1 Sustainability and environment. Appraisal. Habitats regulations assessment (formerly HD 44/09). Revision 1. [Online] Available at: <https://www.standardsforhighways.co.uk/prod/attachments/e2fdab58-d293-4af7-b737-b55e08e045ae?inline=true>

¹⁹ Natural England. (2018). Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitat Regulations.

geometry of the local roads (e.g. junction changes or road alignment changes) have the potential for significant air quality impacts on human health. The approach first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha or is non-residential and will provide less than 1,000 m² of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment.

7.30 The EPUK and IAQM guidance¹⁹ explains that there may also be a need to consider the impacts on the Proposed Development itself to determine the Site Suitability. The need to consider the site suitability should take into account:

- “the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;
- the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;
- the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and
- the presence of a source of odour and/or dust that may affect amenity for future occupants of the development”.

Human Health Impacts

7.31 With regards to road traffic emission related impacts on human health, the second stage then compares the changes in vehicle flows on local roads that a development will result in against specified screening criteria. Where these criteria are exceeded, a detailed assessment is required, although the guidance advises that “the criteria provided are precautionary and should be treated as indicative”, and “it may be appropriate to amend them on the basis of professional judgement”. The criteria are set out in paragraph 7.26.

7.32 With regards to changes in road geometry and streetscape, the second step of the approach is to determine whether there are any changes to roads alignments or junctions, in addition to these, consideration of the potential for air quality effects due to changes in streetscape massing is included, which is not explicitly mentioned in the criteria. This screening approach requires the use of professional judgement, and the experience of the consultants preparing the assessment is set out in **ES Volume 3, Appendix: Air Quality – Annex 1**.

Impacts on Nature Conservation Sites

7.33 As explained in paragraph 7.28, the IAQM guidance sets out screening criteria for assessing air quality impacts due to changes in road traffic flows on designated nature conservation sites¹⁷.

7.34 The IAQM guidance sets of a screening threshold, taken from the Defra/Environment Agency’s Air emissions risk assessment for your environmental permit (which applies to industrial emission sources) for considering the impacts due to emissions from stationary combustion plant, which defines distances of:

- 2 km for locally and nationally important sites and areas of ancient woodland; and
- 5, 10 or 15 km depending on the emission source for European Sites.

7.35 Impacts are considered ‘not significant’ at distances beyond these thresholds.

7.36 The assessment has been carried out taking account of the relevant planning policy and guidance set out in **ES Volume 3, Appendix: Air Quality – Annex 2**.

7.37 The overall assessment comprises of a number of assessments which are split into two categories:

- Assessments which have a magnitude of change and a defined likely effect, which include:
 - A demolition and construction related air quality assessment, comprising:
 - An assessment of the impacts of fugitive dust and particulate matter emissions;
 - An assessment of construction traffic impacts;
 - An assessment of NRMM impacts; and
 - An assessment of the impacts of the completed development;

- Assessments which either achieve a requirement or not and do not have a magnitude of impact, which include:
 - An assessment of compliance with Limit Values; and
 - An assessment of the Site suitability;
 - Locations of Relevant Exposure

7.38 The assessment is carried out with consideration of the locations of relevant exposure. There are three subtly different locations based on the three parallel assessment requirements, those for the AQOs, Limit Value compliance purposes, and in relation to the WHO Guidelines.

AQO Receptors

7.39 The 2007 Air Quality Strategy²⁰ explains that Air Quality Standards (AQSS) and AQOs were determined based on expert recommendations and represent “levels at which no significant health effects would be expected in the population as a whole”. The AQOs apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the AQO.

7.40 The annual mean AQO applies at locations where members of the public might be regularly exposed, such as building façades of residential properties, schools, nurseries, hospitals, and care homes.

7.41 The 24-hour mean AQO applies at the annual mean locations of exposure and at hotels, residential gardens and any location where members of the public might reasonably be expected to spend one day or longer.

7.42 The 1-hour mean AQO applies at the annual mean locations of exposure and at hotels, residential gardens and any outdoor location where members of the public might reasonably be expected to spend one hour or longer, such as busy pavements, parks, balconies, terraces, and locations with outdoor seating.

7.43 Places of work like factories or offices are not considered places where members of the public might be regularly exposed and therefore the AQO’s do not apply at these locations.

Limit Value Compliance Receptors

7.44 Defra reports Limit Value compliance based on their monitoring and modelling at locations which match specific parameters (including distance from road, proximity to junctions etc.). The compliance with the Limit Values should be achieved at any location where members of the public have access. However, in accordance with Article 2(1), Annex III, Part A, paragraph 2 of Directive 2008/50/EC, locations where compliance with the Limit Values does not need to be assessed include:

- a) Any locations situated within areas where members of the public do not have access and there is no fixed habitation;
- b) In accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- c) On the carriageway of roads; and on the central reservation of roads except where there is normally pedestrian access to the central reservation.”

7.45 The government models compliance with the Directive at locations 4m from the kerbside, 2m high, more than 25m from major road junctions and adjacent to at least 100m of road length where the Limit Value applies.

7.46 As these are Limit Values set to protect human health all relevant locations set out in paragraph 7.44 are considered of high sensitivity.

WHO Guideline Receptors

7.47 The WHO criteria apply wherever there is relevant exposure in relation to each time period for each pollutant. These are considered to be the same as those set out above for AQO receptors.

Demolition and Construction

7.48 As set out in **ES Volume 1, Chapter 5: Demolition and Construction**, a demolition and construction programme has been assumed to enable assessment within the EIA. The demolition and construction works are expected to be carried out in phases over a period of approximately 5 years (60 months), commencing in 2024, with the demolition works due to be undertaken in Q2 2025 (with 2026 been taken as the peak

²⁰ Defra (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Defra.

construction year for assessment) and completing in Q2 2029 (with 2029 being taken as the completed operational year), as described in **ES Volume 1, Chapter 5: Demolition and Construction**.

Phasing

- 7.49** The Proposed Development will be built in four phases during the construction period, though construction will be undertaken continuously. The construction dust assessment considered the length of construction period and peak construction year of 2026. Information provided in **ES Volume 1, Chapter 5: Demolition and Construction** has been used within the assessment. The peak construction year of 2026 was used within the assessment to provide the worst-case approach for existing receptors. Consideration has also been given to introduced receptors within the Proposed Development. The IAQM guidance¹⁵ was used to provide an assessment approach for the construction dust assessment. The approach of the construction dust assessment is set out in paragraph 7.50.

Fugitive Dust and Particulate Matter Emissions

- 7.50** The assessment method follows the approach provided by the IAQM guidance document¹⁵. This approach follows a sequence of steps:

- Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Details of the screening criteria are set out in paragraph 7.25.
- Step 2 is to assess the risk of dust impacts.
 - Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site.
 - Step 2b defines the sensitivity of the area to any dust that may be raised.
 - Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation.
- Step 3 uses this information to determine the appropriate level of site-specific mitigation required to ensure that there should be no significant impacts.
- Step 4 is to examine the residual effects and to determine whether or not these are significant.

- 7.51** The approach developed by IAQM¹⁵, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

- 7.52** Further details on the above approach are provided in **ES Volume 3, Appendix: Air Quality – Annex 4**.

Construction Traffic

- 7.53** The first step in considering the construction related road traffic impacts on human health due to the Proposed Development has been to screen the traffic generated against the EPUK and IAQM criteria set out in paragraph 7.29, and as described in paragraph 7.26. Impacts on local sensitive nature conservation sites are screened against the criteria set out in paragraph 7.28. Where impacts can be screened out there is no need to progress to a more detailed assessment. In the event that impacts cannot be screened out, then the potential impacts are assessed using the methodology in paragraphs 7.60 and 7.61.

Non-Road Mobile Machinery

- 7.54** Emissions from NRMM utilised during the demolition and construction stages have been assessed qualitatively based on the IAQM guidance¹⁵. The IAQM guidance suggest exhaust emissions from on-site plant (NRMM) would be unlikely to lead to a significant impact on air quality. Consideration is recommended to be given to the number of NRMM vehicles, operating hours and locations to assess the significance of the impact.

Assumptions and Limitations

- 7.55** The construction dust risk assessment has assumed that measures described in ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring Schedule and set out within ES Volume 3, Appendix: Air Quality – Annex 4 will be in place and secured via an appropriately worded planning condition.

- 7.56** A limitation of the construction dust risk assessment is the application of professional judgement to ensure all provided information is accurate for the Proposed Development and the construction dust risk assessment is a representative of the site.

Completed Development

- 7.57** The potential for the impacts of additional emissions and the changes in the dispersion of the emissions due to the Proposed Development once complete and operational have also been considered as follows:

- Once operational, the Proposed Development will lead to a change in traffic flows on local roads, the emissions of which may affect air quality at existing sensitive receptors in the local area. The main air pollutants of concern related to traffic emissions are NO₂ and fine particulate matter (PM₁₀ and PM_{2.5});
- Changes in the streetscape due to building massing can result in a change to the dispersion of pollutant emissions altering concentrations at existing sensitive locations in the local area; and
- The Proposed Development's heating and hot water will be serviced by ASHP. There will be no centralised on-site combustion plant included in the Proposed Development. There will be a life safety system included in the design, which would release NO₂, PM₁₀ and PM_{2.5} emissions and may affect air quality at existing sensitive receptors in the local area as well as those introduced within the Proposed Development;

- 7.58** The first step in considering the impacts of the Proposed Development has been to screen the Proposed Development against the EPUK and IAQM criteria¹⁶ set out in paragraph 7.29. Impacts on local sensitive nature conservation sites are screened against the criteria set out in paragraphs 7.28 and 7.34. Where impacts can be screened out there is no need to progress to a more detailed assessment. In the event that impacts cannot be screened out, these are assessed using the methodology in paragraphs 7.60 and 7.61. The approach includes elements of professional judgement and the experience of the consultants preparing the chapter is set out in **ES Volume 3, Appendix: Air Quality – Annex 1**.

- 7.59** The following section details the methodology of the detailed assessment. The process consists of:

- defining baseline conditions;
- considering the impact of the emissions due to the Proposed Development; and
- evaluating the significance of any impacts in relation to the AQO receptors, using EPUK & IAQM guidance¹⁶.

Assessment Scenarios

- 7.60** NO₂, PM₁₀ and PM_{2.5} concentrations have been predicted for:

- a base year of 2019 (the most recent year of relevant monitoring data available) for verification of the model;
- the year of peak construction traffic generation (2026). For 2026 predictions have been made assuming both that the Proposed Development:
 - does proceed ('With Development'); and
 - does not proceed ('Without Development').
- the year of completion of the Proposed Development (2029) when the maximum number of vehicles will be generated by the Proposed Development. For 2029 predictions have been made assuming that the Proposed Development:
 - does proceed ('With Development').

Road Traffic Modelling

Modelling Approach Overview

- 7.61
- Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted for the scenarios set on in paragraph 7.60.
- 7.62
- Concentrations have been predicted using the ADMS-Roads atmospheric dispersion model (v5)²¹ with vehicle emission factors available from Defra’s Emissions Factors Toolkit (EFT) (v11.1)²², the latest version available when the assessment was undertaken. ADMS-Roads was developed and validated by Cambridge Environmental Research Consultants (CERC). The model is used extensively throughout the UK for dispersion modelling and is accepted as an appropriate tool by local authorities, including RBC. The model requires a range of input parameters which are discussed below.

Modelled Receptors

- 7.63
- Modelled receptor locations are set out in paragraphs 7.138 to 7.145. In addition, concentrations have also been predicted at five diffusion tube monitoring sites in the borough, in order to improve and verify the performance of the modelling (see **ES Volume 3, Appendix: Air Quality – Annex 5**).

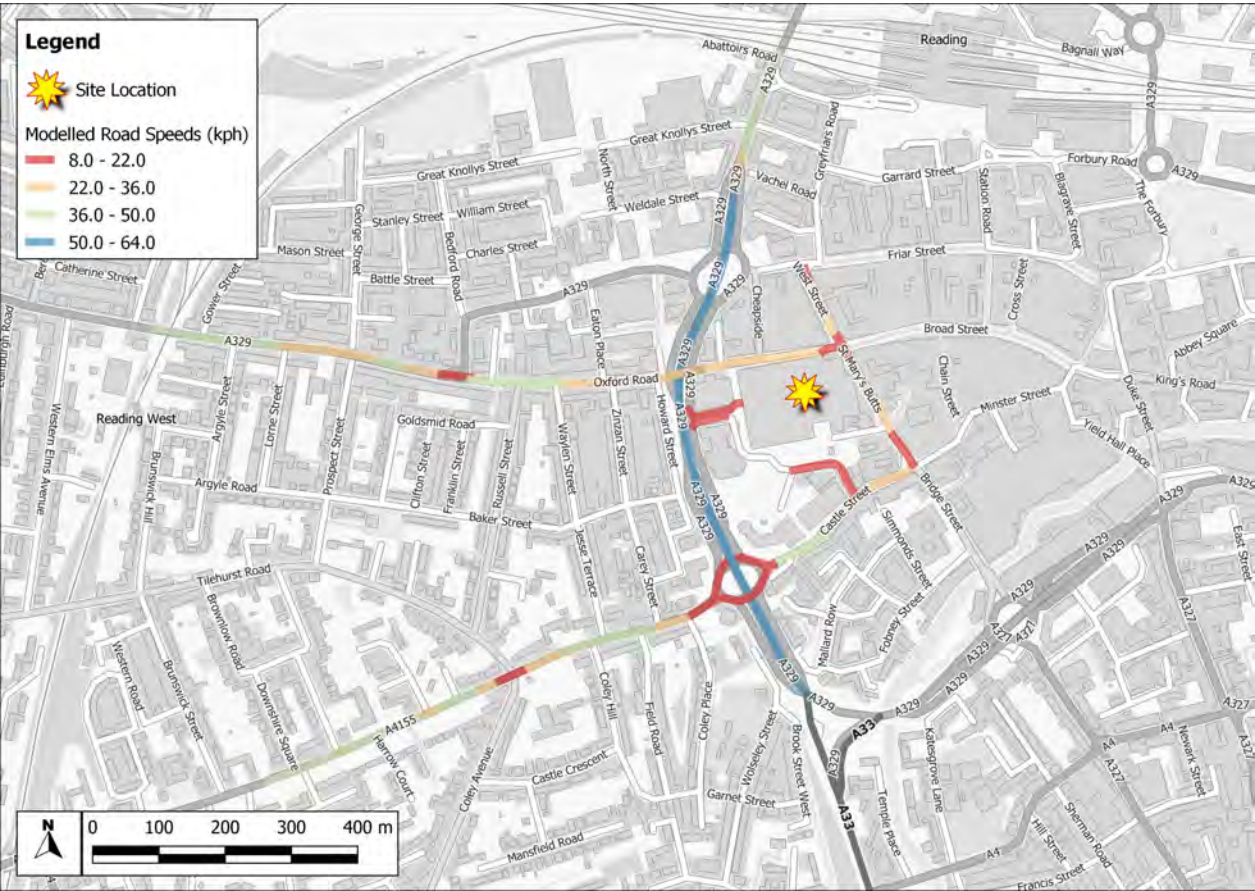
Modelled Roads

- 7.64
- The road geometry, widths and any relevant streetscape parameters included in the dispersion model have been aligned with and calculated from relevant mapping data including Ordnance Survey maps, Google satellite images and terrain data; and particular attention has been paid to ensure the relative distance between the receptors and the roadsides are modelled.
- 7.65
- The extents of modelled road links and the corresponding assumed speeds are shown in Figure 7.1 All main roads within 200m of sensitive receptors or air quality monitoring stations have been included. The modelled roads were all considered for street canyon characteristics. Details regarding the links which are modelled using the advanced street canyon module to account for restrictions in dispersion due to significant massing either side of the links are provided in **ES Volume 3, Appendix: Air Quality – Annex 5**.

Assumptions and Limitations

- 7.66
- RBC air quality monitoring sites have been used within the model to verify the model against recent air quality monitoring data. The RBC monitoring sites were used as it’s standard practice to use local air quality monitoring sites and data to the Proposed Development. The approach of using local monitoring sites is robust as it allows the model to be verified against real measured data. Five passive air quality monitoring sites have been used within the model verification.

Figure 7.1 Modelled Roads Links and Speeds (km per hour)



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Traffic Data

- 7.67
- Traffic data has been provided by Stantec who have undertaken the Transport Assessment for the Proposed Development, and is provided in **ES Volume 3, Appendix: EIA Methodology – Annex 3**. Stantec provided traffic information for local roads for 2019, 2026 and 2029, the data included baseline, construction and development traffic. Further details of traffic information are provided in **ES Volume 3, Appendix: Air Quality – Annex 5**.

Additional Model Setup Parameters and Post-processing

- 7.68
- Further details on additional model setup parameters and post-processing approaches are set out in **ES Volume 3, Appendix: Air Quality – Annex 5**. These include the vehicles emission factors, meteorology, model verification and other key modelling considerations.

Assumptions and Limitations

- 7.69
- The assessment involves a range of uncertainties, including:
- Model inputs derived from:
 - Traffic flows;
 - Traffic fleet composition;
 - Traffic routes;
 - Vehicle speeds;
 - Vehicle emissions; and
 - Meteorological conditions.
 - The model and its treatment of presenting real world conditions;
 - Post processing, including:

²¹ Cambridge Environmental Research Consultants Ltd ADMS-Road 5 Model version 5.0.0.1

²² Defra’s Emission Factor Toolkit (EFT) (v11.1) <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

- Ambient background concentrations; and
- NO_x to NO₂ relationship and f-NO₂.

7.70 A model verification exercise has been undertaken to adjust the predicted concentrations from the model so that they match local conditions as best as possible. This has adjusted concentrations to match average conditions; some locations will remain underpredicted and some overpredicted.

7.71 Although there is uncertainty inherently associated with air quality modelling, the predictions made by this assessment have been carried out in a robust manner to minimise uncertainties where possible. This included undertaking an iterative approach to improve and verify the model against measurements made by RBC. The ADMS-Roads atmospheric dispersion model is used extensively within the UK for planning applications, therefore the model was used to model all required scenarios.

Combustion Plant

7.72 The assessment has been made assuming ASHPs will be installed in the Proposed Development, which do not release any pollutant emissions.

7.73 There will be a life safety system included in the design. An assessment of the effects has not been undertaken at this stage. An assessment demonstrating effects are Negligible (not significant) can be secured by planning condition.

Impacts of Pollutant Concentrations upon Limit Values in the Local Area

7.74 An assessment in relation to Limit Value compliance is based on the modelling carried out for the AQOs assessment and considered the range of sources of information available. As explained in paragraph 7.37, the assessment does not define a magnitude of impact. However, the effect of a development resulting in a delay in compliance would be significant, as the Limit Values are intended to protect human health.

7.75 In consideration of the impact upon the Limit Values, significance is defined based on whether in the assessment year the Proposed Development results in an exceedance of the Limit Value which does not occur in the baseline, i.e. if the Proposed Development delays compliance with the Limit Value the effects are likely to be considered to be significant. Where the Proposed Development does not delay compliance with the Limit Values, the Proposed Development is deemed to have an 'not significant' impact on compliance with the Limit Values.

Site Suitability

7.76 To determine the suitability of the site, an assessment to determine whether there is a potential for exceedances of the relevant AQOs at sensitive locations within the Proposed Development has been undertaken, taking into account future baseline air quality conditions within and in close proximity to the site, and the proximity of sensitive locations within the Proposed Development to nearby sources of emissions and impacts on the dispersion of pollutants due to changes in streetscape.

7.77 Future occupants of the Proposed Development itself will be subject to the impacts of emissions associated with road traffic on local roads and car parking, including taking account of alterations to the local streetscape, as well as ambient background levels of pollution.

7.78 The main air pollutants of concern related to the traffic emissions are NO₂, PM₁₀ and PM_{2.5}. The impacts of local road traffic emissions accounting for the changes in streetscape massing due to the Proposed Development, have been assessed quantitatively using the methods set out in paragraphs 7.61 to 7.71.

7.79 The impact of combustion plant emissions from nearby extant and cumulative schemes, have been assessed qualitatively using information obtained from air quality assessments and energy statements carried out to support planning applications for these developments. An evaluation of the size and scale of nearby energy plant, and the potential for future exposure to poor air quality as a result of emissions, has been carried out with reference to EPUK/IAQM guidance¹⁶.

7.80 The assessment does not define a magnitude of impact for the future receptors within the Proposed Development, however, exposing new receptors to poor air quality could be considered significant.

7.81 Where the air quality at the Proposed Development is considered to be poor (above the AQOs) the impact of the Proposed Development is considered to be 'significant' or 'not suitable' mitigation measures may be applied to improve this. Assuming these mitigation measures are effective, the effects may be considered 'insignificant' or 'suitable' for the Proposed Development. Consideration will be given to the potential for further mitigation measures to help minimise health effects (with regard to WHO guidelines).

General Assumptions and Limitations

COVID-19

7.82 This chapter does not consider the impacts of air quality on the health implications associated with the COVID-19 pandemic, as there remains too much uncertainty at this stage to consider this explicitly. In addition, the potential long-term implications of the pandemic on transport practices have not been considered, as it is too uncertain at this stage. The traffic flows used in the assessment have, however, been benchmarked against pre-COVID-19 traffic data by Stantec, the transport consultants for the project.

Methodology for Defining Effects

Receptors and Receptor Sensitivity

Demolition and Construction

7.83 The IAQM guidance¹⁵ on construction dust, provides examples to define receptor sensitivity to dust soiling and health effects of PM₁₀. These are provided in Box 6 to 8 of the guidance and consideration is given to the additional factors presented in Box 9 of the guidance. Residential and educational properties are considered as high sensitivity receptors to both dust soiling and health effects of PM₁₀, while places of work are defined as medium sensitivity receptors. Other properties, such as hotels, theatres and some commercial properties (such as retail shops with windows) may also be considered high sensitivity receptors to dust soiling and would be medium sensitivity for health effects. While other properties that would be less affected by dust, such as religious institutions, would be considered medium sensitivity receptors for both dust soiling and health effects. Parks and open spaces (non-designated sites) are typically considered low sensitivity receptors.

7.84 The sensitivity of receptors to construction related vehicle emissions is considered the same as that for operational traffic (see **Paragraph 7.87**). With regards to the sensitive to ecological effects, locations with a local designation are considered to be of low sensitivity and locations with a national or international designation are considered of high sensitivity. The sensitivity of ecological sites is based on the IAQM guidance¹⁷.

7.85 The guidance explains that the sensitivity of the area should take account of a number of factors including:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM₁₀, the local baseline concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

7.86 When considering the sensitivity of receptors to emissions from NRMM and construction traffic, all human health receptors where the AQOs apply are of high sensitivity. Locations where the AQOs do not apply must be considered not to be sensitive; there are thus no medium or low sensitivity receptors within the context of this assessment. The sensitivity of ecological receptors depends on the specific species and habitat along with the baseline conditions for that habitat. The IAQM guidance¹⁷ explains that for local wildlife sites and ancient woodlands, the Environment Agency uses less stringent criteria in its permitting decisions, as such is it considered that the sensitivity of locally designated nature conservation sites is less than nationally and internationally designated sites. As a simplistic initial assessment stage, locally designated nature conservation sites are considered low sensitivity receptors, national designated nature conservation sites are considered medium sensitivity receptors, while national network sites are considered high sensitivity receptors. Where impacts cannot be screened out, consideration of the sensitivity of the specific habitats at the site will be required.

Completed Development

Human Health Receptors

7.87 All receptors where the AQOs apply are of high sensitivity. Locations where the AQOs do not apply must be considered not to be sensitive; there are thus no medium or low sensitivity receptors within the context of this assessment. This includes locations both within the local area and within the Proposed Development itself.

Ecological Receptors

7.88 The sensitivity of ecological receptors and the approach to the assessment is the same as explained in paragraph 7.86.

Magnitude of Impact

Demolition and Construction

Fugitive Dust and Particulate Matter Emissions

7.89 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management ('IAQM') has been used (the GLA's SPG recommends that the assessment be based on the latest version of the IAQM guidance).

7.90 The IAQM guidance¹⁵ has provided a series of matrices (Table 2, Table 3 and Table 4 of the guidance document are provided in **ES Volume 3, Appendix: Air Quality – Annex 4**) to determine the risk of dust soiling and human health impacts for each activity (demolition, earthworks, construction and the trackout of material from the site onto the local road network), with no mitigation applied based on the potential for dust to be raised from on-site works and by vehicles leaving the site, the receptor sensitivity, number of receptors and the proximity to the dust emission activity. The guidance should be read in conjunction with this ES chapter.

7.91 The guidance explains that the dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large. These are combined with the receptor sensitivities to identify the risks, which are defined as 'negligible', 'low', 'medium' or 'high'.

Construction Traffic and NRMM

7.92 Where a detailed assessment is required, the magnitude of air quality impacts from construction traffic and NRMM emissions are defined using the approach described in guidance developed jointly by EPUK and the IAQM¹⁶, as set out in paragraphs 7.60 and 7.61.

Completed Development

7.93 There is no official guidance in the UK in relation to development control on how to describe air quality impacts and effects, nor how to assess their significance. Standard practice is to assess the impacts of a development on local air quality using the EPUK and IAQM guidance on Land-Use Planning & Development Control: Planning For Air Quality¹⁶, which has been utilised in this assessment. The approach provides a method for describing the impacts on local air quality arising from development.

Impacts of Pollutant Concentrations AQOs

Long-term (Annual Mean) Impacts on Human Health

7.94 Impact descriptors for individual receptors are used which expresses the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion.

7.95 Table 7.3 sets out the matrix for determining the impact descriptor for annual mean concentrations at individual receptors, based on Table 6.3 in the EPUK and IAQM guidance¹⁶ document. Impacts can be beneficial or adverse in nature. The terminology within Table 7.3 comes from the guidance but has been modified to align with the terminology set out in the ES, such that:

- Negligible and Moderate retain their meanings;
- Slight can be considered equivalent to Minor; and
- Substantial can be considered equivalent to Major.

Table 7.3 Annual Mean Impact Descriptors for Individual Receptors

Annual Mean Concentration with Proposed Development (µg/m³)	% Change in Concentration relative to the AQO (µg/m³)			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Minor	Moderate
76-94% of AQO	Negligible	Minor	Moderate	Moderate
95-102% of AQO	Minor	Moderate	Moderate	Major
103-109% of AQO	Moderate	Moderate	Major	Major
110% or more of AQO	Moderate	Major	Major	Major

Short-term Impacts on Human Health

7.96 For impacts in relation to the 1-hour mean and 24-hour mean AQOs it is not practical to define a magnitude of impact as the AQOs related to a number of periods which can exceed the air quality standard threshold.

7.97 Where there is no predicted exceedance of the short-term AQO the impact is described as Negligible.

Defining the Effect

7.98 It is important to differentiate between the terms impact and effect with respect to the assessment of air quality. The term impact is used to describe a change in pollutant concentration at a specific location. The term effect is used to describe an environmental response resulting from an impact, or series of impacts. Within this chapter, the air quality assessment has used published guidance and criteria to determine the likely air quality impacts at sensitive locations.

7.99 For the demolition and construction phase, the assessment effects is considered in several ways. Regarding dust generated, the IAQM guidance¹⁵ does not provide a method for assessing the significance of effects before mitigation and advises that pre-mitigation significance should not be determined. For emissions from NRMM and construction traffic, the assessment considers all receptors to be of High sensitivity, following EPUK and IAQM guidance¹⁶, since the AQOs only apply where there is relevant exposure (such as residential properties) and exposure at these locations are considered highly sensitive due to the health implications associated with air quality. Similarly, the assessment of operational effects considers all receptors to be of High sensitivity, The resultant impacts, for the purposes of the ES, are presented in Table 7.4.

Table 7.4 Resultant Impacts

Receptor Sensitivity	Impact			
	Negligible	Minor	Moderate	Major
High	Negligible	Minor	Moderate	Major

7.100 The impacts are considered adverse where a detrimental or negative effects to a receptor, and beneficial where there is an advantageous or positive effect to a receptor.

Demolition and Construction

Fugitive Dust and Particulate Matter Emissions

7.101 Dust generated by the Proposed Development during demolition and construction has the potential to cause nuisance and air quality effects at a local level (up to 500m from the site boundary). The dust generated has the potential to cause effects which are:

- Direct;
- Local;
- Temporary; and
- Medium-term over the 5-year (60 month) demolition and construction period.

Construction Traffic and NRMM

- 7.102** Pollutant emissions from traffic and NRMM associated with demolition and construction works have the potential to cause air quality effects at a local and borough level. The emissions have the potential to cause effects which are:
- Direct;
 - Local;
 - Temporary; and
 - Medium-term while when vehicles and machinery are in use during the 5-year (60 month) demolition and construction period.

Completed Development

- 7.103** Pollutant emissions from traffic and combustion plant associated with operation of the Proposed Development have the potential to cause air quality effects at a local and borough level. While the changes in dispersion due to the massing of the Proposed Development have the potential to cause air quality effects at a local level. The emissions have the potential to cause effects which are:
- Direct;
 - Local;
 - Permanent; and
 - Long-term effects.

Categorising Likely Significant Effects

Demolition and Construction

Fugitive Dust and Particulate Matter Emissions

- 7.104** Guidance from IAQM¹⁵ is that, with appropriate mitigation in place, the effects of construction dust will be 'not significant'. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that effects will normally be 'not significant'. A significant effect from either of the four construction phases may occur if appropriate mitigation measures are not utilised.

Construction Traffic and NRMM

- 7.105** The likely significant effects from construction traffic emissions have been determined following the approach recommended in EPUK & IAQM guidance¹⁶. The overall significance of the air quality effects is determined using professional judgement, giving consideration to various factors including the magnitude of the predicted impacts; the presence of any AQO exceedances and duration of the works.

Completed Development

- 7.106** The likely significant effects from operation of the Proposed Development have been determined following the approach recommended in EPUK & IAQM guidance¹⁶. The overall significance of the air quality effects is determined as either 'significant' or 'not significant', using professional judgement, giving consideration to various factors.
- 7.107** In consideration of the significance of the impacts upon the human health AQO receptors in the local area, the guidance is clear that many factors need to be consider in the determination of significance including:
- the description of the predicted impacts and where slight (minor) or greater (moderate and major) adverse impacts occur, the number of receptors effected; and
 - the presence of any AQO exceedances.
- 7.108** For ecological receptors, where the impacts are screened out the effects are deemed 'not significant'. Where impacts cannot be discounted as not significant based on screening, impacts due to air quality would require an ecological assessment to determine the potential effects on habitats.

BASELINE CONDITIONS

AQMAs

- 7.109** RBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. The Council have declared an Air Quality Management Area (AQMA) in August 2009 covering Reading Town Centre, areas along the major radial road routes into Reading (including J11 of the M4) and along the railway lines where they pass through built-up areas, for exceedances of the annual mean NO₂ AQO. The Proposed Development lies within the Reading AQMA.

Air Quality Emission Zones

- 7.110** There are no declared Clean Air Zones (CAZ), Low Emission Zones (LEZs), Ultra Low Emission Zones (ULEZs), or Non-Road Mobile Machinery (NRMM) Zones within the study area.

Baseline Concentrations

- 7.111** This section presents the monitoring carried out within the local area along with the predicted baseline concentrations in the local area from the modelling. Further information regarding the baseline concentrations from Defra's predicted concentrations are set out in **ES Volume 3, Appendix: Air Quality – Annex 3**.

LAQM Monitoring

- 7.112** The RBC monitors concentrations of NO₂ and PM₁₀ at three automatic monitoring stations within the borough. The Reading AURN and RD1 are not considered to be representative of the Proposed Development due to their unsimilar locations and distance from the site. They do, however, provide valuable insight into the conditions in the area in terms of air quality and so information has been provided in Table 7.5 to Table 7.9 for context relating to the concentrations in the borough.
- 7.113** The RBC also measures NO₂ using a network of fifty-seven passive monitors (diffusion tubes). The nearest representative monitoring station, 'DT20' (Blenheim Terrace, Castle Hill) is located approximately 280m south of the Proposed Development. The monitoring site is considered representative as it is not situated adjacent to an A-road when compared to the Proposed Development location.
- 7.114** Monitoring sites 'DT18', 'DT19', 'DT20', 'DT33', 'DT34', 'DT39', 'DT40', 'DT41' and 'DT42' are operated by RBC and considered representative given their proximity to the Proposed Development. Therefore, information from these monitoring stations have also been provided in Table 7.5 for context relating to the concentrations in the borough.
- 7.115** The monitoring locations and measured data for RBC are shown in Figure 7.2 and Table 7.5. Data for these monitoring sites have been taken from the RBC 2022 Air Quality Annual Status Report²³, which presents data for 2017 to 2021. Data for the year of 2022 is not yet available.

²³ RBC (2022) Reading Borough Council Air Quality Annual Status Report for 2021.

Figure 7.2 Monitoring Sites relative to Proposed Development, with 2019 NO₂ concentrations presented (µg/m³)



Imagery © 2023 Google, Map data © 2023.

Table 7.5 Measured NO₂ Annual Mean Concentrations (µg/m³)

Site ID – Name (Type)	2017	2018	2019	2020	2021
RD1 – Caversham Road (Roadside) ^a	37	40	35	25	26
AURN – Reading AURN (Urban background) ^a	29	26	22	15	20
DT18 – 162a Castle Hill (Roadside)	34.9	35.3	33.7	25.3	29.6
DT19 – 128 Castle Hill (Roadside)	45.9	42.4	38.6	26.0	32.2
DT20 – Blenheim Terrace (Roadside)	39.2	33.0	34.1	26.8	29.8
DT33 – 165 Oxford Road (Roadside)	47.2	42.3	36.5	28.2	30.5
DT34 – 10 Trinity Place (Roadside)	28.9	31.9	26.1	21.3	22.3
DT39 – Friar Street nr Nandos (Roadside)	50.5	42.0	41.0	28.5	35.9
DT40 – Station 1 (Roadside)	49.2	33.0	35.4	26.9	29.1
DT41 – Station 2 (Roadside)	47.4	35.0	38.0	31.3	32.6
DT42 – 33 Caversham Road (Roadside)	45.3	44.2	35.5	27.0	32.4
AQO			40		
Notes: Exceedances of the AQO are presented in bold. ^a Data presented to nearest whole number, as presented in RBC's Air Quality Annual Status Report.					

7.116 Measured NO₂ concentrations exceeded the annual mean AQO level of 40 µg/m³ at six of the passive monitoring sites (DT19, DT33, DT39, DT40, DT41 and DT42) and at one automatic monitoring site (RD1) between 2017 and 2021. The highest measured concentration of 50.5 µg/m³ was measured at 'DT39'

monitoring site in 2017. Concentrations have, however, decreased significantly and in 2019 there was only one measured exceedance – at DT39. Long term trends of annual means require at least 5 years of data, however, the COVID-19 pandemic has potentially skewed the more recent data. Measured concentrations demonstrate an overall reduction in annual mean concentrations between 2017 and 2021. This is expected to continue into the future, as older vehicles are gradually replaced with low emission alternatives.

7.117 Measured short-term (1-hour mean) NO₂ concentrations are presented in Table 7.6. There were no exceedances of the AQO between 2017 and 2021.

Table 7.6 Measured Exceedances of the NO₂ 1-hour Mean AQO

Site ID – Name (Type)	2017	2018	2019	2020	2021
RD1 – Caversham Road (Roadside)	1	0	0	7	0
AURN – Reading AURN (Urban background)	0	4 (112)	0	0	0 (84)
AQO	18 (200) ^a				
Notes: Exceedances of the AQO are presented in bold. a. Where data capture is below 85%, the 99.79 th percentile of hourly means is provided in brackets.					

7.118 Measured PM₁₀ concentrations in the borough are presented in Table 7.7 for context. There were no exceedances of the AQO between 2017 and 2021.

Table 7.7 Measured PM₁₀ Concentrations

Site ID – Name (Type)	2017	2018	2019	2020	2021
Annual Mean (µg/m³)					
RD1 – Caversham Road (Roadside)	23	24	24	20	20
AURN – Reading AURN (Urban background)	12	13	13	15	15
AQO	40				
No. of Days > 50 µg/m³					
RD1 – Caversham Road (Roadside)	7	3	11	5	2
AURN – Reading AURN (Urban background)	3	1 (24)	0 (20)	0	1
AQO	35 (50) ^a				
Notes: Exceedances of the AQO are presented in bold. a. Where data capture is below 85%, the 90.41 th percentile of daily means is provided in brackets.					

7.119 Measured PM_{2.5} concentrations in the borough are presented in Table 7.8 for context. There were no exceedances of the AQO between 2017 and 2021.

Table 7.8 Measured PM_{2.5} Concentrations

Site ID – Name (Type)	2017	2018	2019	2020	2021
Annual Mean (µg/m³)					
AURN – Reading AURN (Urban background)	10	7	8	8	8
AQO	20				
Notes: Exceedances of the AQO are presented in bold.					

AURN Monitoring

7.120 National Government measures concentrations of PM₁₀ at monitoring sites across the UK, as part of the AURN regime. Reading AURN is approximately 2.5 km east of the Proposed Development, although this AURN is not considered to be representative of conditions at the Proposed Development, measured concentrations from this monitoring site have been presented to provide valuable insight in the context of air quality.

Other Sources of Air Pollution

Permitted Facilities

- 7.121** Defra regulates sites which are at risk of contributing significantly to pollutant concentrations and maintains a database of these sites called the UK Pollutant Release and Transfer Register (PRTR)⁴. The 2021 database is the most recent database; this database has been used to identify that there are no regulated sites within 1 km of the site.

Other Local Sources

- 7.122** Due to the local area being urbanised there are likely to be combustion plant installed in some of the nearby buildings, the emissions from which may contribute to baseline air quality. Confirmation of whether plant were installed and commissioned is unavailable. If plant were installed and are operational, there is a potential for localised elevated pollutant concentrations near to the exhaust of the plant. Their contribution to local air quality will, to a reasonable extent, be accounted for within the local measured concentrations, recorded by the RBC. The local measurements are, however, geographically sparse and there is thus a potential for higher localised concentrations than those measured. In the absence of sufficient information, consideration has been given to the potential for slightly elevated baseline conditions when considering the likely significance of the Proposed Development, based on professional judgement. Those for cumulative developments have been explicitly assessed where relevant and possible.

Local Predicted Concentrations

- 7.123** Baseline concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted at 27 receptor locations, at 1.5m height, representing existing sensitive exposure in the local area, which are the likely worst-case locations that may be affected by changes in road traffic and streetscape.
- 7.124** These receptor locations are shown in Figure 7.6 and described in Table 7.10. Receptors represent locations where the AQO apply and, as explained in paragraph 7.40, they are therefore all are considered highly sensitive.
- 7.125** The results, which cover the peak construction year (2026, 'Without Development'), are set out in Table 7.9. Note, this future year 'Without Development' scenario includes the changes in traffic due to the cumulative schemes.

Table 7.9 Predicted Concentrations in the Local Area in 2026 (µg/m³)

Receptor (Height)	Annual Mean NO ₂	Annual Mean PM ₁₀	Annual Mean PM _{2.5}
C1 (1.5m)	31.6	20.0	13.4
C2 (1.5m)	31.4	19.9	13.4
C3 (1.5m)	31.7	20.1	13.5
C4 (1.5m)	32.8	20.7	13.8
C5 (1.5m)	33.7	21.1	14.0
C6 (1.5m)	33.5	21.1	14.0
C7 (1.5m)	32.0	20.5	13.6
C8 (1.5m)	28.6	19.0	12.8
C9 (1.5m)	28.6	19.0	12.8
C10 (1.5m)	28.5	19.0	12.8
C11 (1.5m)	24.2	17.8	12.2
C12 (1.5m)	24.0	17.8	12.1
C13 (1.5m)	27.0	18.8	12.7
C14 (1.5m)	26.0	18.5	12.5
C15 (1.5m)	25.6	18.3	12.4
C16 (1.5m)	26.5	18.8	12.7
C17 (1.5m)	24.0	17.0	11.7

Receptor (Height)	Annual Mean NO ₂	Annual Mean PM ₁₀	Annual Mean PM _{2.5}
C18 (1.5 m)	23.6	16.8	11.6
C19 (1.5 m)	23.4	16.8	11.6
C20 (1.5 m)	23.3	16.8	11.6
C21 (1.5 m)	23.1	16.8	11.5
C22 (1.5 m)	23.0	16.8	11.6
C23 (1.5 m)	23.2	16.9	11.6
C24 (1.5 m)	23.3	17.0	11.7
C25 (1.5 m)	23.4	17.0	11.7
C26 (1.5 m)	30.4	19.0	12.8
C27 (1.5 m)	31.6	19.3	13.0
AQO	40	40	20
Notes: Exceedances of the AQO are presented in bold.			

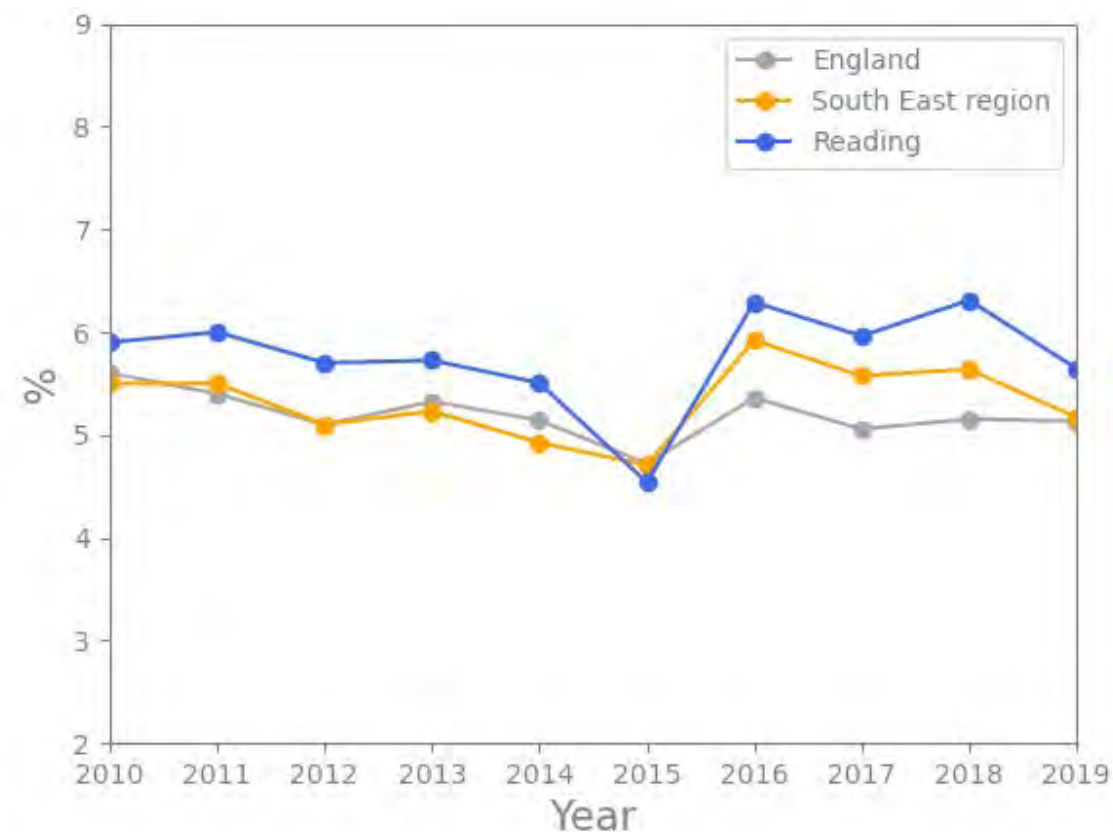
- 7.126** The predicted annual mean concentrations of NO₂ are below the AQO at all existing receptor locations in 2026. The annual mean NO₂ concentrations are below 60 µg/m³ at all receptors; it is, therefore, unlikely that the 1-hour mean NO₂ AQO will be exceeded for the future baseline in 2026.
- 7.127** Annual mean concentrations of PM₁₀ and PM_{2.5} are predicted to be well below the AQOs in 2026 at all receptors. The annual mean PM₁₀ concentrations are below 32 µg/m³ and it is, therefore, unlikely that the 24-hour mean PM₁₀ AQO will be exceeded.

Health Effects

- 7.128** The Public Health Outcomes Framework²⁴ provides information on the fraction of mortality attributable to particulate matter (PM_{2.5}) air pollution (indicator D01). For Reading 5.6% of deaths were attributed to PM_{2.5}, which is slightly higher the average for the Southeast region (5.2%) and England of 5.1%.The long-term trend in proportion of deaths associated with exposure to PM_{2.5} in Reading is shown in Figure 7.3.

²⁴ Public Health England. (2021). Public Health England Outcomes Framework. London: Public Health England.

Figure 7.3 Public Health Framework D01 Fraction of all-cause adult mortality attributable to anthropogenic particulate air pollution in Reading



RECEPTORS AND RECEPTOR SENSITIVITY

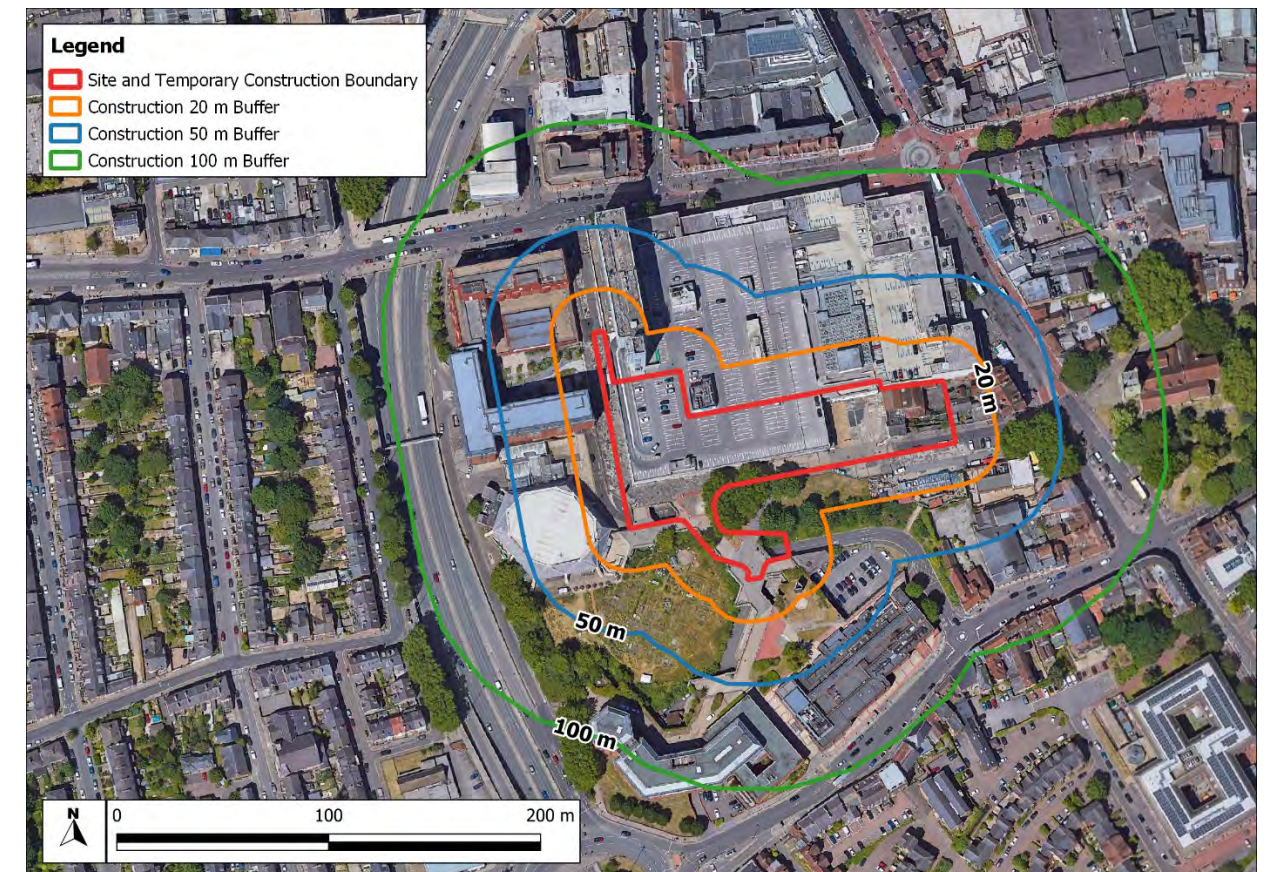
Existing

Demolition and Construction

Fugitive Dust and Particulate Matter Emissions

- 7.129 The IAQM guidance¹⁵, which has been followed when carrying out the construction dust assessment, requires the number of receptors within certain distance bands to be established in order to determine the sensitivity of the surrounding area, rather than focussing on impacts at individual receptors. It is, therefore, not necessary to set out specific receptors for the assessment of dust impacts during the demolition and construction works.
- 7.130 Figure 7.4 shows the site with several bands representing 20 m, 50 m and 100 m distances from the site boundary. There are between 10 to 100 high sensitivity properties within 20 m of the site. Based on Table 2 of the IAQM guidance document¹⁵, the sensitivity of the area to dust soiling impact will be High.
- 7.131 Annual mean PM₁₀ concentrations in the vicinity of the Proposed Development are predicted to be a maximum of 16.9 µg/m³.
- 7.132 Concentrations are likely to have reduced to date and expected to decrease in the coming years. Therefore, it is expected the PM₁₀ concentrations will be below this during the demolition and construction phase. Based on Table 2 of the IAQM Guidance¹⁵, the sensitivity of the area to human health impacts due to elevated levels of PM₁₀ during the demolition and construction phases will be *Low*.
- 7.133 The IAQM Guidance¹⁵ recommends ecological receptors should be considered when they are located within 50 m of the Proposed Development. There are no designated ecological sites within 50 m of the site and therefore the sensitivity will be *negligible*.

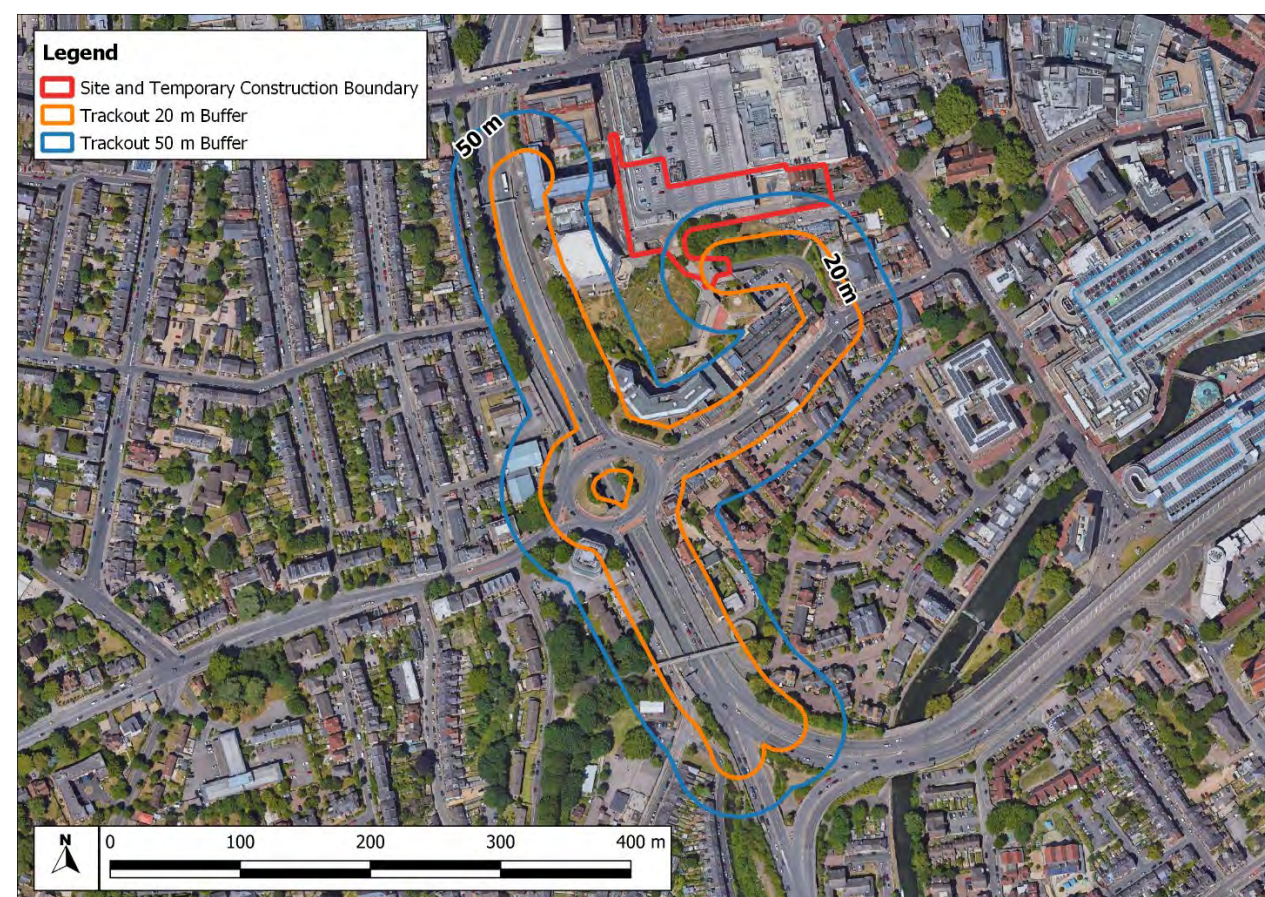
Figure 7.4 Distance Buffers from Site and Temporary Construction Boundary



Imagery © 2023 Google, Map data © 2023

- 7.134 Footnote C of Table 2 of the guidance¹⁵ explains that where there is a Medium dust emission magnitude for trackout there is a risk of material being tracked up to 200 m from the site. Figure 7.5 shows the two buffers around the routes traffic could take upon leaving the site.
- 7.135 There will be more than 10 high sensitivity properties within 20 m of the roads along which material could be tracked, and thus the area is considered to be of High sensitivity to dust soiling impacts due to trackout. Accounting for the local PM₁₀ concentrations discussed in paragraph 7.131, the area is considered of Low sensitivity to human health impacts. There are no designated ecological sites within 50 m of the roads along which material could be tracked, and therefore the area is considered of negligible sensitivity to ecological impacts.

Figure 7.5 Distance Buffers from Road Lanes Where Trackout May Occur



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Non-Road Mobile Machinery

- 7.136** For NRMM, receptors represent locations where the AQO apply and, as explained in paragraph 7.40, they are therefore all are considered highly sensitive. As NRMM will only operate within the site, only receptors located in close proximity are considered. Thus, relevant receptors within the bands representing 50 m of the site in Figure 7.4 are considered.

Construction Traffic

- 7.137** The receptors affected by construction related traffic emissions and NRMM will in general be the same as those affected by the operation of the completed Proposed Development, although the construction routes are like to use fewer route than the generate operation of the Proposed Development when completed. All construction vehicles will access the site via the A392 then into Castle Street. Egress from the site will be from Queens Walk, along Broad Street Mall and connecting to the A329, heading south. This provides access to strategic arterial roads such as the M4. Therefore, should it is necessary to consider effects at specific receptors, those identified in Table 7.10 and Figure 7.6 are considered.

Modelled Receptors

- 7.138** Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted at 27 receptor locations, at 1.5 m height, representing existing sensitive exposure in the local area, which are the likely worst-case locations that may be affected by changes in road traffic and streetscape.
- 7.139** These receptor locations are shown in Figure 7.6 and described in Table 7.10. Receptors represent locations where the AQO apply and, as explained in paragraph 7.40, they are therefore all are considered highly sensitive.
- 7.140** It is important to note that the selection of specific receptors does not negate the potential impact at further locations, however, they have been selected to represent the likely worst-case impacts, upon which the assessment is based.

Table 7.10 Local Area Receptor Locations

Receptor	Type	X (m)	Y (m)
C1	Human Health Receptor	471287.47	173163.19
C2	Human Health Receptor	471281.84	173156.44
C3	Human Health Receptor	471274.06	173149.69
C4	Human Health Receptor	471263.91	173143.31
C5	Human Health Receptor	471255.38	173139.09
C6	Human Health Receptor	471242	173129.27
C7	Human Health Receptor	471232.66	173121.7
C8	Human Health Receptor	471220.66	173111.59
C9	Human Health Receptor	471215.34	173108.25
C10	Human Health Receptor	471209.78	173103.56
C11	Human Health Receptor	471144.12	172988.86
C12	Human Health Receptor	471150.12	172976
C13	Human Health Receptor	471192.03	173042.22
C14	Human Health Receptor	471200.81	173024.16
C15	Human Health Receptor	471212	173004.59
C16	Human Health Receptor	471222.31	172983.91
C17	Human Health Receptor	471022.31	173312.88
C18	Human Health Receptor	471025.06	173297.22
C19	Human Health Receptor	471028.84	173277.62
C20	Human Health Receptor	471031.94	173263
C21	Human Health Receptor	471035.38	173242.72
C22	Human Health Receptor	471039.84	173216.41
C23	Human Health Receptor	471047.81	173208.11
C24	Human Health Receptor	471056.59	173184.42
C25	Human Health Receptor	471062	173169.45
C26	Human Health Receptor	471308.81	173195.38
C27	Human Health Receptor	471316.12	173204.48

Figure 7.6 Existing Specific Receptor Locations in The Local Area



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Completed Development

Human Health Receptors

7.141 The screening criteria set out in the EPUK and IAQM guidance¹⁹ states that the impacts specifically due to road traffic emissions are likely to be negligible where the change in LDV AADT flow is less than 100 within an AQMA and the change in HDV AADT flow is less than 25 within an AQMA. Since the Proposed Development will lead to a net reduction of 309 movements per day and a net increase of 6 HDV movements per day, the AADT changes will be below the EPUK/IAQM criteria there is therefore no requirement to define receptors in the local area.

Ecological Receptors

7.142 The screening criteria for determining impacts on the ecological sites set out in the IAQM guidance¹⁹ states the impacts are likely to be Negligible where the changes in AADT flow is less than 1,000 along roads within 200 m of the ecological site. As the roads are not within 200 m of a designated ecological site and the traffic generation does not exceed the IAQM criteria, there is therefore no requirement to define receptors in the local area.

Introduced within the Site

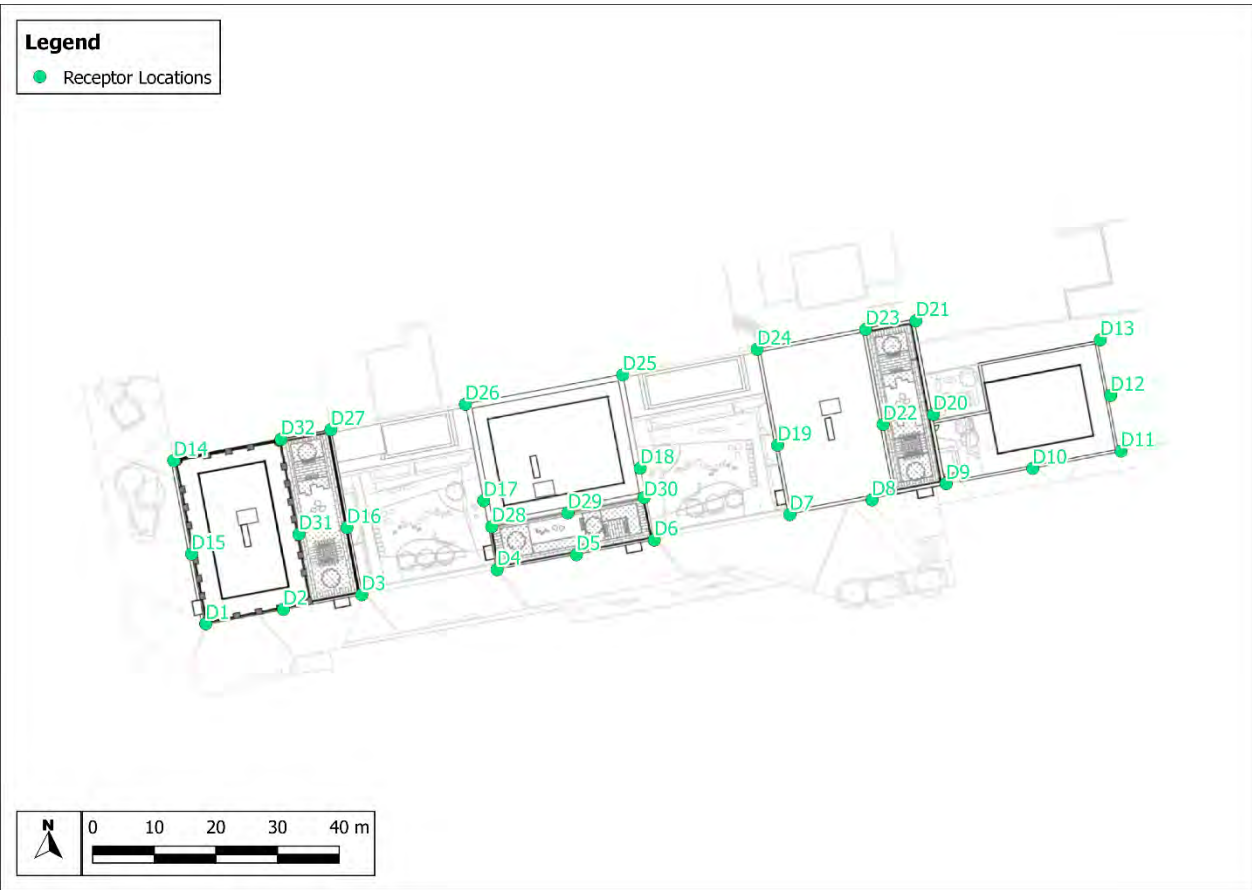
7.143 The Proposed Development will be constructed in various phases from Q2 2025 to Q2 2029. Due to the phased nature of the occupation, the Proposed Development will introduce receptors sensitive to emissions generated by demolition and construction activities and traffic prior to completion. Though a phased occupation will occur, this will occur over a 6-month period towards the completion of the Proposed Development. Once complete, sensitive receptors will remain.

7.144 Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted at 32 receptor locations within the Proposed Development at a range of heights, representing locations of worst-case exposure at the Proposed

Development. The receptor locations are shown in Figure 7.7 and are described in Table 7.11. The receptors have been modelled at a range of heights up to ~96 m above ground level. The receptor locations have been selected using proposed plans to identify the likely worst-case locations of exposure introduced within the Proposed Development and can be considered representative of residential units, terraces, podiums and Use Class E use (where there may be sensitive public exposure)

7.145 The ground floor would only be considered relevant receptors to the 1-hour mean NO₂ AQO, as there are no locations of regular long-term exposure, however members of the public may regularly spend 1-hour or more at retail and amenity areas. Therefore, the receptors will be sensitive at ground floor and will be assessed accordingly.

Figure 7.7 Receptor Locations within the Proposed Development



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Table 7.11 Receptor Locations within the Proposed Development

Receptor	X (m)	Y (m)
D1	471160.183	173284.438
D2	471172.789	173286.760
D3	471185.492	173289.146
D4	471207.448	173293.208
D5	471220.329	173295.642
D6	471232.967	173298.028
D7	471254.956	173302.155
D8	471268.304	173304.541
D9	471280.330	173307.185
D10	471294.387	173309.667
D11	471308.702	173312.472

Receptor	X (m)	Y (m)
D12	471307.025	173321.500
D13	471305.349	173330.527
D14	471154.976	173310.925
D15	471157.878	173295.771
D16	471183.090	173300.027
D17	471205.272	173304.412
D18	471230.678	173309.699
D19	471252.989	173313.439
D20	471278.266	173318.404
D21	471275.429	173333.622
D22	471270.109	173316.792
D23	471267.272	173332.236

Notes: Receptors have been modelled at a range of heights above ground level (m): 1.5, 6.35, 9.34, 12.33, 15.32, 18.30, 21.29, 24.28, 27.27, 30.26, 33.25, 36.24, 39.23, 42.21, 45.20, 48.19, 51.18, 54.17, 57.16, 60.15, 63.14, 66.12, 69.11, 72.10, 75.09, 78.08, 81.07, 84.06, 87.05, 90.03, 93.02 and 96.01.

EMBEDDED MITIGATION

7.146 The EPUK and IAQM guidance¹⁹ is clear that it is important that a proposed development should incorporate good design and best practice measures to ensure any impacts are minimised as far as practicable, even where pollutant concentrations are predicted to be below the AQOs/Limit Values. This Proposed Development includes the following good design and best practice measures by design:

- The Proposed Development includes air source heat pumps to minimise local emission of air pollutants;
- The Proposed Development is situated close to local amenities, helping to minimise vehicle use;
- The Proposed Development will include provision of cycle spaces; and
- The Proposed Development is situated close to several bus stops, allowing easy access to sustainable modes of transport.

POTENTIAL EFFECTS

Demolition and Construction

Fugitive Dust and Particulate Matter Emissions

Step 1

7.147 Step 1 of the assessment procedure is to screen the need for a detailed assessment based on the criteria set out in paragraph 7.25.

7.148 There are human receptors within 20, 50 and 100 m from the site boundary, as set out in the guidance, as set out in paragraphs 7.130 to 7.134, thus an assessment is required for human receptors. The screening distances were also applied to the introduced receptors at the Proposed Development. There are no ecological sites within the screening distance of 50 m and therefore an assessment is not required for ecological receptors.

Step 2

Potential Dust Emission Magnitude

Demolition

7.149 There will be some demolition on-site, including part-demolition of existing retail units, car park and service areas, and demolition and rebuild of car park ramp, as well as demolition of the temporary construction works ramp, and construction of a residential-led, mixed-use development fronting Queens Walk and Dusseldorf Way, including all necessary enabling and alteration works required. It is unknown if there will be any crushing or screening on-site. There will be some internal demolition as part of the change of use works. Although the activities will be phased, taking a conservative approach, and based on the illustrative criteria in the IAQM guidance¹⁵, the dust emission class for demolition is considered *Medium*.

Earthworks

7.150 The dust generated by the earthworks depends on the nature of the earth and soil at the site. The characteristics of the soil at the site have been defined using the British Geological Survey's UK Soil Observatory website²⁵ and are set out in Table 7.12. Overall, it is considered that, when dry, this soil has the potential to be slightly dusty.

Table 7.12 Summary of Potential Dust Emission Magnitude

Category	Record
Soil layer thickness	Deep
Soil texture	Sandy (light to medium)
Subsoil grain size	Arenaceous – Rudaceous
European Soil Bureau Description	River terrace / sand and gravel

7.151 Earthworks will be carried out to enable foundations works. The area for earthworks is unknown but the assessment has been based upon this to provide a conservative approach. Dust will arise mainly from the handling and transport of dusty materials. Based on the illustrative criteria in the IAQM guidance document¹⁵, the dust emission class for earthworks is considered *Small*.

Construction

7.152 Construction works are anticipated to last approximately 5 years, as set out in **ES Volume 1, Chapter 5: Demolition and Construction**. The construction of four tower buildings with 644 units. The total volume for the construction/redevelopment of the Proposed Development is unknown but is anticipated to be over 75,000 m³. Therefore, based on the illustrative criteria in the IAQM¹⁵, the dust emission class for construction is considered *Large*.

Trackout

7.153 The number of outward HGV movements from the site are expected to be up to 50 per day. Therefore, based on the example definitions set out in the IAQM guidance¹⁵, the dust emission class for trackout is considered *Medium*.

Summary of Potential Dust Emission Magnitude

7.154 Table 7.13 summarises the dust emission magnitude for the Proposed Development.

Table 7.13 Summary of Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Medium
Earthworks	Small
Construction	Large
Trackout	Medium

²⁵ British Geological Survey. (2020). UK Soil Observatory (UKSO). Retrieved from British Geological Survey: <http://mapapps2.bgs.ac.uk/ukso/home.html>

Sensitivity of the Study Area

7.155 Paragraphs 7.130 to 7.134 sets out the sensitivity of local receptors and Table 7.14 summarises the sensitivity of the area around the proposed construction works based on the highest level of sensitivity determined for each stage.

Table 7.14 Summary of Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area			
	Earthworks	Demolition	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Low	Low	Low	Low
Ecological	Negligible	Negligible	Negligible	Negligible

Risk of Dust Effect

7.156 The dust emission magnitudes in Table 7.13 have been combined with the sensitivities of the area in Table 7.14 using the matrices in the guidance¹⁵, in order to assign a risk category to each activity. The resulting risk categories for the construction activities, without mitigation, are set out in Table 7.15. Further detailed are provided in **ES Volume 3, Appendix: Air Quality – Annex 4**.

Table 7.15 Summary of Dust Risk for each Stage

Potential Impact	Risk			
	Demolition ^a	Earthworks ^b	Construction ^c	Trackout ^d
Dust Soiling	Medium Risk	Low Risk	High Risk	Medium Risk
Human Health	Low Risk	Negligible	Low Risk	Low Risk
Ecological	Negligible	Negligible	Negligible	Negligible
Notes: a. Based on Table 6 of the IAQM guidance document. b. Based on Table 7 of the IAQM guidance document. c. Based on Table 8 of the IAQM guidance document. d. Based on Table 9 of the IAQM guidance document.				

Scale of Effects

7.157 The IAQM guidance¹⁵ does not provide a method for assessing the significance of effects before mitigation and advises that pre-mitigation significance should not be determined (see paragraphs 7.168 to 7.174).

Non-Road Mobile Machinery

7.158 Consideration has also been given to the potential impacts of emissions from NRMM used during the construction phase.

7.159 Guidance from the IAQM¹⁵ states that “experience from assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) [...] suggests that they are unlikely to make a significant impact on local air quality and in the vast majority of cases they will not need to be quantitatively assessed”. On this basis, significant effects as a result of NRMM emissions can thus be discounted. However, suitable mitigation measures for construction site plant are set out in paragraph 7.170, based on advice presented in IAQM¹⁵ guidance documents. The effects of NRMM on receptors is therefore direct, temporary, direct, local, short-term and negligible and hence considered to be ‘not significant’.

Construction Traffic

7.160 The Proposed Development will be constructed in phases. **ES Volume 1, Chapter 5: Demolition and Construction** provides the key routing of construction vehicles and the transport consultant for the project (Stantec) have provided the construction traffic data. Details of construction traffic are provided in **ES Volume 3, Appendix: Air Quality – Annex 5**. These traffic data was provided for the peak construction year of 2026. The likely significant effects of these movements are assessed below.

7.161 Screening Assessment The screening criteria for determining impacts on human health set out in the EPUK and IAQM guidance states that the impacts are likely to be negligible where the change in LDV AADT flow

is less than 100 and the change in HDV AADT flow is less than 25 within an AQMA. Since the Proposed Development will lead to a temporary increase above the HDV screening criteria, further detailed assessment is necessary.

Detailed Assessment

Impacts on AQOs

7.162 Annual mean NO₂, PM₁₀ and PM_{2.5} concentrations have been predicted at ground floor level for existing receptors in the local area of the Proposed Development. The maximum annual mean concentrations have been predicted using baseline pollutant concentrations, road traffic (including cumulative schemes), car park and streetscape contributions. The maximum concentrations occur at the ground floor level and closest to the road sources. Ground floor concentrations and impacts at the receptors are shown in Table 7.16. The total concentrations are all below the AQOs. Based on the impact descriptors set out in the EPUK and IAQM guidance¹⁶, negligible impacts are predicted at all receptors in the local area of the Proposed Development during peak construction phase. The Proposed Development is thus expected to have direct, local, temporary medium-term Negligible effects (Not Significant).

Table 7.16 Predicted Concentrations in the Local Area during peak Construction Phase (µg/m³)

Receptor (Height)	Annual Mean NO ₂			Annual Mean PM ₁₀			Annual Mean PM _{2.5}		
	Without Development	With Development	Impact Descriptor	Without Development	With Development	Impact Descriptor	Without Development	With Development	Impact Descriptor
C1 (1.5 m)	31.6	31.7	Negligible	20.0	20.0	Negligible	13.4	13.4	Negligible
C2 (1.5 m)	31.4	31.4	Negligible	19.9	19.9	Negligible	13.4	13.4	Negligible
C3 (1.5 m)	31.7	31.7	Negligible	20.1	20.1	Negligible	13.5	13.5	Negligible
C4 (1.5 m)	32.8	32.9	Negligible	20.7	20.7	Negligible	13.8	13.8	Negligible
C5 (1.5 m)	33.7	33.7	Negligible	21.1	21.1	Negligible	14.0	14.0	Negligible
C6 (1.5 m)	33.5	33.6	Negligible	21.1	21.1	Negligible	14.0	14.0	Negligible
C7 (1.5 m)	32.0	32.0	Negligible	20.5	20.5	Negligible	13.6	13.6	Negligible
C8 (1.5 m)	28.6	28.6	Negligible	19.0	19.0	Negligible	12.8	12.8	Negligible
C9 (1.5 m)	28.6	28.6	Negligible	19.0	19.0	Negligible	12.8	12.8	Negligible
C10 (1.5 m)	28.5	28.5	Negligible	19.0	19.0	Negligible	12.8	12.8	Negligible
C11 (1.5 m)	24.2	24.2	Negligible	17.8	17.8	Negligible	12.2	12.2	Negligible
C12 (1.5 m)	24.0	24.0	Negligible	17.8	17.8	Negligible	12.1	12.1	Negligible
C13 (1.5 m)	27.0	27.0	Negligible	18.8	18.8	Negligible	12.7	12.7	Negligible
C14 (1.5 m)	26.0	26.1	Negligible	18.5	18.5	Negligible	12.5	12.5	Negligible
C15 (1.5 m)	25.6	25.6	Negligible	18.3	18.3	Negligible	12.4	12.4	Negligible
C16 (1.5 m)	26.5	26.5	Negligible	18.8	18.8	Negligible	12.7	12.7	Negligible
C17 (1.5 m)	24.0	24.0	Negligible	17.0	17.0	Negligible	11.7	11.7	Negligible
C18 (1.5 m)	23.6	23.6	Negligible	16.8	16.8	Negligible	11.6	11.6	Negligible
C19 (1.5 m)	23.4	23.4	Negligible	16.8	16.8	Negligible	11.6	11.6	Negligible
C20 (1.5 m)	23.3	23.3	Negligible	16.8	16.8	Negligible	11.6	11.6	Negligible
C21 (1.5 m)	23.1	23.1	Negligible	16.8	16.8	Negligible	11.5	11.5	Negligible
C22 (1.5 m)	23.0	23.0	Negligible	16.8	16.8	Negligible	11.6	11.6	Negligible
C23 (1.5 m)	23.2	23.2	Negligible	16.9	16.9	Negligible	11.6	11.6	Negligible
C24 (1.5 m)	23.3	23.3	Negligible	17.0	17.0	Negligible	11.7	11.7	Negligible
C25 (1.5 m)	23.4	23.4	Negligible	17.0	17.0	Negligible	11.7	11.7	Negligible
C26 (1.5 m)	30.4	30.4	Negligible	19.0	19.0	Negligible	12.8	12.8	Negligible

Receptor (Height)	Annual Mean NO ₂			Annual Mean PM ₁₀			Annual Mean PM _{2.5}		
	Without Development	With Development	Impact Descriptor	Without Development	With Development	Impact Descriptor	Without Development	With Development	Impact Descriptor
C27 (1.5 m)	31.6	31.6	Negligible	19.3	19.3	Negligible	13.0	13.0	Negligible
AQO	40		-	40		-	20		-

Compliance with Limit Values

- 7.163** Without the Proposed Development, existing levels of air pollution are predicted by Defra to be below the limit values in 2026 in the vicinity of the Proposed Development. The Proposed Development is not considered to detrimentally effect air quality along local roads and will therefore not delay compliance with the limit values in RBC. The Proposed Development will have a *direct, temporary, local, medium-term negligible effects*, hence the effects on Limit value compliance will be Negligible (not significant).

Completed Development

Impacts of the Development on the Local Air Quality

Stage 1 – Screening General

- 7.164** The Proposed Development involves more than 10 residential dwellings, thus based on the EPUK and IAQM guidance¹⁹ there is a need to consider the impacts on local air quality. An assessment is therefore required in relation to the impact on the AQOs.

Stage 2 – Screening Specifics

Human Health Impacts

- 7.165** Traffic associated with the Proposed Development has been provided by Stantec who have prepared the TA for the Proposed Development. Details of the annual average 24-hour daily traffic (AADT) flows for 2029, with and without the Proposed Development, for local roads were provided. These are given in Table 7.17.

Table 7.17 Net Change in AADT Trip Rates

Proposed BSM	In	Out	2-Way	LDV	HDV
Proposed MSCP AADT	536	539	1,075	1,075	0
Proposed Residential AADT	372	389	761	755	6
Basement Service Yard AADT	66	66	132	110	22
Proposed Development AADT Total	974	994	1,968	1,940	29
<i>net change</i>	<i>-158</i>	<i>-145</i>	<i>-303</i>	<i>-309</i>	<i>6</i>
Notes: LDV means Light Duty Vehicle (cars, taxis, motorbikes, and light goods vehicles) HDV means Heavy Duty Vehicle (rigid heavy goods vehicles, articulated heavy goods vehicles, buses, and coaches)					

- 7.166** The screening criteria set out in the EPUK and IAQM guidance¹⁹ states that the impacts specifically due to road traffic emissions are likely to be negligible where the change in LDV AADT flow is less than 100 within an AQMA and the change in HDV AADT flow is less than 25 within an AQMA. Since the Proposed Development will lead to a net decrease of 309 movements per day and a net increase of 6 HDV movements per day, the AADT changes will be below the EPUK/IAQM criteria, and the impacts on local air quality exclusively based on the generation of traffic will be Negligible (not significant). This effect will be *direct, permanent, borough scale, long-term*.
- 7.167** The Proposed Development will lead to an increase in building massing in the local area which will lead to the flow of air changing in the local environment. However, there is minimal risk of the streetscape causing worsening of local street canyon effects due to the layout of the building and its location being set back from local roads. The impact of the Proposed Development with regards to streetscape is therefore considered Negligible (not significant). This effect will be *direct, permanent, local, long-term*.

MITIGATION, MONITORING AND RESIDUAL EFFECTS

- 7.168** This section sets out the mitigation, monitoring and residual effects in relation the effects on the local area.

Demolition and Construction Mitigation

Fugitive Dust and Particulate Matter Emissions

- 7.169** Measures to mitigate dust emissions will be required during the construction phase of the Proposed Development in order to minimise impacts upon nearby sensitive receptors.
- 7.170** The Proposed Development has been identified as Medium Risk for dust soiling effects during demolition, construction and trackout, and Low Risk during earthworks. In terms of human health, the Proposed Development has been identified as Low Risk during the demolition, construction and trackout, and Negligible Risk during earthworks. In terms of ecology, the Proposed Development has been as Negligible Risk, as set out in Table 7.15.
- 7.171** IAQM¹⁵ guidance documents describe measures that should be employed, as appropriate, to reduce the impacts. In addition to this the IAQM has also published guidance on monitoring during demolition and construction. Based on the finding of this assessment, a set of measures that are both highly recommended (needed to mitigate the impacts) and desirable (useful to mitigate the impacts) to be incorporated into the specification for the construction works has been drawn up. These measures are shown in **ES Volume 3, Appendix: Air Quality – Annex 4**.
- 7.172** The mitigation measures for the site will be integrated into a Code of Construction Practice or the Construction Management Plan (CMP) and will require monitoring. Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses. Furthermore, NRMM will be required to meet at least Stage IV emissions.
- 7.173** The IAQM guidance¹⁵ does not provide a method for assessing the significance of effects before mitigation and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will be not significant.
- 7.174** The IAQM guidance¹⁵ recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be not significant.
- Completed Development Mitigation**
- 7.175** Once the Proposed Development is complete and operational, the impacts on sensitive receptors are considered to be not significant.
- 7.176** The Proposed Development is unlikely to cause any exceedances of the AQOs in the local area. Measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation (which was transposed into UK law). Furthermore, the government and RBC are working to improve air quality under the relevant Air Quality Strategies and LAQM regime which have been considered in this assessment. As such no further mitigation measures are required.
- Residual Effects**
- 7.177** Table 7.18 provides a tabulated summary of the outcomes of the air quality impact assessment of the Proposed Development.

Table 7.18 Residual Effects

Receptor	Description of the Residual Effect	Scale and Nature	Significant / Not Significant	Geo	D I	P T	St Mt Lt
Demolition and Construction							
Existing and Introduced Receptors	Demolition and Construction Dust	Negligible	Not Significant	L	D	T	Mt
	Construction Traffic Emissions	Negligible	Not Significant	L	D	T	Mt
	NRMM Emissions	Negligible	Not Significant	L	D	T	Mt
Completed Development							
Existing and Introduced Receptors	Road Traffic Emissions	Negligible	Not Significant	B	D	P	Lt
	Streetscape Massing Changes	Negligible	Not Significant	L	D	P	Lt
	On-site Combustion Plant Emissions	Negligible	Not Significant	L	D	P	Lt
Notes: Residual Effect - Scale = Negligible / Minor / Moderate / Major - Nature = Beneficial or Adverse Geo (Geographic Extent) = Local (L), Borough (B), Regional (R), National (N) D = Direct / I = Indirect P = Permanent / T = Temporary St = Short Term / Mt = Medium Term / Lt = Long Term N/A = not applicable / not assessed							

SITE SUITABILITY

7.178 This section considers the potential for effects on the Proposed Development and the suitability of the site for the proposed use with regards to air quality.

7.179 Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted for the future year of 2029 at the Proposed Development. The concentrations have been predicted at ground to the 30th floor across the Proposed Development to represent the worst-case locations of sensitive exposure within the Proposed Development. The predicted concentrations at all receptors are presented in **ES Volume 3, Appendix: Air Quality – Annex 6**. The maximum concentrations are predicted at the lowest floor that each receptor represents nearest to the key source of pollution (road traffic emissions), these concentrations are presented in Table 7.19.

Table 7.19 Predicted Concentrations at Lowest Floor Locations within the Proposed Development (µg/m³)

Receptor (Height)	Annual Mean NO ₂	Annual Mean PM ₁₀	Annual Mean PM _{2.5}
D1	24.3	16.9	11.6
D2	24.3	16.9	11.6
D3	24.4	16.8	11.6
D4	24.6	16.8	11.6
D5	24.7	16.8	11.6
D6	24.9	16.8	11.6
D7	25.1	16.8	11.6
D8	25.2	16.8	11.6

Receptor (Height)	Annual Mean NO ₂	Annual Mean PM ₁₀	Annual Mean PM _{2.5}
D9	25.4	16.8	11.6
D10	25.5	16.8	11.6
D11	25.7	16.9	11.6
D12	25.8	16.8	11.6
D13	25.8	16.8	11.6
D14	24.5	16.9	11.6
D15	24.3	16.9	11.6
D16	24.3	16.7	11.5
D17	24.5	16.7	11.5
D18	24.8	16.7	11.6
D19	25.0	16.7	11.6
D20	25.0	16.6	11.5
D21	25.5	16.7	11.6
D22	24.7	16.5	11.4
D23	25.1	16.6	11.5
D24	24.9	16.6	11.5
D25	25.1	16.8	11.6
D26	24.8	16.8	11.6
D27	24.5	16.7	11.6
D28	23.9	16.4	11.4
D29	24.0	16.4	11.4
D30	24.2	16.4	11.4
D31	23.6	16.4	11.4
D32	23.7	16.4	11.4
AQO	40	40	20

Compliance with AQOs

7.180 Table 7.19 demonstrates that there will be no exceedances of the NO₂, PM₁₀ and PM_{2.5} AQOs at any of the receptors.

7.181 Previous research carried out on behalf of Defra identified that, where road traffic emissions are the dominant pollutant source, exceedances of the 1-hour mean NO₂ AQO are unlikely to occur where the annual mean is below 60 µg/m³. The concentrations are below 60 µg/m³, based on Defra's LAQM.TG22 guidance¹³, it is therefore considered unlikely that the 1-hour mean AQO will be exceeded at any of the receptors.

7.182 Similarly, previous research carried out on behalf of Defra identified that, where road traffic emissions are the dominate pollutant source, exceedances of the 24-hour mean PM₁₀ AQO are unlikely to occur where the annual mean is below 32 µg/m³. The concentrations are all below 32 µg/m³; based on Defra's LAQM.TG22 guidance¹³ it is therefore considered unlikely that the 24-hour mean AQO will be exceeded at any of the receptors.

Limit Value Compliance

7.183 Concentrations at the Proposed Development have been considered. Table 7.19 shows the predicted annual mean concentrations of NO₂, PM₁₀, and PM_{2.5}. The maximum predicted concentrations within the Proposed Development in 2029 are all well below the LVs. There is thus unlikely to be a breach of the LVs within the Proposed Development.

¹³ Defra. (2022). Local Air Quality Management Technical Guidance (TG22).

¹³ Defra. (2022). Local Air Quality Management Technical Guidance (TG22).

WHO Compliance

- 7.184** The Proposed Development will include exposure at the WHO IT1, IT3 and IT4 levels for NO₂, PM₁₀ and PM_{2.5} respectively, based on the maximum concentration at the site (at the boundary).
- 7.185** For NO₂, PM₁₀ and PM_{2.5} this is the same as the background level achieved which suggests the site is not located near to a significant local emission source and as air quality improves into the future due to national and regional policy, the conditions at the Proposed Development will also improve.
- 7.186** As background concentrations reduce due to national policy the air quality at the Proposed Development is likely to achieve compliance with the WHO AQGs in the future.

ASSESSMENT OF THE FUTURE ENVIRONMENT

Evolution of the Baseline Scenario

- 7.187** Air quality is expected to improve into the future due to more stringent emission standards for motor vehicles, stricter air quality legislation, improvements in technology, and a greater uptake of renewable technologies. Air quality in the local area is therefore expected to improve in the future, including at the site even in the event that the Proposed Development is not implemented.

Cumulative Effects Assessment

- 7.188** A number of nearby developments have been identified as cumulative schemes and outlined in **ES Volume 1, Chapter 2: EIA Methodology**.

Demolition and Construction

Construction Dust

- 7.189** The IAQM guidance¹⁹ is clear that, with appropriate mitigation measures in place, any residual construction dust effects from an individual site will be 'not significant'. The guidance also suggests that cumulative construction dust impacts are only likely where sites are within 500 m of each other. Work would also have to be taking place in areas of both sites that are close to a receptor in order for cumulative effects to occur.
- 7.190** There are many cumulative schemes which have been identified in the local area, as shown Table 7.20. Of the twelve developments outlined, the majority are largely car free proposals and estimating net reductions in vehicle trips; these have therefore been excluded from any further traffic flow assessment. While all sites within 500 m of the site may result in combined effects, those within 350 m of the construction works are likely to lead to the greatest risk of combined effects. There are six Cumulative Schemes (1, 3, 4, 6, 7, 11) located in close proximity to the site and these have been focused upon within this assessment. These include:
- (Number 1) 52-55 Friar Street Reading and 12 Greyfriars Road, RG1 1DX (Application No. 162210), which is located 150 m north of the Proposed Development and therefore should be considered for cumulative effects on the local area;
 - (Number 2) Station Hill, Reading, including Plot E & Telecom House (Application No. 130436, 151426, 201532 and 201536), which is located approximately 260 m northeast of the Proposed Development and therefore will be considered for cumulative effects on the local area;
 - (Number 4) Land between Weldale Street and Chatham Street, Reading (Application No. 170326), which is located approximately 170 m northwest of the Proposed Development and therefore will be considered for cumulative effects on the local area; and
 - (Number 6) 29 Station Road, Reading, RG1 1LG (Application No. 181930), which is located approximately 340 m northeast of the Proposed Development and therefore will be considered for cumulative effects on the local area.
 - (Number 7) Bristol & West Arcade, Market Place, Reading, RG1 1JL (Application No. 180358),
 - (Number 11) Former Debenhams Department Store, West of Yield Hall Place, The Oracle, RG1 2AS (Application No. 221916).

- 7.191** The Proposed Development is expected to start demolition in Q2 in 2025 and complete the construction of the full Proposed Development in Q2 2029. In accordance with the **ES Volume 1, Chapter 5: Demolition**

and Construction, if there is concurrent construction work on sites within 500 m of each other, the construction contractors should 'hold regular liaison meetings with high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised'. This is particularly applicable to the sites identified within 350 m of the site.

- 7.192** It is anticipated that all construction sites will adopt appropriate mitigation measures to minimise emissions of dust, will hold liaison meetings as necessary and will ensure that plans are co-ordinated to minimise effects. With these measures in place, the cumulative effects of construction activities are likely to be **not significant**.

Construction Traffic

- 7.193** The traffic data included the operational traffic for cumulative schemes; these were included within the future year of 2026 and results of which are presented in Table 7.16. It should be noted that some of the cumulative schemes may still be under construction during the Proposed Development's demolition and construction phase. While the cumulative construction traffic may be different to their cumulative operational traffic, Stantec (the transport consultants for this project) stated that the operational traffic would be higher and provide a conservative assessment approach. The cumulative impacts of construction traffic will result in a **Negligible** (Not Significant) effect.

NRMM

- 7.194** The five nearby Cumulative Schemes may include emissions from NRMM and may thus cause cumulative effects. Guidance from the IAQM¹⁵ states that "experience from assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) [...] suggests that they are unlikely to make a significant impact on local air quality and in the vast majority of cases they will not need to be quantitatively assessed". Given the distances between development sites, it is considered likely that the cumulative impacts will result in a **Negligible** (Not Significant) effect.

Completed Development

Operational Traffic

- 7.195** The traffic data used in the 2029 'With Development' scenario incorporates cumulative traffic flows. As such, predictions of future pollutant concentrations presented in this ES chapter take account of cumulative effects of transport related emissions and the impacts of which have been demonstrated to result in a **Negligible** (Not Significant) effect.

Combustion Plant

- 7.196** A summary of the relevant combustion plant from Cumulative Schemes is set out in Table 7.20. No details of local pollutant contributions are provided within the planning application documentation. Adding the cumulative process contributions of these plant is considered unlikely to alter the impact descriptors or lead to any exceedances. The cumulative effects of combustion plant related emissions are thus demonstrated to be **Negligible** (Not Significant).

Table 7.20 Combustion Plant from Cumulative Schemes in the Local Area

Cumulative Scheme	Description	Assessment of Potential Impacts
52-55 Friar Street Reading and 12 Greyfriars Road, RG1 1DX (Planning Reference: 162210)	The proposals include the demolition of the existing buildings, and construction of a high quality mixed-use development comprising 147 residential dwellings and 627m ² of ground floor retail, leisure and/or office space. An on-site energy centre comprising gas-fired boilers and a combined heat and power (CHP) unit is also proposed.	The energy centre modelled in the air quality assessment is made up of one Ener-G 50kW CHP Unit and two Elco R607 gas-fired boilers. The CHP is estimated to run at 22 hours per day (a total of approximately 7,953 hours per year), and the gas boilers are estimated to run for 12 hours per day (a total of approximately 4,380 hours per year). No further details of combustion plant modelling are provided for the development, including potential impacts.
Station Hill, Reading, including Plot E & Telecom House Land Friar Street/ Garrard Street Station Hill RG1 1DX (Planning	Outline application (Application No. 130436) for mixed use redevelopment of the site through the demolition and alteration of existing buildings and erection of new buildings & structures to provide Offices (Use Class B1), a range of town centre uses including retail and related uses (Use Class A1- A5)leisure (Use Class D2) and residential units, associated infrastructure, public realm	Volume 2 of the Environmental Statement states the proposed heating plant includes five gas-fired boilers and a gas-fired CHP. It also presents the impacts of the development (including plant contributions) upon the local area and determined the magnitude of change to be imperceptible and the effect negligible. It is therefore unlikely that there would be any significant cumulative impacts.

Cumulative Scheme	Description	Assessment of Potential Impacts
Reference: 130436, 151426, 192032, 201532 and 201536)	works and ancillary development (all matters reserved).	
	Outline application (Application No. 151426) with all matters reserved for mixed use redevelopment of Plot E of the Station Hill site and neighbouring Telecom House site (48 to 51 Friar Street & 4 to 20 Garrard Street) to comprise the demolition of existing buildings and erection of new buildings/ structures to provide residential units, a range of town centre uses including retail and related uses (Use Class A1 - A5), associated infrastructure, public realm works and ancillary development. Five gas-fired boilers and one gas fired CHP plant are proposed within the Development.	According to information derived from Chapter 10 – Air Quality, the stack heights range from 44.2 m – 88.6 m (above the ground). Therefore, the combustion products can disperse readily to the environment without causing a nuisance or danger to people or property. No further details of combustion plant modelling are provided for the development, including potential impacts.
	Hybrid application (Application No. 192032) comprising (i) application for Full Planning Permission for Phase 2 (Plot G and public realm) including demolition of existing structures, erection of an eighteen storey building containing office use (Class B1) and flexible retail, non-residential institution and assembly and leisure uses (Class A1, A2, A3, A4, A5, D1 and D2). Provision of podium deck, vehicular access and parking. New public open space and landscaping. Bridge link over Garrard St and(ii) Application for Outline Planning Permission for Phase 3 (all Matters reserved) for four building Plots (A, B, C and D). Demolition of existing buildings and structures. Mixed-use redevelopment	Volume 1 of the Environmental Statement included a review of the potential energy strategy for the development. When considering the potential use of combustion plant (such as boilers and CHP plant) the review stated the “ <i>use of energy derived from fossil fuels such as gas is and will continue to be a depleting resource that has a negative impact on the environment. This option is therefore not the proposed strategy</i> ”. It is therefore unlikely that there would be any significant cumulative impacts.
	Outline application (Application No. 201532) under s.73 of the Town & Country Planning Act 1990 with all matters reserved for mixed use redevelopment of Plot E of the Station Hill site and neighbouring Telecom House site (48 to 51 Friar Street & 4 to 20 Garrard Street) to comprise the demolition of existing buildings and erection of new buildings/ structures to provide residential units (Use Class C3), a range of town centre uses, including retail and related uses (Use Class E (a),(b) and (c); Drinking establishments (sui generis) and Hot food takeaways (sui generis)), and leisure uses (Use Class E (d), (e), and (f); Class F.1; Class F.2; and Theatres; Cinemas; Concert Halls; Bingo Halls; Dance Halls (sui generis)), associated infrastructure, public realm works and ancillary development as permitted by planning permission 190442 granted on 6 December 2019 (as amended).	The Environmental Statement Addendum – Volume 1, Main Text states that “ <i>the Air Quality Chapter will remain unchanged and no further assessment is considered to be required</i> ”. No further details of combustion plant modelling are provided for the development, including potential impacts. It is therefore unlikely that there would be any significant cumulative impacts.
	Outline application (Application No. 201536) (pursuant to Section 73 of the Town & Country Planning Act 1990) for mixed use redevelopment of the site through the demolition and alteration of existing buildings and erection of new buildings & structures to provide Offices (Use Class E (g)(i) and (g) (ii)), a range of town centre uses including retail and related uses (Use Class E (a),(b) and (c); Drinking establishments (sui generis) and Hot food takeaways (sui generis)), leisure and community (Use ClassE (d), (e), and (f); Class F.1; Class F.2; and Theatres; Cinemas; Concert Halls; Bingo Halls; Dance Halls (sui generis)), and residential units (Use Class C3), associated infrastructure, public realm works and ancillary development (all matters reserved) as permitted by planning permission 190441 granted on 6 December 2019 (as amended).	The Environmental Statement Addendum stated “ <i>the findings of the Air Quality Chapter will remain unchanged and no further assessment is considered to be required</i> ”. It is therefore unlikely that there would be any significant cumulative impacts.
Land between Weldale Street	Demolition of all existing buildings (including 3 retail units) and structures, and erection of new	No details of on-site combustion plant are provided for the development.

Cumulative Scheme	Description	Assessment of Potential Impacts
and Chatham Street Reading (Planning Reference: 170326)	buildings ranging between lower ground& 4 storeys to lower ground & 11 storeys in height, providing 427 (233x1, 182x2 & 12x3-bed) residential units (Use Class C3) and 1 flexible ground floor retail shop (Use Class A1) or restaurant and cafe (Use Class A3) unit, together with new public realm, landscaping, accesses, parking and associated works (amended description).	
29 Station Road, Reading, RG1 1LG (Planning Reference: 181930)	Demolition of the existing vacant 6-storey retail and office building and erection of a replacement basement and part 4, part 22 (with rooftop plant above) storey building to provide flexible retail (Use Class A1, A2 or A3) use at part ground floor level, a 135-bedroom hotel (Use Class C1) at 1st to 16th floors and offices (Use Class B1a) at 17th to 21st floors, associated servicing from Garrard Street and other associated works (amended description).	According to information derived from Chapter 10 – Air Quality, the stack heights are 79 m (above the ground). Therefore, the combustion products can disperse readily to the environment without causing a nuisance or danger to people or property. No further details of combustion plant modelling are provided for the development, including potential impacts.
Bristol & West Arcade Market Place Reading RG1 1JL (Planning Reference: 180358)	Demolition of vacant former Bristol & West Arcade (173 – 175 Friar Street) and erection of an eight storey mixed –use building (plus basement) to provide 35 residential units, 4,208m ² of B1 office floorspace, and 5 retail units (A1/A2/A3), demolition of rear parts of 29 – 31 and 32 Market Place, the change of use of the retained units at 27 – 28, 29 - 31 Market Place at first, second and third floors to provide 8 residential units, change of use at ground and basement level of 32 Market Place from A2 to flexible retail use (A1/A2/A3), retention of 260.4m ² of A4 use at ground and basement at 29-31 Market Place, change of use at ground and basement of 27 – The proposed development has a proposed centralised boiler plant.	According to information derived from the air quality assessment, the energy plant proposed for the proposed development is proposed to comprise a centralised communal gas boiler. The exact model is not specified in the report; however, the proposed plant is anticipated to have a combined NOx emission rate of less than 5 mg s ⁻¹ , which is below the EPUK guidance criterion that would trigger further assessment. It is concluded that the energy plant within the proposed development is unlikely to have an adverse effect on local receptors. Assuming a combined plant NOx emission rate of less than 5 mg/s, there will be a negligible impact on local air quality as a result of the operation of the building. If these emission rates are exceeded, an assessment of the chosen boiler plant may be required.
Former Debenhams Department Store West of Yield Hall Place The Oracle RG1 2AS (Planning Reference: 221916)	Mixed use development comprising part demolition of former department store and erection of new building comprising up to 202no. build to rent residential dwellings (Use Class C3) and 1,209m ² commercial uses within Uses Class E and / or bar (Sui Generis Use). Reconfiguration and change of use of up to 5,866m ² remaining department store floorspace (Sue Class E) to uses with within Use Class E and / or bar (SuiGeneris Use) and / or experiential leisure use (Sui Generis Use). Associated public realm, infrastructure works and external alterationsto shopping centre, including creation of new shopping centre entrance.	According to the air quality assessment, the development is car free and there will be no substantial combustion sources associated with the Proposed Development, as such impacts from these sources were not discussed further. It is therefore unlikely that there would be any significant cumulative impacts.

Minster Quarter Development Framework

- 7.197** Directly to the south of the Proposed Development is the Minster Quarter Area, which is outlined for major mixed-use development under the Minster Quarter Development Framework. At this stage it is unknown whether there would be any cumulative impacts during the demolition and construction phase. However, if there will be concurrent construction work at Minsters Quarter Area and the Proposed Development, then the construction contractors should ‘*hold regular liaison meetings with high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised*’. It is anticipated that all construction contractors will adopt appropriate mitigation measures to minimise dust from demolition and construction activities and minimise emissions from NRMM, will hold liaison meetings as necessary and will ensure that plans are co-ordinated to minimise effects. With these measures in place, the cumulative effects of construction activities are likely to be **not significant**. Should Minster Quarter Area generate operational traffic or include on-site combustion plant then these may add cumulative emissions into the local area, however, this is anticipated to occur beyond the years assessed for the Proposed Development. However, should it occur within the years assessed, then the emissions

would elevated baseline concentrations marginally and not alter the impacts of the Proposed Development. The cumulative operational effects are thus likely to be **not significant**.

LIKELY SIGNIFICANT EFFECTS

- 7.198** No likely significant effects have been identified during demolition and construction or once complete or operational. In addition, no additional cumulative effects have been identified during demolition and construction or once complete and operational. The site has also been identified as being suitable for the proposed uses.
- 7.199** Overall, the Proposed Development is considered acceptable with regards to air quality based on current legislation.

Chapter 8: Noise and Vibration

NOISE AND VIBRATION	
AUTHOR	Sol Acoustics
SUPPORTING APPENDIX	ES Volume 3, Appendix: Noise and Vibration Annex 1: Plant noise levels used in construction noise assessment; Annex 2: Glossary of acoustic terminology; Annex 3: Legislation, Planning Policy and guidance; Annex 4: Noise survey data.
KEY CONSIDERATIONS	The following elements are the key noise and vibration issues relating to the Proposed Development: - Noise and vibration will be generated during the construction works of the Proposed Development as well as during any required enabling works which has the potential to affect nearby residential receptors. General construction activities are not likely to generate perceptible levels of vibration at the nearby sensitive receptors. However, piling and enabling structural works may generate perceptible levels of construction vibration within the existing Broad Street Mall; - The Proposed Development has the potential to generate noise during operation that may affect nearby residential receptors such as new building services plant associated with the proposed residential and commercial (flexible Class E use) units; and - The Proposed Development site is exposed to noise from external noise sources (i.e. road traffic from the surrounding road network) ('site suitability').

ASSESSMENT METHODOLOGY

Defining the Baseline

Current Baseline Noise Conditions

- 8.1
- Noise monitoring has been carried out across the site to determine the existing noise environment and the potential impacts of existing noise levels on the Proposed Development and the suitability of the proposed uses.
- 8.2
- Unattended noise monitoring was carried out at three positions on-site, LP1 to LP3, continuously between Friday 13th January 2023 and Friday 20th January 2023, equating to a total of seven days.
- 8.3
- Short term attended noise level measurements were conducted at three further locations, SP1 to SP3, on Thursday 19th January and Friday 20th January 2023.
- 8.4
- ES Volume 3, Appendix: Noise and Vibration - Annex 4** provides full details of the survey and the equipment used, which in summary comprised continuous fifteen-minute measurements of ambient sound levels ($L_{Aeq,15min}$), maximum sound levels ($L_{Amax,t}$) and background sound levels ($L_{A90,15min}$). The survey equipment was calibrated immediately before and immediately after usage; no significant drift in level was found to have occurred.
- 8.5
- All measured noise levels have been processed and summarised to provide an overall level at each location for the whole survey period. Ambient sound levels have been logarithmically averaged for the day (07:00 – 23:00) and night (23:00 – 07:00) periods to present the overall $L_{Aeq,16hour}$ and $L_{Aeq,8hour}$ noise levels respectively.
- 8.6
- An additional noise survey was conducted on-site as part of a previous planning application between Wednesday 13th June 2018 and Monday 18th June 2018. The noise levels measured are comparable to those detailed in this chapter.
- 8.7
- Baseline noise level predictions have been made using the CadnaA noise mapping software to produce a baseline noise model. The measured noise levels at the monitoring locations have been used to calibrate the noise model.

Current Baseline Vibration Conditions

- 8.8
- Vibration on-site is not considered to be a potential issue, as the nearest major vibration source is the railway line located approximately 500m to the north of the development. The A329 located approximately 80m from

the site is not considered to cause levels of vibration within the development that will adversely effect occupants. For context DMRB states that perceptible vibration only occurs in rare cases and identifies that 'normal use of a building, such as closing doors and using domestic appliances can generate similar levels of vibration to that from traffic'¹.

Evolution of the Baseline

- 8.9
- In addition to the assessment of the existing baseline conditions, consideration has been given to the evolution of the baseline condition due to future cumulative schemes and the wider Minster Quarter Development Framework plans.
- 8.10
- Potential changes in road traffic flows are considered to have the biggest potential to affect the future noise baseline at the site. As the local area comprises a busy city centre, to have a material impact on traffic noise levels, any increase in traffic flows would need to be substantial. For reference, traffic flows would have to double to result in a 3dB increase in noise levels².
- 8.11
- Traffic flow predictions show that there will not be a significant increase in traffic flows and therefore it is not considered that there will be any significant increase in road traffic noise levels over time. As such, it is considered that the construction of the cumulative schemes surrounding the site should not significantly increase the noise and vibration levels at the Proposed Development such that these substantially alter the nature of the Site and/or its suitability for mixed use development.

Impact Assessment Methodology

- 8.12
- The assessment of the Proposed Development for both the period of demolition and construction works has been carried out via a desktop assessment. The assessment of the completed and operational Proposed Development has been undertaken using CadnaA noise mapping software to produce a noise model to generate noise level predictions.

Demolition and Construction

Construction Activities

- 8.13
- ES Volume 1, Chapter 5: Demolition and Construction** outlines the proposed demolition and construction works. The noise and vibration assessment is based on the assumptions set out in **ES Volume 1, Chapter 5: Demolition and Construction** and so may be subject to modification during detailed demolition and construction planning.
- 8.14
- The first stage of construction involves enabling works (setup of the site, including the disconnection of services), and partial localised demolition of the existing mall and Dusseldorf Way. Substructure works follows, including piling and groundworks. A new car park ramp will also be constructed, replacing the existing one.
- 8.15
- The confirmed build programme is to be carried out in sequence for each Building, starting with Building A and then overlapping with the start of each subsequent Building construction in sequence every few months. Therefore, construction work for all Phases will be largely simultaneous. The construction noise assessment accounts for the above phasing of works.
- 8.16
- Occupation of the site will be staggered over a 6 month period, with Buildings C and D occupied first, followed by Building B and then Building A. Landscaping works and access around each Building are assumed to be completed before the first occupation of each new building.
- 8.17
- Part of the construction and demolition works are proposed to undertaken above ground within the Broad Street Mall redline boundary, and part below ground under Dusseldorf Way within the Dusseldorf Way Demolition redline boundary. The Dusseldorf Way works involve the demolition of the existing route, to create a temporary construction ramp.
- 8.18
- The analysis of likely construction noise has been undertaken in accordance with BS 5228-1³, which provides methods for predicting construction noise levels based on reference data for the emissions of typical construction plant and activities.
- 8.19
- Table 8A.1 within Annex A of this ES chapter shows the construction stages (based on **ES Volume 1, Chapter 5: Demolition and Construction**) that would take place on-site and the associated predicted sound power levels during these stages based on the plant/equipment expected to be in operation based on the information

¹ The Highways Agency, (2008). Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7 Noise and Vibration. Stationary Office.

² Department of Transport Welsh Office, (1988) Calculation of Road Traffic Noise. HMSO.

³ British Standards Institution, (2014). BS 5228 Code of practice for noise and vibration control on construction and open sites Parts 1 and 2, BSI Standards.

provided. These sound power levels are based on conservative assumptions which may over-state noise emissions in some cases (see section 'Assumptions and Limitations').

- 8.20** The resulting calculated construction noise levels in accordance with BS 5228-1 shall be compared with noise threshold limits relative to the existing background noise level determined in line with the ABC method (defined in BS 5228-1) for temporary construction activities that are commonly regarded as providing an acceptable level of protection from the short-term noise levels associated with construction activities.

Construction Traffic

- 8.21** Throughout the construction programme, HGV and other delivery vehicles will be accessing the site. **ES Volume 1, Chapter 5: Demolition and Construction** advises the highest number of vehicles per day (average) occurring during the construction programme is a total of 52 daily movements. This has been translated into the required AAWT format by the project transport consultant for consideration. As a worst case this assessment will assume all vehicles to be HGVs as they are noisier than smaller delivery vehicles. Traffic data has been provided by Stantec who have undertaken the Transport Assessment for the Proposed Development, and is provided in **ES Volume 3, Appendix: EIA Methodology – Annex 3**.
- 8.22** The noise impacts of the construction related traffic travelling along local surrounding roads has been calculated using the accepted UK prediction methodology provided by the Calculation of Road Traffic Noise (CRTN)⁴. The predicted change in road traffic noise with and without the construction vehicles is assessed against criteria listed in the Design Manual for Roads and Bridges (DMRB)⁵ for assessment of short-term road traffic noise impacts.

Construction Vibration

- 8.23** Construction vibration noise levels shall be assessed in accordance with BS 5228-2, and the resulting calculated levels compared against set maximum threshold of acceptability as defined within the standard as providing an acceptable level of protection from the short-term vibration levels associated with construction and demolition activities.

Assumptions and Limitations

- 8.24** The exact location of each of the specific construction activities or plant used is not available at this stage. The construction noise assessment assumes that all plant and equipment used are operated continuously throughout the 10-hour working day and are located on the site boundary. This is considered unlikely to occur in practice and therefore represents a robust assessment.
- 8.25** Part of the construction and demolition works are proposed to be undertaken above ground within the Broad Street Mall redline boundary, and below ground under Dusseldorf Way within the Dusseldorf Way Demolition redline boundary. Below ground works associated with Dusseldorf Way (demolition & enabling work and substructure & basement work phases) have been considered at the worst-case location within the combined Broad Street Mall development and Dusseldorf Way boundary, whereas the remainder of the works have been considered within the above ground redline boundary for the Broad Street Mall development.
- 8.26** Building C and D will be completed and may be occupied while works are being completed on Buildings A and B. Given the relatively small overlap (6 months), it is assumed that the works will be fit out and external works, as set out in **ES Volume 1, Chapter 5: Demolition and Construction**. As such, Buildings C and D have been considered as sensitive receptors in the later construction stages.
- 8.27** Vibration levels have been calculated to the closest point of the nearest sensitive receptor. This has been regarded to be the closest façade of R8 to the corner of Building A.

Completed Development

Building Services

- 8.28** When operational, the Proposed Development has the potential to generate noise associated with the proposed land uses, including the residential units and future commercial units. These uses have associated on-site activity, plant and / or deliveries in connection with their use, all of which have the potential to generate noise.
- 8.29** Noise levels from the operation of the commercial and residential building services plant within the Proposed Development have been assessed using BS 4142:2014+A1:2019⁶ and the measured levels of existing background noise.
- 8.30** Existing commercial units are currently located across the existing mall at street level. If consented, this development would result in the removal of these units, and the introduction of new commercial provision as well as core access to the new residential buildings above street level.

Operational Traffic

- 8.31** Guidelines for Environmental Assessment of Traffic and Movement states that in order for 1dB change in noise level to occur, traffic flows must be increase by 25%. Any change below this is considered imperceptible in line guidance provided in DMRB.
- 8.32** Given the small number of retail units being created by the Proposed Development, some of them as a direct replacement of currently existing premises within an existing mall, predicted traffic flows show that the level of delivery and operational traffic to the existing mall will not change significantly as a result of the completed Proposed Development, given the established and retained commercial nature of the existing mall. As such, operational delivery traffic movements associated with the completed Proposed Development are not anticipated to have a significant impact on noise levels experienced at the nearest receptors and have not been assessed.
- 8.33** The Proposed Development is generally not expected to be accessed by car, however, 100 parking spaces allocated for private residential lease are being provided outside of the redline boundary for future residents of the site. These spaces are existing spaces within the MSCP, and which are currently used for retail parking purposes. Given the number of parking spaces provided and existing traffic flows on local road links, it is anticipated that the changes in flows will result in a negligible impact. As such, an assessment of road traffic has not been deemed relevant and has been scoped out of this assessment.

Assumptions

- 8.34** The proposed commercial premises at street level are currently proposed for flexible use class E use (and which are assumed for the EIA to comprise of retail, offices, or food & drink establishments). No specific location for each use has been given, therefore a worst-case use has been assumed to provide the required envelope performance and suitable example glazing types, in this instance office use provides the most stringent internal noise criteria.
- 8.35** It is understood that no significant amplified music venues are being considered at any of the commercial units included in the Proposed Development and as such an assessment of amplified noise egress has not been included. Where future uses have the potential for amplified music (such as gyms) the façade and separating constructions may be enhanced to control noise such that there is no significant adverse impact on residents of the Proposed Development or surrounding noise sensitive properties.

Site Suitability

- 8.36** A site suitability assessment for the Proposed Development has been undertaken using CadnaA noise mapping software to produce a baseline noise model to generate noise level predictions.
- 8.37** The impact of existing sources of noise upon future proposed residents has been assessed to determine the suitability of the noise climate for the proposed use.
- 8.38** The noise levels across the site have been assessed for suitability for residential use against appropriate criteria from BS 8233:2014⁷, World Health Organisation (WHO) Guidelines⁸, and ProPG⁹.

⁴ Department of Transport Welsh Office, (1988) Calculation of Road Traffic Noise. HMSO.

⁵ The Highways Agency, (2008). Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7 Noise and Vibration. Stationary Office.

⁶ British Standards Institution, (2019). BS 4142 Methods for rating and assessing industrial and commercial sound, BSI Standards.

⁷ British Standards Institution, (2014). BS 8233 Guidance on Sound Insulation and Noise Reduction for Buildings, BSI Standards

⁸ World Health Organization, (2000) Guidelines for Community Noise. WHO.

⁹ ANC Working Group, (2017) ProPG Professional Practice Guidance on Planning & Noise New Residential Development. ANC IOA & CIEH.

Methodology for Defining Effects

Receptors and Receptor Sensitivity

- 8.39 The categories to determine sensitive receptors are based on the guidance contained in BS 8233, WHO Guidelines, and other relevant reference criteria (see **ES Volume 3, Appendix: Noise and Vibration – Annex 3**).
- 8.40 Table 8.1 summarises the sensitivities for the different receptor types.

Table 8.1 Definition of Sensitive Receptors

Sensitivity	Typical descriptors
High	Residential (dwellings as well as residential healthcare and hotels) Educational facilities (schools and colleges) Theatres and concert halls Places of worship
Medium	Non-residential healthcare and hospitals Noise-sensitive leisure (museums and libraries)
Low	Commercial facilities (retail and office uses)
Very Low	Industrial receptors (workshops and warehouses)

Magnitude of Impact

- 8.41 The magnitude of impact will depend on the nature and characteristic of the noise that a listener is subjected to. Set out below are the various magnitudes of impact associated with:
- Temporary construction activities noise;
 - Temporary construction traffic;
 - Temporary construction vibration; and
 - Completed development building services noise.

Construction Activities

- 8.42 Annex E of BS 5228¹⁰ provides example criteria of absolute noise limits for construction activities and shall be used to determine the impact of construction noise impacts within this assessment. The criteria do not represent mandatory limits, but a set of example approaches intended to reflect the type of methods commonly applied to construction noise. The example criteria are based on a set of limiting values which, if exceeded, may result in a significant effect unless ambient noise levels are sufficiently high to provide a degree of masking of construction noise.
- 8.43 The range of guidance values detailed in BS 5228-1 Annex E has been used to numerically define the magnitude levels, as per Table 8.2. This method classifies proposed development sites into a linear category scale (A to C) defined by the ambient noise levels prevalent at the development site, with Category A representing quieter sites, and Category C representing loud urban sites. According with the findings of the noise survey, the Proposed Development falls under Category A under this method. The values presented in Table 8.2 have therefore been informed by this and chosen to relate to daytime hours from 08:00 to 17:30 on weekdays, and 08:00 to 13:00 on Saturdays.
- 8.44 As construction noise will be an introduction of a new temporary noise source, where impacts are identified they will be adverse.

Table 8.2 Magnitude of Construction Activities Noise Impacts

Magnitude	Noise level dB $L_{Aeq,T}$	Details
High	> 75	Trigger level for noise insulation works, or cost thereof, as set out in Table E.2 of BS 5228. > 85dB $L_{Aeq,T}$ is the trigger level for temporary rehousing, or reasonable cost thereof, as set out in E.4 of BS 5228.
Medium	> 65 ≤ 75	-
Low	= 65	Threshold of significance for the site based on measured noise levels and BS 5228 Annex E, category A
Very Low	< 65	Noise is likely to be audible, but unlikely to change behaviour.

Construction Traffic

- 8.45 The magnitude of impact for construction traffic noise to be used for this assessment are shown in Table 8.3. This approach is based on DMRB, where the change in road traffic noise level when comparing the same year with and without construction traffic is assessed rather than setting an absolute noise level to determine the impact.

Table 8.3 Magnitude of Construction Traffic Noise Impacts

Magnitude	Noise Change dB $L_{A10,18hour}$	Details
High	≥ 5.0	Change in short term noise would be clearly perceptible. Considered in DMRB to be a major magnitude.
Medium	≥ 3.0 < 5.0	Change in short term level may be perceptible under normal conditions. Considered in DMRB to be a moderate magnitude.
Low	≥ 1.0 < 3.0	Change in short term level may be perceived at the upper end of the range under certain conditions. Described in DMRB to be a minor magnitude.
Very Low	< 1.0	Imperceivable change. Described in DMRB to be of negligible magnitude.

Construction Vibration

- 8.46 The magnitude of impact of construction vibration has been determined from criteria set out in BS 5228-2. The values presented in Table 8.4 are based on human response to construction vibration levels in a residential environment.
- 8.47 Cosmetic damage to buildings caused by vibration has not been assessed as this typically would occur at higher vibration than those outlined in Table 8.4. As such, where vibration levels are controlled to meet the levels outlined below, cosmetic damage to building is highly unlikely to occur.

Table 8.4 Magnitude of Construction Vibration Impacts

Magnitude	Vibration level PPV mm/s	Details
High	> 10.0	Vibration is likely to be intolerable for any more than a very brief exposure to this level.
Medium	> 1.0 ≤ 10.0	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
Low	≥ 0.3 ≤ 1.0	Vibration within this range would be perceptible in a residential environment and has the potential to cause complaint but may be tolerated if prior warning has been given.
Very Low	< 0.3	Vibration levels below this level are unlikely to be perceptible in residential environments

¹⁰ British Standards Institution, (2014). BS 5228 Code of practice for noise and vibration control on construction and open sites Parts 1 and 2. BSI Standards.

Completed Development – Building Services

- 8.48 The magnitude of noise impacts associated with the operation of any building services associated with the commercial and residential areas of the Proposed Development have been defined based on guidance found within BS 4142 and the requirements of Policy EN 17 as stated in the Reading Borough Council (RBC) Local Plan¹¹, which required building services noise to be controlled to at least 10dB below the existing background noise levels ($L_{A90,15min}$).
- 8.49 The impact of the sound of a commercial nature depends upon how much the rating level ($L_{Ar,Ti}$) of the specific sound source exceeds the typical background sound level and the context in which the sound occurs. The impact can be determined by subtracting the typical measured background sound level from the rating level. The magnitude of impact for this source of noise is given in Table 8.5.

Table 8.5 Magnitude of New Building Services Plant Noise Impact

Magnitude	Details
High	A difference of +10dB or more is likely to be an indication of a significant adverse impact, depending on context.
Medium	A difference of +5dB is likely to be an indication of an adverse impact, depending on context.
Low	The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
Very Low	Where the rating level is lower than 10dB below the background sound level, this is an indication of the specific sound source not contributing to the overall noise climate, even if it emits constant noise and therefore would have a negligible impact. This is the rating level – background difference required by RBC.

Effect Nature

- 8.50 The following terms have been used to define the environmental effects:
- Adverse – resulting in a negative impact to environmental factors or receptors; and
 - Beneficial – resulting in a positive impact to environmental factors or receptors.

Effect Scale

- 8.51 The resulting effect of a predicted impact (summarised in Table 8.6), is determined through a standard method of assessment based on professional judgement, taking into account the sensitivity of the receptor (as set out in Table 8.1) and the magnitude of change (as set out in Table 8.2 to Table 8.5).

Table 8.6 Significance of Effect Matrix

Sensitivity	Magnitude of impact			
	Very Low	Low	Medium	High
Very Low	Negligible	Negligible	Negligible	Minor
Low	Negligible	Negligible	Minor	Minor
Medium	Negligible	Minor	Moderate	Moderate
High	Negligible	Minor	Moderate	Major

Geographic Extent of Effect

- 8.52 The geographic extent of the effects is identified. The 'local' effects are those affecting the site and neighbouring receptors, while effects upon receptors in the RBC beyond the vicinity of the site and its neighbours are at a 'district' level. Effects affecting Berkshire are at a 'regional' level, whilst those which affect different parts of the country, or England, are considered being at a 'national' level.

Effect Duration

- 8.53 For the purposes of the ES, effects that are generated because of the construction works (i.e., those that last for this set period) are classed as 'temporary'; these may be further classified as either 'short term' or 'medium-term' effects depending on the duration of the construction works that generate the effect in question in line with the general guidance contained within BS 5228-1.
- 8.54 Effects that result from the completed and operational as of the Proposed Development are classed as 'permanent' or 'long-term' effects.

Direct or Indirect effects

- 8.55 For the purposed of the ES, 'direct' effects are those that are classed as a direct consequence of a project related impact and are likely to be spatially or temporally concurrent.
- 8.56 'Indirect' effects are a secondary consequence to a project related impact and are likely to be spatially or temporally removed from the direct impacts.

Categorising Likely Significant Effects

- 8.57 Effects that are 'Moderate' and 'Major' are considered as 'significant' (shaded grey in Table 8.8), and 'Negligible' and 'Minor' effects are considered as 'not significant'.

BASELINE CONDITIONS

Current Baseline Conditions

- 8.58 The prevailing weather conditions were generally suitable for the purposes of environmental noise measurements during the noise survey with the exception of the following periods which were affected by rainfall and have been excluded from subsequent acoustic assessments and marked on the sound level time history graphs presented in Appendix A:
- 13/01/2023 17:00 to 20:30 hours;
 - 14/01/2023 04:00 to 15/01/2023 18:00 hours

- 8.59 The above exclusion is not considered to alter the robustness of the assessments included in this chapter.

- 8.60 **ES Volume 3, Appendix: Noise and Vibration - Annex 4** contains the details of the noise survey and the data measured.

Noise Climate

- 8.61 The main noise sources were noted to be road traffic on the A329 to the west of the proposed site and traffic on Oxford Road and St Mary's Butts to the north and east of the site, respectively.
- 8.62 The site is located in a predominantly commercial setting, with a number of hotels located to the west, along with the Hexagon theatre. Several shops and pub/restaurants are located along Oxford Road, St Mary's Butts, and Hosier Street to the north and east of the Proposed Development, including as part of the Broad Street Mall shopping centre.

- 8.63 In addition to road traffic noise, plant items associated with the surrounding commercial developments contribute to the existing noise climate at site.

Noise from Former Night Club

- 8.64 The former nightclub located on Hosier Street was not operating at the time of the noise survey and will be demolished as part of the redevelopment of the site. Therefore, noise levels from the operation of the night club do not contribute to the baseline noise levels and are not considered in the assessments.

Noise from Neighbouring Venues

- 8.65 The results of the noise survey do not indicate any significant entertainment noise generated from neighbouring entertainment venues, namely The Boundary Pub on St Mary's Butts and Blue Collar Corner on Hosier Street.

11 Reading Borough Council, (2019). Reading Borough Local Plan Adopted November 2019.

8.66 Due to the nature of The Boundary Pub as a drinking establishment with an outdoor terrace area at the western façade of the building, it is deemed that noise from the Pub requires assessment from a noise impact perspective.

8.67 It should be noted that the Blue Collar Corner has been retained as a “Meanwhile Use” by Reading Borough Council and will remain in operation during the construction of the Proposed Development until its lease expires in March 2025. The Council is currently determining how and where to locate Blue Collar Bar going forward, but given works proposed to the south of the site associated with the Minster Quarter, where the Blue Collar Bar is currently located, it has been determined to exclude this from the assessment.

Noise from The Hexagon Theatre

8.68 Measurements taken at SP1 were taken to determine if entertainment noise from the Hexagon theatre may impact the Proposed Development. The measurements were undertaken on the 19th January 2023 between 18:45 and 22:15. The event during the time of the measurements was a musical (Baz Luhrmann’s Strictly Ballroom) with amplified music, which is considered to be a typical event for the theatre. The show was noted to take place from 19:30 until 21:30.

8.69 The results of the noise survey show that the ambient noise level at SP1 (in the absence of the noise produced by the event at the Hexagon Theatre) were between 62 and 64dB $L_{Aeq,15mins}$. When the show was in progress, the measured noise levels were also between 62 and 65dB $L_{Aeq,15mins}$. The 1dB exceedance of the ambient noise level was noted to occur for a single 15-minute period and is likely due to pedestrians in close proximity to the measurement position, as this along with road traffic noise was noted to be the dominant noise source.

8.70 The noise levels detailed above do not indicate any significant entertainment noise generated from the nearby Hexagon Theatre impacted the site during the survey.

Unattended Monitoring (Long-Term)

8.71 Long term noise monitoring was carried out at locations LP1 to LP3 overlooking the roads below.

8.72 Table 8.7 and Table 8.8 provide a summary of the noise levels measured at the long-term monitoring locations, LP1 to LP3, for the day and night respectively.

Table 8.7 Summary of Measured Noise Levels at Locations L1 to L3 - Day (07:00 – 23:00 hours)

Start Date	Daytime Noise Level, dB $L_{Aeq,16hour}$		
	Location LP1	Location LP2	Location LP3
13/01/2023*	58	62*	56*
15/01/2023*	54	62*	55*
16/01/2023	57	64	57
17/01/2023	57	65	57
18/01/2023	58	64	57
19/01/2023	-	-	57

Note*: Adverse weather conditions were noted to impact the measurements, such periods have been excluded from the results.

Table 8.8 Summary of Measured Noise Levels at Locations L1 to L3 - Night (23:00 – 07:00 hours)

Start Date	Location LP1		Location LP2		Location LP3	
	dB $L_{Aeq,8hour}$	dB $L_{Amax,f}$	dB $L_{Aeq,8hour}$	dB $L_{Amax,f}$	dB $L_{Aeq,8hour}$	dB $L_{Amax,f}$
13/01/2023	55*	59 – 86	60*	65 – 80*	55*	60 – 83
15/01/2023	55	58 – 81	59	64 – 71	54	63 – 89
16/01/2023	53	53 – 84	59	63 – 74	53	53 – 76
17/01/2023	50	53 – 88	59	63 – 83	52	52 – 75
18/01/2023	-	-	59	63 – 72	52	54 – 74

Start Date	Location LP1		Location LP2		Location LP3	
	dB $L_{Aeq,8hour}$	dB $L_{Amax,f}$	dB $L_{Aeq,8hour}$	dB $L_{Amax,f}$	dB $L_{Aeq,8hour}$	dB $L_{Amax,f}$
19/01/2023	-	-	-	-	52	58 - 74

8.73 Table 8.8 also includes the night time noise events in terms of the $L_{Amax,f}$ parameter. The 10th highest maximum noise level at each measurement location, $L_{Amax,f}$, determined for a typical night is presented below. This is considered relevant as Building Regulations Approved Document O (ADO)¹² and WHO refer to internal maximum noise levels that should not be exceeded more than 10 times per night.

Table 8.9 Summary of 10th Highest Maximum Noise Level at Locations L1 to L3 - Night (23:00 – 07:00 hours)

Start Date	Night Time Maximum Noise Level, dB $L_{Amax,f}$		
	Location LP1	Location LP2	Location LP3
16/01/2023	66	68	64

8.74 ES Volume 3, Appendix: Noise and Vibration – Annex 4 provides a statistical analysis graph for the day and night periods measured at each of the locations which presents the distribution of the background noise levels during each day and night periods recorded during the survey. Table 8.10 presents the values deemed to be statistically representative of the background levels at each location at during the day and night periods. It should be noted that a time-weighting period of 15-minutes has been used for both the day and night.

Table 8.10 Statistically Representative Background Noise Levels at Locations L1 to L3

Period	Representative background noise level, dB $L_{A90, 15 minutes}$		
	Location LP1	Location LP2	Location LP3
Day	53	62	55
Night	43	55	49

Attended Monitoring (Short-Term)

8.75 In addition to the long-term survey, short sample measurements were taken at location SP1, SP2 and SP3 on 19th and 20th January 2023. The purpose of each measurement location is outlined below:

- SP1 (19/01/23) – Measurement of the evening noise levels incident on the Proposed Development as a result of a musical taking place at the nearby Hexagon Theatre;
- SP2 (20/01/23) – Measurement of the daytime noise levels at the edge of A329 to calibrate the 3D noise model;
- SP3 (20/01/23) – Measurement of the daytime noise levels at the edge of St Mary’s Butts to calibrate the 3D noise model.

8.76 The noise levels measured at each short-term location are presented in Table 8.11.

Table 8.11 Summary of Noise Levels at Locations SP1 to SP3

Measurement Location	Duration (min)	Time Period, T (min)	Typical Measured Noise Level (dB, Range L_{Aeq} , $L_{Amax,f}$ and L_{A10})		
			L_{Aeq}	$L_{Amax,f}$	L_{A10}
SP1	210	15 min	62 - 65	70 - 89 ¹	2
SP2	180	1 min	71 - 79	75 - 93	77
SP3	60	1 min	57 - 76	66 - 94	67

¹² HM Government, (2021). The Building Regulation 2010: Approved Document O. RIBA Publishing.

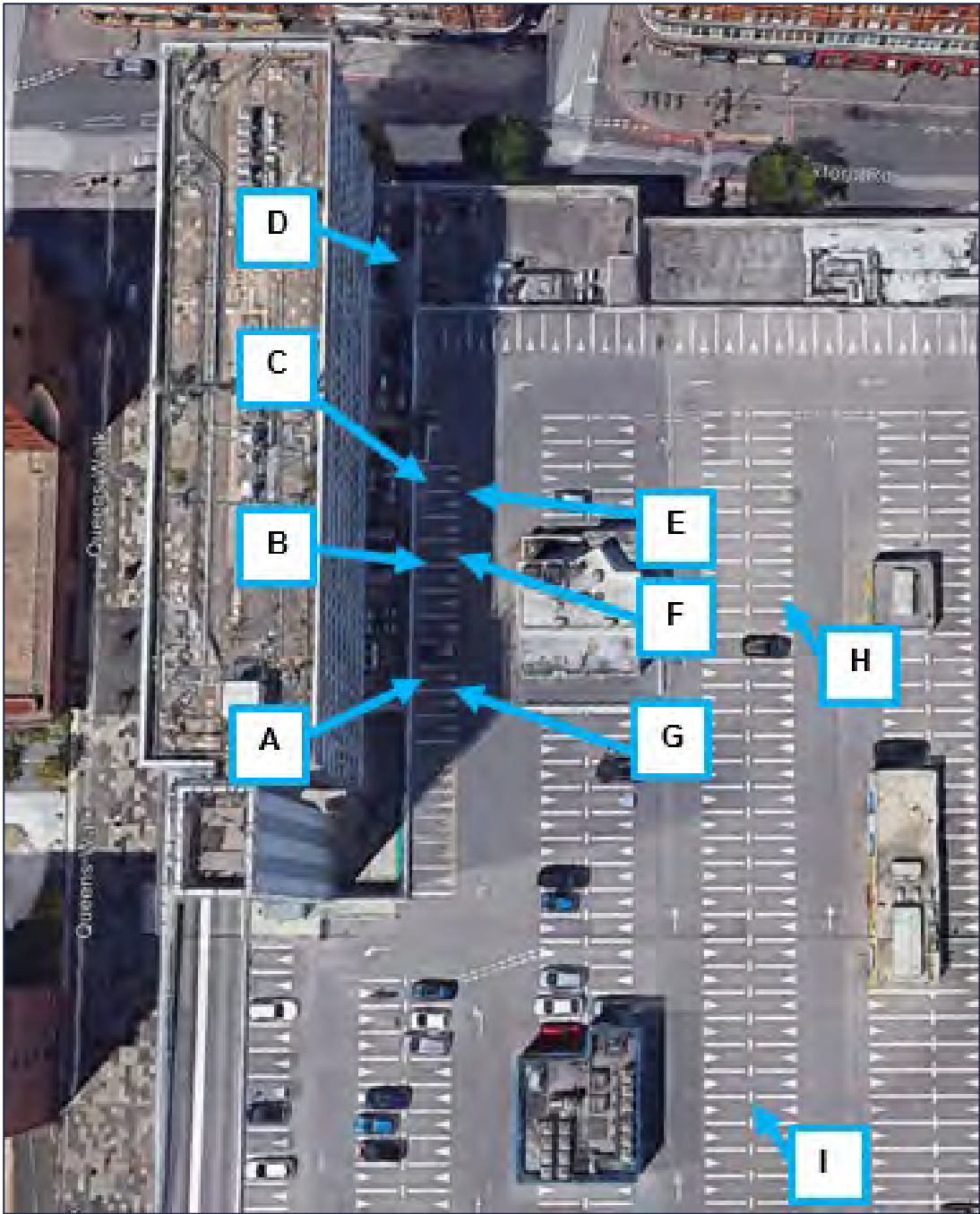
Measurement Location	Duration (min)	Time Period, T (min)	Typical Measured Noise Level (dB, Range L_{Aeq} , $L_{Amax,f}$ and L_{A10})		
			L_{Aeq}	$L_{Amax,f}$	L_{A10}
Note 1: The L_{Amax} noise levels are not considered relevant to the assessment at this location. The L_{Amax} noise levels were mainly caused by local pedestrian movement along Dusseldorf Way and in the carpark, therefore are not considered representative.					
Note 2: The noise monitoring equipment was not setup to record L_{A10} levels at this location, as they are not relevant to the assessment to be undertaken based on the noise levels at this location.					

- 8.77 Attended spot measurements were also taken of various plant items located across the roof level of the Broad Street Mall Shopping Centre between 13:00 and 14:30 on 13th January 2023. The plant items consisted of a number of condenser units, as well as ducted extract fans. The noise climate on-site was dominated by the extract fans and was steady and continuous.
- 8.78 These locations were selected to measure noise from existing mall retail unit fans and included measurements in octave bands between 63Hz and 8kHz. When operating, the kitchen extract fan serving the boundary was noted to be the main source dominating the noise climate at measurement position LP1.
- 8.79 The octave band data measured at each location are summarised in 8.79 below. 8.79 presents the logarithmic average of the total duration taken during the day at the distance specified in the Table.

Table 8.12 Summary of Measured 1/1 Octave Band Noise Levels at Locations A-I

Location	Approximate Distance from Plant (m)	Sound Pressure Level, L_{eq} (dB)								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
A	3.5	73	70	69	64	60	57	52	46	67
B	3.5	72	70	68	67	64	59	53	47	69
C	3.5	68	68	65	64	62	59	56	56	67
D	1	80	81	73	74	71	69	64	54	77
E	7.5	69	66	62	61	58	54	47	40	63
F	7.5	68	64	64	62	58	53	47	40	64
G	7.5	69	68	66	62	58	54	49	41	64
H	7	71	64	59	54	54	49	40	33	58
I	10	60	56	54	54	54	46	44	39	57

Figure 8.1 Plant Spot Measurement Locations



RECEPTORS AND RECEPTOR SENSITIVITY

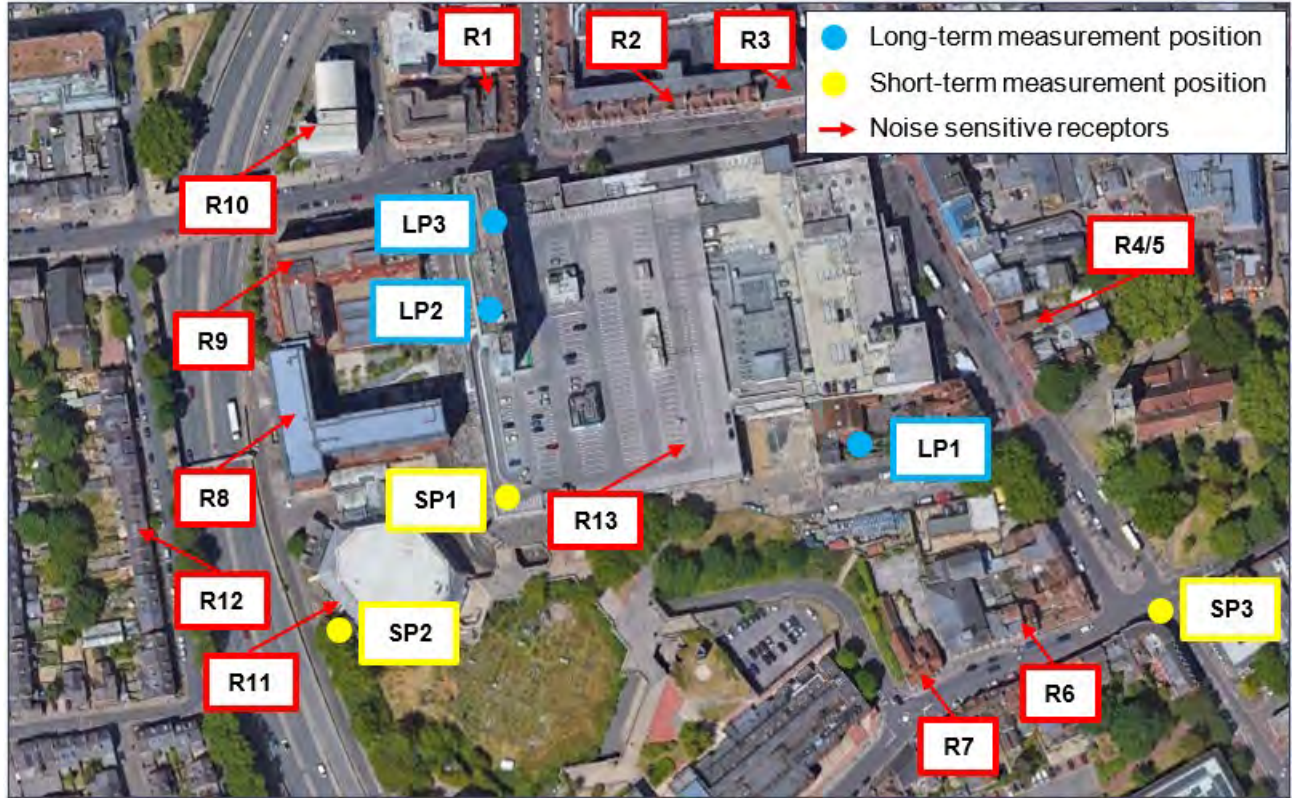
Existing Receptors and Receptors within the Evolved Baseline

- 8.80 The list of existing noise-sensitive receptors is not intended to be exhaustive, and it aims to contain a representative selection of the closest noise sensitive receptors in each direction from the site. These receptors are considered representative of other potential receptors further away from the site, as if noise levels are not deemed significant at these receptors, the receptors further afield will also not be significantly affected. Should significant effects be experienced at the closest receptors, receptors at a greater distance will then be considered to determine the extent of the significant effects.
- 8.81 Table 8.13 contains the nearest sensitive receptors that would be present at the time of construction of the Proposed Development. Figure 8.1 illustrates the location of the receptors and survey locations.

Table 8.13 Existing Nearest Noise-Sensitive Receptors

Reference	Name	Receptor use	Distance to site	Sensitivity
R1	42 Oxford Street	Residential	20 m	High
R2	Mcilroys building	Residential	20 m	High
R3	City Wall House Aparthotel	Hotel	40 m	Medium
R4	59-61 St Marys Butts	Residential	30 m	High
R5	Allied Arms Public House	Assumed tenanted residential	30 m	High
R6	Castle Street flats	Residential	90 m	High
R7	The Sun Inn Public House	Assumed tenanted residential	90 m	High
R8	Queens Court student accommodation	Residential	18 m	High
R9	Pentahotel Reading	Hotel	60 m	Medium
R10	Travelodge Reading Central	Hotel	88 m	Medium
R11	Hexagon Theatre	Theatre	20 m	High
R12	2 – 42 Howard Street	Residential	130 m	High
R13	Broad Street Mall	Retail	2 m	Low

Figure 8.2 Long-term Survey and Receptor Locations



Introduced Receptors

8.82 Consideration has also been given to the introduced receptors, Building C and D. These Buildings will both be occupied prior to the completion of Buildings A and B and have been considered as sensitive receptors whilst the construction of Buildings A and B are completed.

Table 8.14 Introduced Noise-Sensitive Receptors

Reference	Name	Receptor use	Distance to site	Sensitivity
R14	Building C	Residential	Within the site	High
R15	Building D	Residential	Within the site	High

POTENTIAL EFFECTS

Demolition and Construction

Construction Activities

- 8.83 Noise generated during the demolition and construction works of the Proposed Development has the potential to adversely affect nearby residential receptors. In the absence of mitigation and management, activities relating to these works may have a high magnitude of impact at highly sensitive receivers (i.e., residential), and could result in a significant effect.
- 8.84 A conservative noise assessment of the predicted construction noise levels based on the construction programme at the receptors identified in Table 8.13 has been carried out, and a summary of the worst-case calculated incident noise levels at each receptor is presented in Table 8.15.
- 8.85 The assumed construction activities for each of phase of work are detailed in Table 8A.1 within Annex A of this ES chapter. The cumulative sound power level assumes each item is running continuously throughout each phase, which, in practice, is unlikely to occur.

Table 8.15 Predicted Construction Noise Levels at Noise-Sensitive Receptors

Ref	Reference	Construction noise level incident at receptor, $L_{Aeq,T}$ dB						
		Demolition & enabling works	Substructure & basement	Superstructure	Envelope, roof, shell and core	Fit out and external works	Fit out and external works (Buildings A & B)	Fit out and external works (Building A)
R1	Predicted Noise Level	71 (Medium)	67 (Medium)	64 (Very Low)	71 (Medium)	68 (Medium)	67 (Medium)	64 (Very Low)
	Effect Nature, Scale	Moderate Adverse		Negligible	Moderate Adverse		Negligible	
R2	Predicted Noise Level	72 (Medium)	67 (Medium)	65 (Low)	72 (Medium)	69 (Medium)	68 (Medium)	65 (Low)
	Effect Nature, Scale	Moderate Adverse		Minor Adverse	Moderate Adverse		Minor Adverse	
R3	Predicted Noise Level	68 (Medium)	64 (Very Low)	62 (Very Low)	68 (Medium)	66 (Medium)	65 (Very Low)	62 (Very Low)
	Effect Nature, Scale	Moderate Adverse	Negligible		Moderate Adverse		Negligible	
R4	Predicted Noise Level	67 (Medium)	64 (Very Low)	62 (Very Low)	67 (Medium)	56 (Very Low)	62 (Very Low)	59 (Very Low)
	Effect Nature, Scale	Moderate Adverse	Negligible		Moderate Adverse	Negligible		
R5	Predicted Noise Level	67 (Medium)	64 (Very Low)	62 (Very Low)	67 (Medium)	56 (Very Low)	62 (Very Low)	59 (Very Low)
	Effect Nature, Scale	Moderate Adverse	Negligible		Moderate Adverse	Negligible		
R6	Predicted Noise Level	72 (Medium)	68 (Medium)	66 (Medium)	72 (Medium)	65 (Low)	67 (Medium)	64 (Very Low)

Ref	Reference	Construction noise level incident at receptor, $L_{Aeq,T}$ dB						
		Demolition & enabling works	Substructure & basement	Superstructure	Envelope, roof, shell and core	Fit out and external works	Fit out and external works (Buildings A & B)	Fit out and external works (Building A)
	Effect Nature, Scale	Moderate Adverse				Minor Adverse	Moderate Adverse	Negligible
R7	Predicted Noise Level	73 (Medium)	69 (Medium)	66 (Medium)	73 (Medium)	64 (Very Low)	63 (Very Low)	60 (Very Low)
	Effect Nature, Scale	Moderate Adverse				Negligible		
R8	Predicted Noise Level	85 (High)	81 (High)	78 (High)	85 (High)	80 (High)	79 (High)	76 (High)
	Effect Nature, Scale	Major Adverse						
R9	Predicted Noise Level	75 (Medium)	71 (Medium)	68 (Medium)	75 (Medium)	70 (Medium)	69 (Medium)	66 (Medium)
	Effect Nature, Scale	Moderate Adverse						
R10	Predicted Noise Level	59 (Very Low)	56 (Very Low)	54 (Very Low)	59 (Very Low)	54 (Very Low)	55 (Very Low)	52 (Very Low)
	Effect Nature, Scale	Negligible						
R11	Predicted Noise Level	82 (High)	78 (High)	77 (High)	78 (High)	67 (Medium)	66 (Medium)	63 (Very Low)
	Effect Nature, Scale	Major Adverse				Moderate Adverse		Negligible
R12	Predicted Noise Level	63 (Very Low)	60 (Very Low)	57 (Very Low)	59 (Very Low)	62 (Very Low)	61 (Very Low)	58 (Very Low)
	Effect Nature, Scale	Negligible						
R13 - BSM	Predicted Noise Level	100 (High)	97 (High)	94 (High)	97 (High)	94 (High)	95 (High)	92 (High)
	Effect Nature, Scale	Minor Adverse						
R14 - Building C	Predicted Noise Level	-	-	-	-	-	79 (High)	76 (High)
	Effect Nature, Scale	N/A					Major Adverse	
R15 - Building D	Predicted Noise Level	-	-	-	-	-	73 (Medium)	70 (Medium)
	Effect Nature, Scale	N/A					Moderate Adverse	

8.86 The predicted noise levels in Table 8.15 show that, as a worst-case (unmitigated), a high magnitude of impact is predicted at receptor R8, R11, R13 and R14. Receptors R8 and R14 are residential with high sensitivity which results in a direct, local, temporary, Major Adverse effect (significant). Receptor R11 is a commercial

receptor with high sensitivity which results in a direct, local, temporary, Major Adverse effect (**significant**). Receptor R13 is a commercial receptor with low sensitivity which results in a direct, local, temporary, Minor Adverse effect (not significant), albeit is recognised that the absolute noise levels are considered to be very high at the external envelope of the receptor due to the immediate adjacency of the building to the development.

- 8.87 The predicted noise levels in Table 8.15 show that, as a worst-case (unmitigated), a medium magnitude of impact is predicted at receptor R1, R2, R3, R4, R5, R6, R7, R9 and R15. These receptors are residential with high sensitivity which results in a direct, local, temporary, Moderate Adverse effect (not significant).
- 8.88 As previously noted, in practice this noise level is unlikely to occur, as the plant items will be spread across the site rather than located in a single location is close proximity to each of the receptors.
- 8.89 The predicted noise levels in Table 8.15 show that, as a worst-case (unmitigated), a very low magnitude of impact is predicted at the other residential receptors (R10 and R12). These receptors are high sensitivity, resulting in a direct, local, temporary, Negligible effect (not significant).

Construction Traffic

- 8.90 Construction traffic passing to and from the site along Castle Street, Libre Walk and the A329 will also represent a potential source of noise to surrounding properties. The amount of construction traffic is likely to be small in comparison to the existing flow on these roads. It is reasonable to assume that at the peak of the construction 92 HGVs will access the site in a day. This additional HGVs would result in 0.1dB or less increase in road traffic, which results in a very low magnitude of impact. Such a magnitude of impact, which in highly sensitive receptors creates a direct, local, temporary, Negligible effect (not significant).

Construction Vibration

- 8.91 The main source of vibration during construction is anticipated to come from the piling of for each building. The proposed piling method to achieve this is via use of a Continuous Flight Auger (see **ES Volume 1, Chapter 5: Demolition and Construction**). As stated in Annex F of BS5228-2, the levels of vibration associated with this type of piling are minimal as the process relies on slow steady motions.
- 8.92 The minimum distance between a vibration sensitive residential receiver and location at which piling is assumed to take place is 14m, whereas the distance to a commercial receptor is less than 5m. Based on the PPV values given in Annex D of BS 5228-2 for augering, PPV levels from construction of the Proposed Development are not expected to exceed 0.3 mm/s at the nearest residential receptors but may be up to 3 mm/s at the nearest commercial receptor.
- 8.93 The above vibration levels would be a very low magnitude of impact at the closest residential receptors (high sensitivity), which is a direct, local, temporary, Minor Adverse effect (not significant). At the commercial premises within the Broad Street Mall shopping centre (low sensitivity), there may be a medium level of impact, which would result in a direct, local, temporary, Minor Adverse effect (not significant).
- 8.94 The partial demolition works as part of the enabling works at Buildings A, B and C will be carried out by hand. To allow the demolition to commence a mechanical disc saw will be used to cut the slab at all levels with mobile towers and scissor lifts to access upper floor.
- 8.95 The initial saw cut and light demolition works may result in a medium impact on the retail units within Broad Street Mall (low sensitivity) which would result in a direct, local, temporary, minor adverse effect (not significant).

Completed Development

Building Services

- 8.96 Any proposed new fixed building services plant associated with the Proposed Development shall be specified such that the total cumulative Rating Level ($L_{Ar,Ti}$) from the proposed building services items, as determined in accordance with Policy EN 17 as stated in the Reading Borough Council (RBC) Local Plan, does not exceed 10dB below the background noise level at the nearest noise sensitive receptors.
- 8.97 Cumulative noise contributions from the building services scheme, including future provision for the commercial units created as part of the Proposed Development at low-level, will be controlled through the selection of adequate items of plant and the provision of suitable noise mitigation measured, as required.
- 8.98 This will ensure that all noise from the operation of the building services plant is of very low magnitude of impact at highly sensitive receptors, resulting in a direct, local, permanent, Negligible effect (not significant).

8.99 In accordance with the above, the building services plant for the Proposed Development will be designed such that the limits presented in Table 8.16 are not exceeded.

Table 8.16 Maximum Permissible Cumulative Plant Noise Limits at Sensitive Receptors

Cumulative plant noise limits at 1m from any noise sensitive façade, dB $L_{A,T,r}$	
Daytime (07:00 - 23:00)	Night time (23:00 – 07:00)
38	33

Site Suitability

8.100 The site, as part of the existing Broad Street Mall Shopping Centre located in the Reading town centre, is exposed to noise from external noise sources (i.e., commercial activities, road traffic from the surrounding road network).

Existing Building Services

8.101 As mentioned previously there are several existing building services plant items located on the rooftop of the Multi-Storey Car Park (MSCP) serving the commercial premises located in the existing mall and as well as a kitchen extract fan on the rooftop of The Boundary Pub to the east of the development site.

8.102 Measurements of the individual plant items located on the rooftop of the MSCP were undertaken and are detailed previously in 8.79. When operating, the kitchen extract fan serving the boundary was noted to be the main source dominating the noise climate at measurement position LP1, and as such this noise levels gathered at this location have been used to inform the assessment.

8.103 A summary of the sound power levels assigned to each of the noise sources based on calibration of the noise 3D noise model are presented in the following Table.

Table 8.17 Existing Building Services Plant Sound Power Levels

Source	Sound Power Level, dB L_{WA}
S1	84
S2	87
S3	81
S4	92
S5	90

8.104 The 3D model as shown in Figure 8.3 predicts that noise levels from rooftop plant items at the worst affected facades on the west of the development to be **60dB $L_{Aeq,T}$** .

Figure 8.3 Predicted Noise from the Existing Building Services Plant ($L_{Aeq,T}$)



8.105 Table 8.18 presents the BS 4142:2014+A1:2019 assessment of the existing building services plant on the western façade. The assessment considers the night time period only as this is considered “worst case” with respect to noise impact.

Table 8.18 BS 4142 Assessment of Existing Building Services Plant

Parameter / Description	Time Period		Commentary
	Daytime (07:00 – 23:00 hrs)	Night Time (23:00 – 07:00 hrs)	
Predicted Specific Sound Level at residential apartments	60dB $L_{Aeq,15mins}$	60dB $L_{Aeq,15mins}$	-
Acoustic Feature Correction	+3dB	+3dB	3dB feature correction for intermittency has been applied.
Rating Level	63dB $L_{Ar,15mins}$	63dB $L_{Ar,15mins}$	The exact operating times for plant items is unknown, so it is assumed they may operate during the night time period.
Background Sound Level	53dB L_{A90}	43dB L_{A90}	Representative Background Sound Levels as measured at LP1. This is worst case as noise levels measured at LP2 and LP3 are higher.
Excess of Rating Level over Background Sound Level	10dB	20dB	In line with the guidance in BS 4142, this exceedance is an indication of a significant adverse impact, depending on the context.

8.106 The BS 4142:2014+A1:2019 assessment finds that the Rating Level of the plant noise is significantly above the existing Background Sound Level at the future western façade of the development and is therefore concluded to be a significant impact and requires a scheme of mitigation.

8.107 To mitigate the impact on the internal ambient noise levels within apartments from other environmental noise sources on the western facade, windows are required to remain closed for both standard background ventilation conditions and during periods of overheating which will assist in controlling the impact on internal ambient noise levels as a result of noise emission from the existing plant items.

8.108 The existing plant noise has been included in the calibrated model as part of the external noise intrusion assessment, therefore the specified glazing is considered suitable to control the plant noise such that the

internal ambient noise levels detailed in BS 8233:2014 will be achieved. Given that the plant is considered to not be a dominant noise source across the majority of the development, this approach is considered acceptable.

- 8.109 Plant noise is noted to be the dominant noise source on the western façade of Building D during the daytime, as such the contribution of the building services will be mitigated such that it does not exceed a more stringent criteria of NR20 (L_{eq}) within the overlooking apartments.
- 8.110 The glazing performance of the dual aspect living rooms overlooking the outdoor area is recommended to be enhanced to mitigate the plant noise break-in to the living rooms when the windows are closed. To achieve the NR20 (L_{eq}) criterion the glazing is required to provide a minimum acoustic performance of **35dB R'_w+C_{tr}** .

Existing Neighbouring Venue

- 8.111 An assessment of the noise emission from the external garden located at the neighbouring public house, The Boundary Pub, has been undertaken.
- 8.112 There are no formal guidance documents that are directly applicable to entertainment noise from patrons of a public house that allow for an assessment of the noise impact to be undertaken. However, NANR 163 Noise from Pubs and Clubs¹³, although not directly applicable, provides absolute noise levels that may be applied to determine acceptability. It should be noted that the types of noise (karaoke, dance music, rock and sport noise) used to inform the above research paper are not directly comparable to patron noise and typically would have consisted of a higher level of low frequency noise that is typically more disruptive to nearby residents.
- 8.113 The following Table presents the semantic descriptors and associated value of acceptability presented in NANR 163 for bedrooms during the night time period that will be used to inform the assessment:

Table 8.19 Reproduced NANR 183 Descriptor and Associated Value of Acceptability

Semantic Descriptor	Score	Absolute $L_{Aeq,5mins}$
Clearly Acceptable	1	17.0
	2	20.4
	3	23.8
	4	27.2
Just Acceptable	5	30.6
Just Unacceptable	6	34.0
	7	37.4
	8	40.8
	9	44.2
Clearly Unacceptable	10	47.5

- 8.114 Based on information from The Boundary Pub website it is understood that the establishment operates as follows:
- Opening hours are until 00:00 hours Sunday to Thursday, and until 02:00 hours Friday and Saturday;
 - Based on the number of seats, the outdoor seating area holds up to a maximum of c.36 people at the busiest times.
- 8.115 With regard to the use of the outdoor terrace area, noise levels under worst case conditions have been predicted using the 3D noise model. The model is based on 18 people (half of the maximum capacity) all talking in a “loud” voice simultaneously, as is considered a typical “worst case” scenario.
- 8.116 Sound source levels for a loud voice are derived from ANSI 3.5 and shown in Table 8.20.

Table 8.20 Source Noise Levels, Loud Voice (ANSI 3.5)

Sound Source	A-weighted Broadband Noise Level, dB L_{WA}	Unweighted Sound Power Level (dB L_w) @ Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
Loud Voice	82.6	52.0	63.0	72.1	79.6	80.2	72.9	65.9

- 8.117 The 3D model as shown in Figure 8.4 predicts that the worst case noise level at the façade as a result of noise from the terrace to be **68dB $L_{Aeq,T}$** at living rooms on the western façade and **52dB $L_{Aeq,T}$** at the bedrooms on the south façade of the development.

Figure 8.4 Noise Map of Patron Noise from The Boundary Pub Outdoor Seating Area ($L_{Aeq,T}$)



- 8.118 Table 8.21 presents a summary of the noise break-in assessment of The Broadway outdoor terrace operation.

Table 8.21 Assessment of Public House Terrace

Parameter / Description	Room	
	Bedroom	Living Room
Predicted Specific Sound Level at Facade	52dB $L_{Aeq,T}$	68dB $L_{Aeq,T}$
Specified Glazing Sound Insulation Performance	27dB $R'_w + C_{tr}$	35dB $R'_w + C_{tr}$
Predicted Internal Ambient Noise Level	21dB $L_{Aeq,T}$	32dB $L_{Aeq,T}$

13 DEFRA, (2006). Noise from Pubs and Clubs (Phase II) Final Report. DEFRA.

Parameter / Description	Room	
	Bedroom	Living Room
NANR 163 Score & Descriptor of Acceptability	2-3 Clearly Acceptable	5-6 Between Just Acceptable and Just Unacceptable

- 8.119 As mentioned previously the NANR 163 guidance is applicable to bedrooms during the night time period, and it is considered that a higher noise level is likely to be tolerated in living rooms, particularly during the daytime. On this basis it is anticipated that the predicted worst case patron noise will be acceptable within living rooms
- 8.120 The assessment finds that the noise emission from the pub terrace may be suitably mitigated by the proposed glazing specification when windows are closed, in line with the ventilation strategy for standard background ventilation conditions and during periods of overheating, and as such is not anticipated to result in a significant impact. Therefore, no further mitigation is required.

Building Envelope

- 8.121 Predictions have been undertaken using the CadnaA noise mapping software to produce a baseline noise model to generate noise level predictions for the site and surrounding area. The predicted noise levels incident on the façade are presented in Figure 8.5 to Figure 8.8.

Figure 8.5 Predicted SW Façade Incident Noise Levels – Daytime (07:00 – 23:00)



Figure 8.6 Predicted NE Façade Incident Noise Levels – Daytime (07:00 – 23:00)

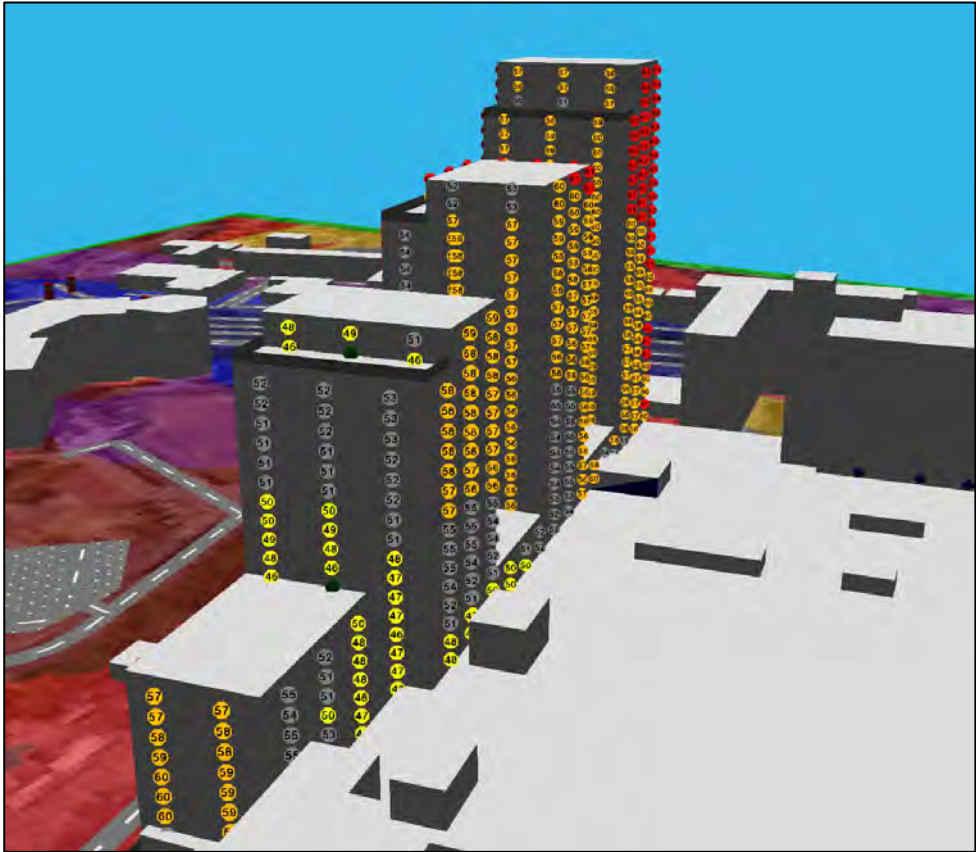


Figure 8.7 Predicted SW Façade Incident Noise Levels – Night time (23:00 – 07:00)

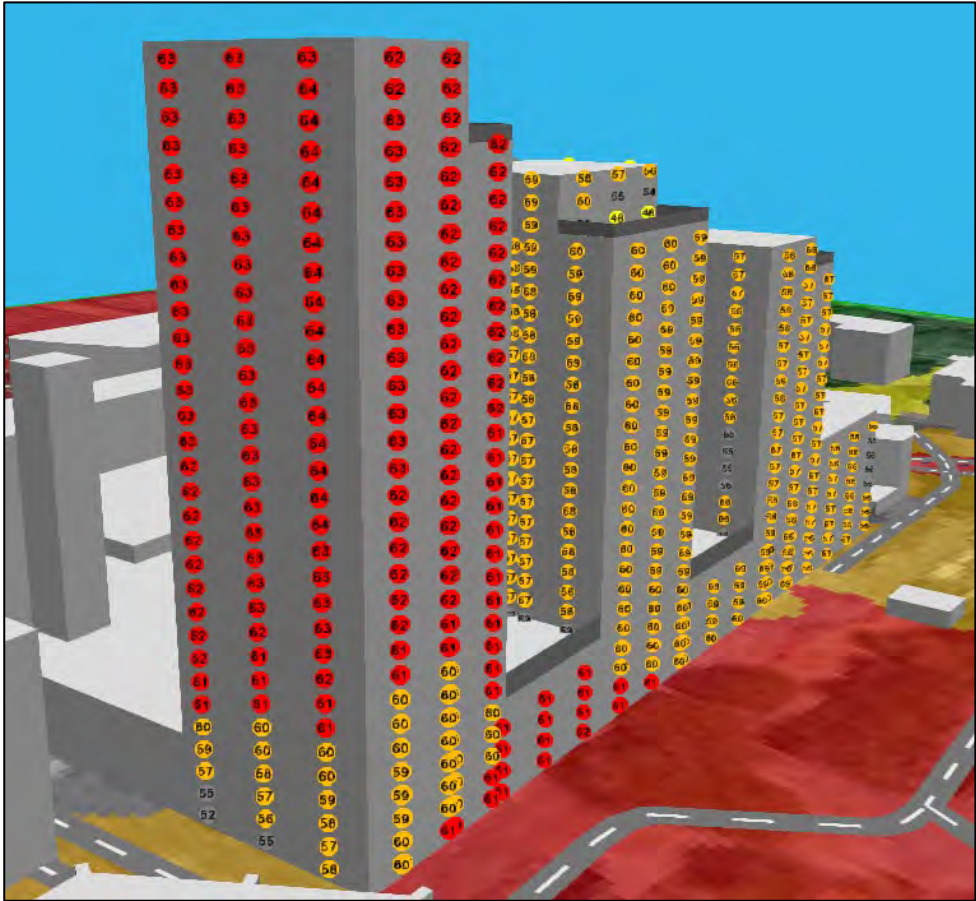
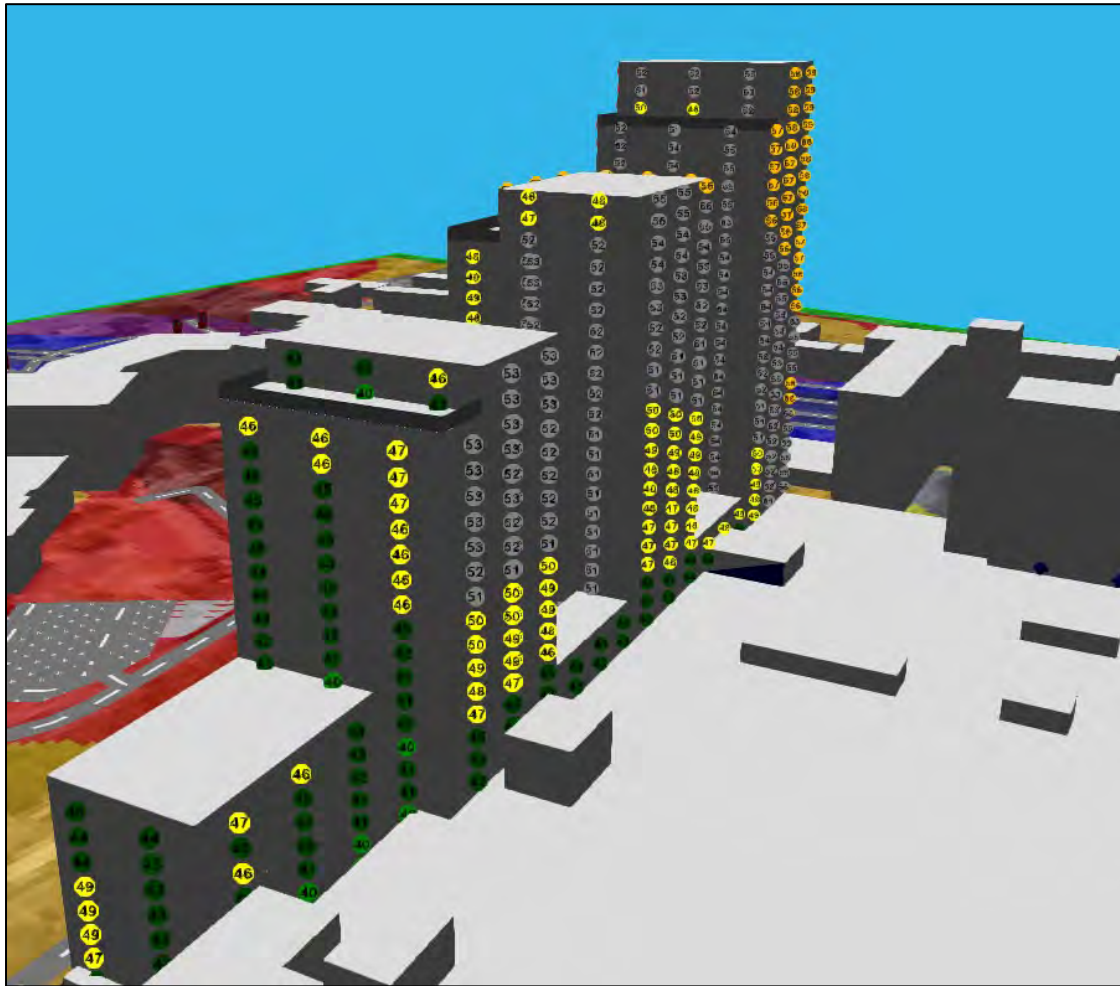


Figure 8.8 Predicted NE Façade Incident Noise Levels – Night time (23:00 – 07:00)



- 8.122** The sound insulation performance of the building envelope will be driven by the performance of the glazed elements within the build-up. On the basis that the solid non-glazed elements of the building envelope will achieve a minimum sound insulation performance of 45dB $R'_w + C_{tr}$, Table 8.22 provides preliminary acoustic performance requirements for the glazing (and any glazed doors) for residential dwellings forming part of the development that are needed to meet the requirements for suitable internal ambient noise levels when windows are closed.
- 8.123** These specifications are provided to demonstrate site suitability only and will require further review during detailed design.
- 8.124** Note: The values in Table 8.22 are given in terms of the on-site performance requirement $R'_w + C_{tr}$ and a suitable correction should be included from standard laboratory test data; for large glazing units this is typically up to 2dB.
- 8.125** Figure 8.9 shows where the façade performances presented in Table 8.22 apply.

Figure 8.9 Façade Zone Markup



Table 8.22 Recommended Minimum Sound Insulation Performance of Façade Glazed Elements

Façade Zone	Room Type	Example Glazing Configuration	Minimum Weighted Sound Reduction Index dB $R'_w + C_{tr}$
Zone A	Bedrooms / Dual Aspect Living Rooms	4mm / 12mm / 8mm Double Glazing	33
	Living Rooms	4mm / 12mm / 6mm Double Glazing	29
Zone B	Dual Aspect Living Rooms	4mm / 12mm / 8mm Double Glazing	33
	Living Rooms / Bedrooms / Studios	4mm / 12mm / 6mm Double Glazing	29
Zone C	Dual Aspect Living Rooms	4mm / 12mm / 8mm Double Glazing	33
	Living Rooms / Bedrooms	4mm / 12mm / 4mm Double Glazing	27
Zone D	Dual Aspect Living Rooms / Bedrooms	4mm / 12mm / 6mm Double Glazing	29
	Living Rooms	4mm / 12mm / 4mm Double Glazing	27
Zone E	Living Rooms / Bedrooms	4mm / 12mm / 4mm Double Glazing	27
Zone F	Dual Aspect Living Rooms	6mm / 12mm / 8mm laminated	35*
All	Commercial Uses	4mm / 12mm / 4mm Double Glazing	27

Note*: Enhanced glazing specification required to mitigate noise impact from pub outdoor area overlooked by the apartments

- 8.126** The indicative levels of sound insulation presented in Table 8.22 would typically be achievable with standard thermal double-glazing configurations when closed. It is understood that a full-house mechanical ventilation strategy will be provided to all residential units within the Proposed Development capable of providing background ventilation as well as additional thermal comfort to address overheating, with openable windows only relied upon for purge ventilation.
- Acoustics, Ventilation and Overheating*
- 8.127** The noise levels incident on the development, as predicted using the previously mentioned CadnaA model, have been used to assess the acoustic suitability of natural means (e.g., openable windows) of mitigating overheating within dwellings against the requirements of ADO.
- 8.128** The assessment shows that in the majority of locations, the use of openable windows for natural ventilation would result in an exceedance of the ADO criteria and therefore is unlikely to be suitable. There is a substantial area overlooking the existing Broad Street Mall Shopping Centre where partially openable windows may be acceptable for use as part of the overheating mitigation strategy, however, it is understood that all windows will remain closed during periods of overheating.

External Amenity

- 8.129** External amenity spaces are proposed on the rooftop of the podium, as well as on the rooftop of each of the buildings.
- 8.130** Solid balustrades are proposed around each of the terraces. The height of the balustrades are 2.2m around the tower terraces and 1.9m high to the south of the podium roof terraces.
- 8.131** Based upon the results of the environmental noise survey and the 3D noise model of the site, the daytime noise levels across the rooftop terraces are presented in the following Table:

Table 8.23 Predicted noise level in external amenity spaces

Terrace Location	Predicted Noise Level dB $L_{Aeq,T}$
Building A	51 - 54
Building B	53
Building C	49 - 50

Terrace Location	Predicted Noise Level dB $L_{Aeq,T}$
Building A & B	56 – 59
Building B & C	52 – 58

- 8.132** Based on the results shown above, the predicted noise levels on the terraces of Buildings A, B and C comply with the BS 8233:2014 upper limit of 55dB $L_{Aeq,16hr}$.
- 8.133** Predictions show that environmental noise levels within the proposed external amenity spaces on the podium terrace between Buildings B & C also comply with the upper noise level limit, with the exception of the southeast corner where a 3dB exceedance is noted. The noise levels on the podium terrace between Buildings A & B do not meet the BS 8233:2014 upper limit of 55dB $L_{Aeq,16hr}$. However, as recognised in BS 8233, these criteria are not always achievable in desirable urban locations where other factors such as convenience of location are likely to take priority, therefore this should not prevent development.
- 8.134** To control the noise level on the terraces where exceedances are noted, to meet the BS 8233:2014 upper limit of 55dB $L_{Aeq,16hr}$, a 3.1m high balustrade would be required to the south side of the podium terraces.
- 8.135** ProPG¹⁴ states that “Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings.”
- 8.136** The roof terrace amenity spaces on Buildings A, B and C comply with the BS 8233:2014 guidance for external amenity areas and can provide an off set to any residual adverse impact across the other terrace areas.

MITIGATION AND MONITORING MEASURES

Demolition and Construction

- 8.137** Under the assumed absolute worst-case assessment presented within this ES chapter, adverse effects due to construction noise have been identified and therefore require mitigation to reduce potential impacts at receptor locations. As the construction activity is not finalised at this stage, it is not possible to identify specific mitigation measures prior to formulation of a detailed construction programme, in addition to detailed planning and logistics.
- 8.138** In general, construction noise and vibration would be managed using best practicable means (BPM), i.e., the use of all reasonable measures to minimise construction noise and vibration. Measures to mitigate construction noise and vibration is presented in **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring Schedule**.

Best Practicable Means

- 8.139** The Principal Contractor will use 'best practicable means' (BPM) to minimise nuisance from noise and vibration. BPM is defined in Section 72 of the Control of Pollution Act 1974 and Section 79 of the Environmental Protection Act 1990 as those measures which are:
- ‘... reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications.’*
- 8.140** The noise and vibration control measures to be implemented on-site should be captured within a construction management plan (CMP).
- General Noise and Vibration Control Measures*
- 8.141** General noise and vibration control measures are listed, with reference to British Standard (BS) 5228 ‘Code of practice for noise and vibration control on construction and open sites’, Part 1: Noise (+A1:2014), and Part 2: Vibration (+A1:2014). This will include the following measures:
- Construction will be confined to the permitted hours as set out in the CMP;

- Loading/unloading activities will be located away from residential properties and shielded from those properties, where practicable;
- Materials will be handled in a manner that minimises noise and drop heights of materials will be minimised;
- Careful selection of plant and construction methods. Only plant conforming to relevant national, EU or international standards, directives and recommendations on noise and vibration emissions will be used. The Principal Contractor will ensure that each item of plant used on the project complies with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701 (as amended). The Principal Contractor’s Environmental Manager will maintain a register of plant and equipment and statutory certification;
- Design and use of acoustic screening measures where practicable and necessary, at the earliest opportunity to meet the noise limits within the CMP. Acoustic screening measures include site hoardings, acoustic barriers, acoustic enclosures, acoustic housing for plant and temporary stockpiles. Such measures can be particularly appropriate for stationary or near-stationary plant such as pneumatic breakers, piling rigs and compressors. Barriers will be located as close to the plant as possible and, in order to provide adequate attenuation, and must have a mass per unit area of at least 7 kg/m²;
- All vehicles and mechanical plant used for the purpose of the work will be fitted with effective exhaust silencers and shall be maintained in good and efficient working order and operated to minimise noise emissions;
- All compressors and generators will be "sound reduced" models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- All machines in intermittent use will be shut down in the intervening periods between works or throttled down to a minimum. Lorry engines will be switched off when vehicles are stationary. Noise emitting equipment which is required to run continuously will be housed in a suitable acoustic enclosure;
- Plant and equipment liable to create noise and/or vibration whilst in operation will, as far as reasonably practicable, be located away from sensitive receptors and away from walls which could reflect noise towards sensitive receptors;
- Where reasonably practicable, fixed items of construction plant will be electrically powered in preference to diesel or petrol driven;
- Vehicles will not wait or queue on the public highway with engines idling; construction traffic movements will be undertaken in accordance with the Construction Traffic Management Plan (“CTMP”);
- All appropriate contractor personnel will be instructed on BPM measures to reduce noise and vibration as part of their induction training, and followed up by ‘tool box’ talks;
- Noisy activities will be staggered in time and space where feasible;
- Only designated access routes (on-site) will be used;
- Reversing alarms incorporating one of more of the features listed below or any other comparable system will be used where reasonably practicable:
 - Highly directional sounders;
 - Use of broad band signals;
 - Self-adjusting output sounders;
 - Flashing warning lights; and
 - Reversing alarms will be set to the minimum output noise level required for health and safety compliance.

14 Institute of Acoustics, Association of Noise Consultants and Chartered Institute of Environmental Health, (2017). Professional Practice Guidance on Planning and Noise – New Residential development. IOA, ANC and CIEH.

- All site personnel will receive training appropriate to the nature of their roles and responsibility; the training will include specific information in relation to noise and vibration management. If their work activities are assessed as being particularly noise/vibration emission prone all staff will receive induction training that will incorporate environmental awareness training, plus specific training in relation to noise and vibration.
- For piling activities, where practicable, piles should be installed by continuous flight auger or vibratory piling. Where necessary, mitigation to reduce vibration levels (in particular, that associated with piling) at receptors near construction works should include consideration of:
 - Use of alternative methods;
 - Removal of obstructions;
 - Provision of cut-off trenches;
 - Reduction of energy input per blow;
 - Reduction of resistance to penetration, including mudding in for rotary bored piles; and adding water to the bore hole for impact bored piles;
 - Excavation under support fluid;
 - Removal of the plug when using casing vibrators;
 - Bottom-driving; and
 - Use of variable moment vibrators.
- Where noisy activities are to take place in close proximity to the exiting mall, the following is recommended to reduce occupants' exposure to high noise levels:
 - Internal shuttering/screening to the facade to reduce the internal noise levels;
 - Zoning to prevent occupants accessing areas where noise levels are high for a specific activity.

8.142 It is expected that, by use of BPM and when the spatial separation of the equipment across the site is considered, up to 10dB attenuation may occur (please note, it is difficult to predict the overall attenuation provided so this is provided as an indicative level only). On this basis it is anticipated that the majority of receptors currently experiencing Moderate Adverse effects (R1, R2, R3, R4, R5, R6, R7 and R15) due to construction noise will be reduced to Minor Adverse effects (not significant).

8.143 Where receptors are currently experiencing Major Adverse effects, the use of BPM and spatial distribution is likely to reduce the overall noise levels, but not sufficiently to reduce the overall effect level which remains as significant adverse. It should be noted that some Major adverse effects should be anticipated with a development of this scale, type, location, and proximity to noise sensitive receptors and impacts to receptor groups will be temporary as works progress across the site impacting different receptor groups to different extents at any given time.

8.144 When considering R8 and R11, it is anticipated with the use of BPM, the effect would be reduced to Minor Adverse, when construction activities are not in progress on the west of the site. For certain construction processes (for example piling where the piling rig will move across the site), this will limit the duration that a major adverse effect is experienced for. At this stage sufficient information is not available to determine how long the major adverse impact will be experienced for.

8.145 Due to the low sensitivity of R13, the effect is currently categorised as Minor Adverse but the predicted noise levels due to construction are very high. As such, it is anticipated that the noise levels within the commercial development may be disruptive to occupants. This approach will be managed as far as practicable using the mitigation measures detailed above and close liaison with the occupiers of the mall. Demolition works including the saw cutting of the existing structural slabs which can give rise to significant levels of vibration have the greatest potential to adversely impact a large number of commercial units within the mall including the cinema, therefore, it is recommended that these works are co-ordinated with the mall operators to be undertaken at specific times to minimise the impact to commercial operations.

Completed Development

8.146 In locations where the ADO noise criteria are exceeded during periods of overheating, mechanical means of overheating mitigation must be provided. A suitable overheating mitigation strategy will be developed during the detailed design stage of the project.

8.147 Noise mitigation measures may be required to building services plant to meet the plant noise emission limits. The required measures will be developed during the design stage of the project.

8.148 To control the noise level on the terraces to meet the BS 8233:2014 upper limit, solid balustrades would be required around the perimeter of the terraces. The required mitigation measures will be developed during the design stage of the project to ensure the mitigation is in keeping with the scheme.

8.149 The need to control noise to the suggested levels can be enforced through the use of a suitable planning condition attached to any decision notice for the Proposed Development.

RESIDUAL EFFECTS

8.150 The residual effects resulting from the Proposed Development, incorporating the mitigation measures identified above, are summarised in 8.150.

Table 8.24 Summary of Residual Effects

Receptor	Description of the Residual Effect	Scale and Nature	Significant / Not Significant	Geo	D I	P T	St Mt Lt
Demolition & Construction							
Existing Queens Court student residential (R8)	Construction activity noise	Major Adverse	Significant	Local	D	T	St
Existing residential dwellings (R10 & R12)		Negligible	Not Significant	Local	D	T	St
Other existing dwellings		Minor Adverse	Not Significant	Local	D	T	St
Existing theatre (R11)		Major Adverse	Significant	Local	D	T	St
Existing shopping centre (R13)		Minor Adverse	Not Significant*	Local	D	T	St
Buildings C of the Proposed Development (R14)	Construction activity noise – whilst Buildings A and B are being completed	Moderate Adverse	Significant	Local	D	T	St
Buildings D of the Proposed Development (R15)		Minor Adverse	Not Significant*	Local	D	T	St
Existing residential dwellings	Construction activity vibration	Minor Adverse	Not Significant	Local	D	T	St
Existing commercial developments		Minor Adverse	Not Significant	Local	D	T	St
Existing residential dwellings	Construction traffic noise	Negligible	Not Significant	Local	D	T	St
Existing commercial developments		Negligible	Not Significant	Local	D	T	St
Completed Development							
Existing residential dwellings	Building services noise	Negligible	Not Significant	Local	D	P	Lt
Existing residential dwellings	Change in operational road traffic	Negligible	Not Significant	Local	D	P	Lt

Receptor	Description of the Residual Effect	Scale and Nature	Significant / Not Significant	Geo	D I	P T	St Mt Lt
Notes: Residual Effect - Scale = Negligible / Minor / Moderate / Major - Nature = Beneficial or Adverse Geo (Geographic Extent) = Local (L), Borough (B), Regional (R), National (N) D = Direct / I = Indirect P = Permanent / T = Temporary St = Short Term / Mt = Medium Term / Lt = Long Term N/A = not applicable / not assessed * Note - although the scale and nature is predicted to be Minor Adverse effect at R13 due to the Low sensitivity, the noise level is likely to be significant and careful consideration will be required.							

ASSESSMENT OF FUTURE ENVIRONMENT

Evolution of the Baseline Scenario

8.151 Refer to paragraphs 8.9 to 8.11.

Cumulative Effects Assessment

- 8.152 This section identifies the effects of the Proposed Development in combination with the effects of other cumulative schemes within the surrounding area (identified in **ES Volume 1, Chapter 2: EIA Methodology**).
- 8.153 A number of cumulative schemes have been identified as being relevant to this assessment.
- 8.154 The assessment is based on the best available information and draws on the assessments included in the ES and Application Reports that accompany the development applications, where available.
- 8.155 A number of cumulative schemes have been identified as being relevant to this assessment and have been assessed below for the inter-project effects:
- 52-55 Friar Street and 12 Greyfriars Road, Reading, RG1 1DX
 - Station Hill, Reading including Plot E and Telecom House, Friar Street/ Garrard Street Station Hill, RG1 1DX
 - Land between Weldale Street and Chatham Street, Reading
 - Former Sorting Office, Caversham Road / Vastern Road, Reading
 - 29 Station Road, Reading, RG1 1LG
 - Bristol & West Arcade Market Place, Reading, RG1 1JL
 - Former Car Park, East Street, Reading, RG1 4QH
 - 55 Vastern Road, Reading, RG1 8BU
 - Existing Vue Cinema Complex Land West of Yield Hall Place / London Road, The Oracle, Reading, RG1 2AG
 - Former Debenhams Department Store West of Yield Hall Place, The Oracle, RG1 2AS
 - Vastern Court, Caversham Road, Reading
- 8.156 The locations of the above receptors are shown in Figure 8.10.

Demolition and Construction

8.157 There are a number of cumulative schemes in the local area that may generate construction noise. The closest cumulative schemes are located approximately 290m from the Proposed Development and therefore none of these are likely to be close enough for the construction noise of both developments to cumulatively effect the

relevant nearest sensitive receptors. The redline shown in Figure 8.10 shows the area that is 290m from the centre of the site, the threshold of significant impact due to construction noise, in this case 65dBA, is significantly closer to the site. As such it is considered that any site outside of the boundary would have a negligible cumulative impact.

8.158 The Proposed Development and cumulative schemes will each have controls on construction noise applied at their respective closest sensitive receptors and do not share any closest noise sensitive receptors with the proposed scheme. For any cumulative significant effect to occur it would be necessary for the construction works to occur concurrently and generate sufficient levels of noise at any common receptor. Therefore, the negative cumulative effects of construction activity have been assessed as Negligible (not significant).

Construction Traffic

- 8.159 There is a possibility that the cumulative construction traffic from the Proposed Development and the nearby cumulative schemes could increase the baseline noise levels on the wider road traffic network.
- 8.160 However, even for a worst-case scenario where each of the identified cumulative schemes produces the same peak daily construction traffic flow as the Proposed Development, the predicted increase in traffic flow on the major road network and corresponding noise levels would not be significant.
- 8.161 Therefore, the negative cumulative effects of construction traffic have been assessed as Negligible (not significant).

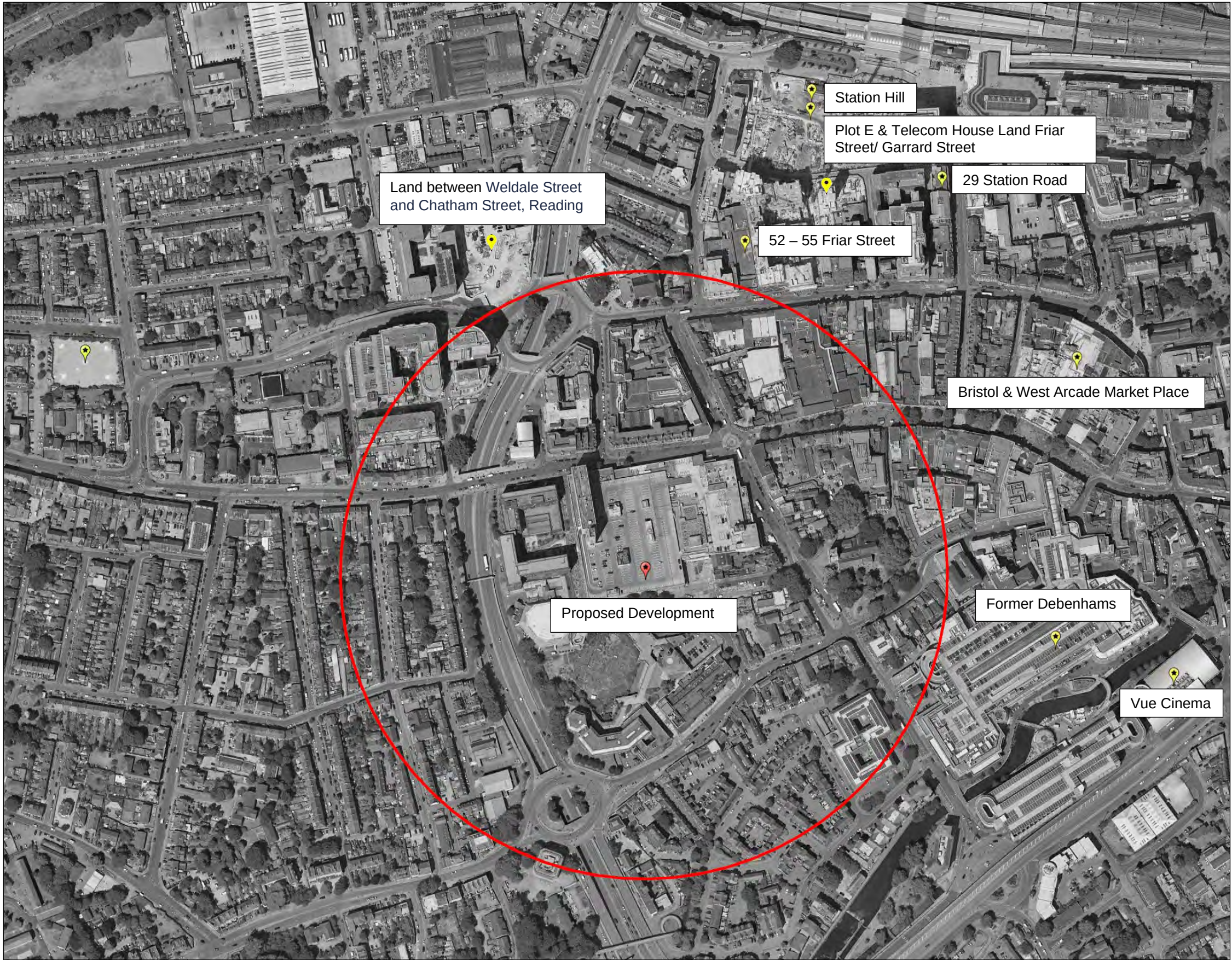
Operational Phase

- 8.162 During operation, noise from each cumulative schemes would be controlled to achieve the noise criteria set by RBC at the nearest noise sensitive receptor. The cumulative negative impact of the operation of the Proposed Development and other committed developments would therefore be Negligible.
- 8.163 Operational traffic flows from all of the cumulative schemes have been reviewed and predictions show that there will be an overall increase of between 0 and 6% in the number of vehicles on the local traffic links. As a 25% increase in the number of vehicles is required to increase the noise level by 1dB, it is not considered that there will be any significant adverse impacts due to road traffic noise levels over time.
- 8.164 The noise levels produced by existing traffic has been included in the baseline assessment for the Proposed Development, therefore, there will be no additional cumulative operational traffic impact.

Minster Quarter Area Development Framework (MQADF)

- 8.165 Under the MQADF the Proposed Development comprises the first phase of delivery. Further phases would see the area immediately to the south of the site undergo mainly residential-led regeneration.
- 8.166 It is anticipated that the Proposed Development will be under construction simultaneously with the following Phases of the MQADF. Therefore, cumulative construction noise as a result of the Proposed Developments is anticipated to have an adverse impact on the surrounding area. The extent of the cumulative impact is dependent on the construction programme, processes, and location and therefore is difficult to predict. Given the proximity of the developments, it is likely that there will be Moderate to Major Adverse impact on surrounding receptors, however the scale will be dependent on the factors mentioned previously. Where receptors are located further away, for example to the north of Broad Street Mall shopping centre, it is anticipated that there will be a significantly reduced impact.
- 8.167 Developments within this proposed Minster Quarter Area Framework will need to account for the four high sensitivity receptors being created as part of the Proposed Development. Depending on future proposals, adequate assessments of future development impact shall be required as part of any future planning applications for which the Proposed Development may be considered a relevant noise sensitive receptor.

Figure 8.10 Site plan showing nearby cumulative schemes



Chapter 9: Daylight, Sunlight and Overshadowing

Topic	Daylight, Sunlight and Overshadowing
AUTHOR	Delva Patman Redler
SUPPORTING APPENDIX	ES Volume 3, Appendix: Daylight, Sunlight and Overshadowing (for ease of reference, hereafter referred in this chapter as 'ES Volume 3, Appendix: DSO') Annex 1 – Key Legislation, Planning Policy & Guidance Annex 2 – Drawings of the existing baseline and Proposed Development Annex 3 – Daylight and Sunlight results Annex 4 – No Sky Line Contour drawings Annex 5 – Window Maps Annex 6 – Sun Hours on Ground assessment Annex 7 - Transient Overshadowing assessment
KEY CONSIDERATIONS	This chapter outlines the relevant policy context; methodologies applied to identify and assess the potential daylight, sunlight and overshadowing impacts to sensitive receptors; baseline conditions at the site and its surrounds and the likely significant effects associated with the Proposed Development. Mitigation is set out as necessary and the residual effects are identified. The potential daylight, sunlight and overshadowing effects associated with the Proposed Development are as follows: • Temporary changes to daylight, sunlight and overshadowing, during the demolition and construction works; • Alterations to daylight and sunlight amenity to sensitive surrounding receptors on completion of the Proposed Development; and • Changes to overshadowing of surrounding public and private amenity areas, in addition to amenity areas within the site on completion of the Proposed Development.

ASSESSMENT METHODOLOGY

Defining the Baseline

Baseline Conditions

- 9.1 An existing baseline scenario of the surrounding area has been established following a review of the land uses in proximity of the site with reference to information available via the Valuation Office Agency ('VOA') website¹ (i.e. council tax records) in order to identify potentially sensitive receptors.
- 9.2 To accurately capture the existing baseline condition on-site, a detailed measured survey of the site and surrounding properties was undertaken by MBS Surveys Software Ltd in June 2018. This captured the building outlines and structural openings which forms the basis of the 3D AutoCAD computer model which has been utilised to undertake the assessments. There was no requirement to update this given the surrounding context has not altered materially since it was commissioned and therefore remains relevant to the assessments in this ES chapter. Buildings considered to be within sufficient proximity (i.e. building massing is considered relevant to the daylight and sunlight amenity context for the site and neighbouring properties) to the site (determined on the basis of professional opinion) have been represented within the 3D computer model utilised for the assessment of the 'existing' context, or 'baseline condition'. Figure 9.1 shows the site plan Ground Floor of the Proposed Development. The temporary construction application is not relevant to this assessment, and as such it focusses on the completed Main Proposed Development.
- 9.3 The technical analysis presented in this ES chapter, including assessment of the Baseline condition, has been undertaken in accordance with the BRE Guidelines² and defined by reference to the Vertical Sky Component (VSC), No-Sky Line (NSL) and Annual Probable Sunlight Hours (APSH) methods (refer to 'Impact Assessment – Completed Development' section of this ES chapter for further details).
- 9.4 The baseline level of overshadowing, with regard to relevant surrounding amenity spaces has been defined in terms of the 'Sun Hours on Ground' assessment (calculated on the 21st March³), and the 'Transient Overshadowing' method (refer to 'Impact Assessment – Completed Development' section of this ES chapter for further details).

¹ Website - VOA search engine - <http://cti.voa.gov.uk> (undertaken in July 2018)

² BRE Guidance - 'Site Layout Planning for Daylight and Sunlight 2022: A Guide to Good Practice'

Figure 9.1 Site plan indicated with red outline below.



Likely Evolution of the Baseline

- 9.5 From a daylight, sunlight and overshadowing assessment perspective, evolution of the baseline condition can only occur with further schemes being built in the local area.
- 9.6 The evolution of the baseline without the implementation of the Proposed Development is likely to be consistent with the current baseline conditions. However, this will be subject to change should any future nearby schemes materialise such as the Minister Quarter Area Development Framework (MQADF) proposals which are located to the southwest of the site.

Impact Assessment

Demolition and Construction

- 9.7 There is no particular methodology for determining demolition and construction effects as these are variable and constantly change as partial demolition is undertaken and the Proposed Development is constructed.
- 9.8 However, with regard to daylight, sunlight and overshadowing, it is considered that the potential impacts would vary throughout the demolition and construction phases and gradually increase to the potential effects identified for the completed Proposed Development.
- 9.9 During the construction phase, a number of tall cranes are likely to be present on-site (see **ES Volume 1, Chapter 5: Demolition and Construction**). It is considered highly unlikely that any impacts in relation to daylight, sunlight, and overshadowing will be caused to neighbouring properties as a result of vehicles and construction related activities. Any effects (at worst) would be temporary, and most likely negligible in terms of the effect on surrounding receptors.

³ BRE Guidance – 3.2.13 states 'the sunlighting of an existing dwelling maybe adversely affected' if 'the centre of the window receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21st September and 21st March' and 'receives less than 0.8 times its former sunlight hours during either period'. 21st March and 21st September occur on the equinox where day and night are equal in length and as such represent midpoints of the yearly movements of the sun.

- 9.10** It is therefore considered that the completed Proposed Development represents the worst-case assessment in terms of likely daylight, sunlight, and overshadowing effects.
- 9.11** On this basis, no technical analysis of the likely effects on the surrounding properties and amenity spaces during the demolition and construction phases has been carried out and the remainder of this chapter focuses on the effects relating to the completed Proposed Development.

Completed Development

- 9.12** The assessment of the completed Proposed Development has been undertaken in accordance with the BRE Guidelines. The following methods have been considered to assess the likely impact of the Proposed Development on sensitive neighbouring receptors:

- Daylight:
 - Vertical Sky Component (VSC);
 - No Sky Line (NSL) assessments;
- Sunlight:
 - Annual Probable Sunlight Hours (APSH) assessment;
- Overshadowing:
 - Sun Hours on Ground;
 - Transient Overshadowing assessments.

Daylight

VSC

- 9.13** The VSC method of assessment is defined in the BRE Guidelines as the 'ratio of that part of illuminance at a point on a given vertical plane that is received directly from a CIE standard overcast sky, to illuminate on a horizontal plane due to an unobstructed hemisphere of this sky'.
- 9.14** This ratio is the percentage of the total unobstructed view that is available, once obstructions (e.g. the Proposed Development), are placed in front of the point of view.
- 9.15** The assessment is calculated from the centre of a window on the outward face and measures the amount of light available on a vertical wall or window following the introduction of visible barriers, such as buildings.
- 9.16** The VSC has been calculated by using a 'Waldram Diagram'. The Waldram Diagram is effectively a snapshot that is taken from that point of the sky in front of the window, together with all relevant obstructions to it, i.e. the buildings. For calculation purposes, trees may be ignored unless they form dense continuous belts.
- 9.17** The maximum VSC value is almost 40% for a completely unobstructed vertical wall or window. In terms of assessment criteria, the BRE Guidelines state that: *'if the VSC, with the development in place, is both less than 27% and less than 0.8 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window may appear more gloomy and electric lighting will be needed more of the time.'*

NSL

- 9.18** The BRE Guidelines advise that where room layouts are known, the effect on the daylight distribution can be calculated by plotting the NSL. In terms of the neighbouring receptors, it has not been possible to obtain room layouts for all of the properties and therefore their layouts have been assumed where information has been unavailable.
- 9.19** The NSL is a measure of the distribution of daylight at the 'working plane' within a room. The 'working plane' means a horizontal 'desktop' plane 0.85m in height for residential properties. The NSL divides those areas of the working plane which can receive direct sky light from those which cannot. If a significant area of the working plane lies beyond the NSL (i.e. it receives no direct sky light), then the distribution of daylight in the room will be poor and supplementary electric lighting may be required.
- 9.20** The potential effects of daylight distribution in an existing building can be identified by plotting the NSL in each of the main rooms. For residential dwellings, this will include living rooms, dining rooms and kitchens. Bedrooms should also be analysed, although they are less important in terms of daylight and sunlight amenity due to the nature of their use. The BRE Guidelines identify (2.2.9) that if the area of a room that does receive direct sky light is reduced to less than 0.8 times its former value, then this would be noticeable to its occupants.

- 9.21** In regard to deep rooms which are lit by windows on one side, the BRE Guidelines state at paragraph 2.2.12: 'If an existing building contains rooms lit from one side only and greater than 5 m deep, then a greater movement of the no sky line may be unavoidable.'

- 9.22** Only residential properties and religious buildings have been considered by the daylight assessment. Offices and retail spaces are not considered sensitive receptors to daylight amenity. In addition, non-habitable rooms such as circulation spaces and bathrooms have not been considered, in accordance with the BRE Guidelines.

- 9.23** The BRE Guidelines state in Section 2.2.2:

"The guidelines given here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed."

Sunlight

Annual Probable Sunlight Hours (APSH)

- 9.24** With regard to sunlight, the same skylight indicator is used as the VSC assessment using the same reference point to calculate Annual Probable Sunlight Hours (APSH), which is expressed as a percentage. The BRE guidelines state:

"Access to sunlight should be checked for the main window of each room which faces within 90 degrees (°) of due south".

- 9.25** The maximum number of APSH for the London orientation is 1,486 hours. Sunlight is measured using a sun indicator which contains 100 spots, each representing 1% of APSH. Therefore, where no obstruction exists, the total APSH would amount to 1,486 and therefore each spot equates to 14.86 hours of the total annual sunlight hours. The number of spots is calculated for the baseline and Proposed Development scenarios during the year and also during the winter period. This provides a percentage of APSH for each of the time periods for each window assessed.

- 9.26** The BRE Guidelines propose that the appropriate date for undertaking a sunlight assessment is on 21st March, (the Spring Equinox). Calculations of both summer and winter availability are made with the winter analysis (WPSH) covering the period from the 21st September to 21st March.

- 9.27** The BRE Guidelines state in Section 3.2.3 that:

"[...] kitchens and bedrooms are less important, although care should be taken not to block too much sun."

- 9.28** Only residential properties and religious buildings have been considered by the sunlight assessment. Offices and retail spaces are not considered sensitive receptors to sunlight amenity. As per the BRE Guidelines, non-habitable rooms such as circulation spaces and bathrooms have also not been considered.

- 9.29** The BRE Guidelines state in Section 3.2.3:

"To assess loss of sunlight to an existing building it suggested that all main living rooms of dwellings, and conservatories, should be checked if they have a window facing within 90° of due south."

- 9.30** In regard to existing neighbouring receptors, the BRE Guidelines advise that a window may be adversely affected if a point at the centre of the window receives for the whole year, less than 25% of the APSH, including at least 5% of the APSH during the winter months (21st September to 21st March) and less than 0.8 times its former sunlight hours during either period.

- 9.31** As is often the case, it is not possible to determine the room uses within each of the neighbouring properties, nor is it clear which window should be considered as the 'main window'. Therefore, all windows facing the site, serving rooms that have been identified as habitable, and within 90 degrees of due south have been considered in the assessment (unless research dictates otherwise).

Overshadowing

Sun Hours on Ground

- 9.32** The sun hours on ground (SHOG) assessment considers the proportion of a designated amenity space which receives two hours of direct sunlight on the 21st March. The BRE Guidelines provide numerical criteria for the sun hours on ground assessment; where the results show compliance, the potential effect will be negligible and not significant.

- 9.33** Using specialist software, the path of the sun is tracked. This maps obstructions and compares them to the known sun paths to determine where the sun would reach the ground and where it would not.

- 9.34** The BRE Guidelines recommend that for a garden or amenity area to appear adequately sunlit throughout the year, no more than half (50%) of the area should be prevented by buildings from receiving two hours of sunlight on the 21st March, between the hours of 7am-5pm.
- 9.35** The BRE Guidelines suggest that if, as a result of new development, an existing garden or amenity area does not meet the Guidance, or the area which can receive some sun on the 21st March is less than 0.8 times its former value then the loss of sunlight is likely to be noticeable.
- 9.36** Both public and private amenity space (considered sensitive to the Proposed Development) located to the north, east, west and southwest has been assessed (for list of areas, see section 'Receptor and Sensitivity').
- Transient Overshadowing*
- 9.37** The BRE Guidelines suggest that where large buildings are proposed which may affect a number of gardens or open spaces in the surrounding area, it is useful and illustrative to plot a shadow plan to show the location of shadows at different times of the day and year. This can be done by using the Sun Hours on Ground indicator in reverse.
- 9.38** For the purpose of this assessment, the overshadowing has been mapped for the following three key dates in the year, at hourly intervals throughout the day:
- 21st March (Spring Equinox) - 8.00am-5.00pm;
 - 21st June (Summer Solstice) - 7.00am-7.00pm; and
 - 21st December (Winter Solstice) - 9.00am-3.00pm.
- 9.39** The period of September 21st (Autumn Equinox) provides the same overshadowing images as March 21st (Spring Equinox), as the sun follows the same path at these corresponding times of year.

Table 9.1 BRE Daylight, Sunlight and Overshadowing Guidance in the Assessment

BRE Test	BRE Criteria
Daylight - VSC	A window may be affected if the vertical sky component (VSC) measured at the centre of the window is less than 27% and less than 0.8 times its former value.
Daylight - NSL	A room may be adversely affected if a significant area of the room is beyond the No-Sky Line (NSL) and is less than 0.8 times its former value.
Sunlight	A window may be adversely affected if a point at the centre of the window receives in the year less than 25% of the annual probable sunlight hours (APSH), including at least 5% of the annual probable sunlight hours (APSH) during the winter months (21st September to 21st March) and less than 0.8 times its former sunlight hours during either period.
Overshadowing	For it to appear adequately sunlit throughout the year at least half of a garden or amenity area should receive at least two hours of sunlight on 21st March. If, as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21st March is less than 0.8 times its former value, then the loss of light is likely to be noticeable. If a detailed calculation cannot be carried out, it is recommended that the centre of the area should receive at least two hours of sunlight on 21st March. Where the results show compliance with the BRE Guidelines, there is no impact and resultant effect as users of the space will be unlikely to notice any change in the sunlight amenity levels.

Assumptions and Limitation

Assessment Model

- 9.40** In order to undertake the technical assessments, a 3D AutoCAD computer model of the site and neighbouring properties has been created, using the following available information:
- MBS Survey Software Ltd - 3D measured survey of the site and surrounding existing properties
 - AccuCities Ltd – 3D Photogrammetry wider context model (Photogrammetry captured 2016) which did not require updating given the immediate context has not materially altered since; and
 - Google Map and Bing Maps aerial imagery.
- 9.41** The contextual scope of buildings considered has been determined as a reasonable zone based on professional opinion, which considers both the scale of the massing proposed and the proximity of those

buildings which surround and face the site. Only those neighbouring properties which have windows facing towards the site have been included in the assessments.

- 9.42** A series of historic site visits were undertaken between September 2017 and October 2019 in order to confirm building uses and rationalise floor plans obtained from research with what is *in-situ*. The surrounding area remains unchanged from when these sit visits were undertaken, therefore historic site visits remain valid for the context provided in this ES chapter.

Receptors – Habitable Rooms

- 9.43** The BRE Guidelines suggest that residential properties have the highest requirement for daylight and sunlight, stating 'The guidelines are intended for use for rooms in adjoining dwellings where light is required, including living rooms, kitchens and bedrooms'. Non-habitable rooms such as circulation spaces and bathrooms are not considered relevant for consideration by the BRE Guidelines. The assessments presented in this chapter therefore focus on habitable rooms within residential properties and religious buildings neighbouring the site that could be sensitive to impacts resulting from the Proposed Development. Only those neighbouring properties which have sensitive windows facing towards the site have been included in the assessments. The location of residential occupation within neighbouring properties was identified from external observation and VOA council tax band searches.

External Receptors

- 9.44** Internal layouts of neighbouring properties are only relevant for the 'No Sky Line' (NSL) assessment methodology (associated with daylight distribution). Access to any of the neighbouring properties has not been sought to undertake the assessments; however, partial or full floor plans were sourced for a number of the neighbouring properties and incorporated within the assessment. These floor plans were acquired from a mix of sources, including: the RBC planning application search website⁴, estate agent websites⁵ and online searches⁶.
- 9.45** Internal layout information has been sourced for the following surrounding existing properties:
- 38 Oxford Road;
 - 59-60 St Mary's Butts;
 - 15 Queens Walk (Queens Court); and
 - McIlroys Building.
- 9.46** Where internal layouts have not been acquired, reasonable assumptions have been made based on practitioner experience, in most cases assuming a standard 4.2m deep room (14ft) for residential properties (unless the building form dictates otherwise). Based on practitioner experience internal layouts have been incorporated where access to buildings is unavailable and layouts have not been acquired. Internal layout information has been assumed for the following properties:
- 40-42 Oxford Road;
 - 61-62 St Mary's Butts;
 - 58 St Mary's Butts;
 - 57 St Mary's Butts;
 - 55-56 St Mary's Butts;
 - 16 Castle Street;
 - 8 Castle Street;
 - 2-6 Castle Street;
 - Reading Minster; and
 - St Mary's Church
- 9.47** The contextual scope of buildings considered has been determined as a reasonable zone which considers both the scale of the massing proposed and the proximity of those buildings which surround and face the site. Only those neighbouring properties which have windows facing towards the site have been included in the assessments.
- 9.48** Floor levels have also been assumed for the neighbouring properties where this information was not available from available drawings. This dictates the level of the working plane which is relevant for the NSL assessment.

⁴ RBC planning application: http://planning.reading.gov.uk/fastweb_PL/welcome.asp (accessed November 2023)

⁵ Agent websites: <https://www.zoopla.co.uk/>, <https://www.rightmove.co.uk/> (accessed November 2023)

⁶ Online searches: Google.com (accessed November 2023)

9.49 In relation to sunlight analysis (APSH), only windows which are orientated within 90 degrees of due south and face the site have been considered as they have a reasonable expectation of sunlight. On this basis the following properties have not been assessed for sunlight:

- 16 Castle Street;
- St Mary's Church
- 8 Castle Street; and
- 2-6 Castle Street.

9.50 Due to the southerly rotation of the sun, only sensitive amenity areas located to the north of the site have been considered for the purpose of the overshadowing assessment.

Methodology – Assessment Scenarios

9.51 Technical analysis of the Proposed Development has been undertaken using specialist computer software applied to the 3D AutoCAD computer model for the following scenario:

- Existing Baseline Condition:
 - Assessment of the 'existing' context, or 'baseline condition', as represented within Figure 9.1 (showing the 3D representation of the existing baseline scenario (including the site and surrounding built context));
- Development Scenario: Existing Baseline Condition 'v' The Proposed Development:
 - A 3D model of the Proposed Development has been inserted into the baseline condition / context model to be assessed.

Methodology for Defining Effects

Receptor Sensitivity

9.52 In terms of sensitivity, nearby existing residential dwellings and religious buildings (receptors) are considered highly sensitive to daylight and sunlight levels, and specifically habitable rooms within the properties such as living rooms, kitchens and bedrooms, in accordance with the BRE Guidelines. All existing residential receptors assessed are considered highly sensitive due to the expectation of natural light and are given equal weighting.

9.53 Commercial spaces such as offices and retail areas are not considered sensitive receptors and are therefore not assessed.

9.54 For transient overshadowing, all public and private areas of open space such as playgrounds, playing fields, parks, squares and gardens in close proximity to the site are considered highly sensitive within the assessment.

Defining the Effect

9.55 As the approach is to categorise all existing residential receptors being assessed as highly sensitive (not assign a level of sensitivity as per general EIA methodology), this results in the assessment of the magnitude of impact being synonymous with the determining the scale of effect. Therefore, the key terminology used to describe the scale of an effect is as follows:

- Major;
- Moderate;
- Minor; and
- Negligible.

9.56 More information on how the scale of effect has been determined for each type of assessment being undertaken has been discussed in the following sections of this chapter.

9.57 The nature of the effects may be either adverse (negative or detrimental) or beneficial (advantageous or positive).

Categorising Likely Significant Effects

9.58 Windows that have low existing levels of sky visibility are vulnerable to large percentage alterations, which are often unavoidable with even modest proposed massing. It should be noted that large percentage changes do not always equate to large perceptible alterations in light.

9.59 The criteria used to determine likely significant effects are based on the recommendations presented in the BRE Guidelines, in addition to professional judgement. The overall effect on a receptor is based on the statistical data, taking all relevant factors, such as proportion of windows/rooms effected, percentage

alterations, absolute changes, environmental context and any mitigating factors into consideration to determine whether the scale of effects are major, moderate, minor, or negligible, and the nature is either beneficial or adverse.

9.60 There are no set criteria for beneficial effects; it is generally regarded that the Proposed Development introduces new massing and therefore has a degree of impact (adverse) on surrounding existing receptors. However, for the purpose of this chapter a beneficial effect occurs if the receptor would be more favourable when compared with the baseline.

9.61 It should be noted that the numerical values quoted in the BRE Guidelines are purely advisory. The guidance for the criteria to determine the likely effects should not be applied mechanically, taking all relevant factors (such as environmental context) when determining the scale of an effect and whether an effect is significant or not. Numerical analysis, guidance notes and professional judgement has been used to determine the scale and nature of effects and so ultimately, their significance.

9.62 The BRE Guidelines do not advise on the whether an effect is considered to be significant or not but where an effect exceeds of the guidance, it is considered significant. As such minor, moderate and major effects are considered 'significant' and negligible effects are considered 'not significant'.

9.63 Effects that result from the completed and operational Proposed Development are classed as 'permanent' or 'long-term' effects. The subsequent technical assessment identifies whether the effect is 'direct' (i.e. resulting without any intervening factors) or 'indirect' or 'secondary' (i.e. not directly caused or resulting from something else).

Daylight Criteria

9.64 Table 9.2 and Table 9.3 present the numerical values which have been used for the VSC and NSL significance criteria for existing sensitive residential properties surrounding the site, based on the recommendations in the BRE Guidelines.

Table 9.2 VSC Criteria – Scale of Effect

Scale of Effect	Numerical Criteria
Negligible	≥27% VSC and/or reduction ≤ 20%
Minor	Reduction between 20.1% and 29.99% VSC
Moderate	Reduction between 30% and 39.99% VSC
Major	Reduction above 40% VSC

Table 9.3 NSL Criteria – Scale of Effect

Scale of Effect	Numerical Criteria
Negligible	Reduction ≤ 20% NSL
Minor	Reduction between 20.1% and 29.99% NSL
Moderate	Reduction between 30% and 39.99% NSL
Major	Reduction above 40% NSL

9.65 When assigning the scale of an effect to each property, consideration needs to be given to:

- The number of rooms / windows affected;
- The nature of room uses affected (bedrooms, kitchens, or living rooms);
- The percentage alterations to daylight levels (very low existing levels of VSC, NSL or APSH can result in large percentage changes that may not result in perceptible changes of light);
- The absolute changes to daylight levels;
- Existing daylight levels;
- Retained daylight levels;
- Window orientation; and
- The presence of balconies, overhangs or other existing design features.

9.66 In addition, in dense urban locations there is often an existing obstruction angle of 50 degrees, and in such situations, this results in an associated VSC value in the region of 13% (Table F1, Appendix F, BRE Guidelines). Therefore, a retained VSC around the mid-teens is considered to be commensurate in an urban context, Delva

Patman Redler consider this to be around circa 15%/16% (compared with the 27% VSC recommended target in the BRE Guidelines, which are predicated upon a more suburban type environment). This has been further acknowledged during the Whitechapel Estate development appeal⁷ in which the inspector's decision letter dated 21st February 2018 stated the following:

"112. The figures show that a proportion of residual Vertical Sky Component ('VSC') values in the mid-teens have been found acceptable in major developments across London. This echoes the Mayor's endorsement in the pre- SPG decision at Monmouth House, Islington that VSC values in the mid-teens are acceptable in an inner urban environment."

- 9.67 Furthermore, whilst the BRE implies that NSL of at least 80% would be considered sufficiently lit, in an urban context, daylight distribution (NSL) of 50% and over could be considered adequate.
- 9.68 Therefore, the guidance summarised in VSC and NSL BRE Guidance criteria tables should not be applied mechanically, in consideration of the above when determining the scale of an effect and so whether an effect is considered to be significant or not.

APSH Sunlight Criteria

- 9.69 Table 9.4 below presents the numerical values which have been used as sunlight significance criteria for relevant sensitive residential properties surrounding the site, based on the recommendations in the BRE Guidelines.

Table 9.4 APSH Criteria – Scale of Effect

Scale of Effect	Numerical Criteria
Negligible	≥25% Total APSH, of which ≥5% during winter months and/or reduction ≤ 20% APSH
Minor	Reduction between 20.1% and 29.99% APSH
Moderate	Reduction between 30% and 39.99% APSH
Major	Reduction above 40% APSH

Overshadowing Criteria

Sun Hours on Ground Overshadowing

- 9.70 In relation to external neighbouring amenity areas, the effect to those which receive two hours or more of direct sunlight to over 50% of their area on the 21st March and/or experience an alteration of less than or equal to 20% will be considered negligible and therefore not significant.
- 9.71 The assessment of the scale of adverse effects to those spaces that do not receive two hours or more of direct sunlight to over 50% of their area on the 21st March is based on the above guidance, context, and professional judgement. Table 9.5 presents the numerical values which have been used for the overshadowing significance criteria.

Table 9.5 Overshadowing Criteria – Scale of Effect

Scale of Effect	Numerical Criteria
Negligible	Reduction < 20% of area with 2 hours sunlight
Minor	Reduction between 20.1% and 29.99% of area with 2 hours sunlight
Moderate	Reduction between 30% and 39.99% of area with 2 hours sunlight
Major	Reduction above 40% of area with 2 hours sunlight

Transient Overshadowing

- 9.72 The BRE Guidelines do not provide specific criteria for the significance of transient overshadowing other than to identify the different times of the day and year when shadow would be cast over a surrounding area.
- 9.73 The assessment of potential adverse or beneficial effects as a result of transient overshadowing are therefore based on professional judgement, taking into consideration the baseline conditions of the site and surrounding area, and comparing these conditions against the effect of the transient overshadowing arising from the Proposed Development.

Receptors and Sensitivity

Daylight/Sunlight Receptors

- 9.74 Analysis has focussed on sensitive residential properties that are in sufficient proximity to the site for their daylight and sunlight amenity to be potentially impacted by the Proposed Development these properties are listed in Table 9.6 below.
- 9.75 Whilst the BRE Guidelines are not intended to be used for the assessment of commercial properties, they do state that they may be applied to non-domestic land uses where the occupants may have a reasonable expectation of daylight, such as schools, hospitals, hotels and places of worship.

Table 9.6 Sensitive Residential Receptors

Receptor Number	Receptor Description (numbered within Figure 9.2)
1	40-42 Oxford Road
2	38 Oxford Road
3	McIlroys Building
4	61-62 St Mary's Butts
5	59-60 St Mary's Butts
6	58 St Mary's Butts
7	57 St Mary's Butts
8	55-56 St Mary's Butts
9	Reading Minster
10	2-6 Castle Street
11	8 Castle Street
12	St Mary's Church
13	16 Castle Street
14	15 Queens Walk (Queens Court)

Overshadowing Receptors

- 9.76 Surrounding areas of public amenity space have been identified for the sun hours on ground and transient overshadowing assessments these areas have been identified please see Table 9.7 below and Figure 9.3. We have not identified any private amenity area.

Table 9.7 Overshadowing Receptors (Amenity Areas)

Amenity Area Number	Receptor Description (outlined and shaded blue and numbered Figure 9.3)
1	Public space - pedestrian shopping street - Oxford Road
2	Public space - pedestrian shopping street - St Mary's Butts
3	Public amenity space (adjacent to St Mary's Butts, the south of site)
4 and 5	Public space - pedestrian shopping street - Hosier Street
6	Public space - pedestrian shopping street - Queens Walk

⁷ Appeal Ref: APP/E5900/W/17/3171437 Appeal Decision 21 February 2018 Brendan Lyons, Inspector appointed by the Secretary of State

Figure 9.2 Location of Sensitive Receptors for Daylight Assessment

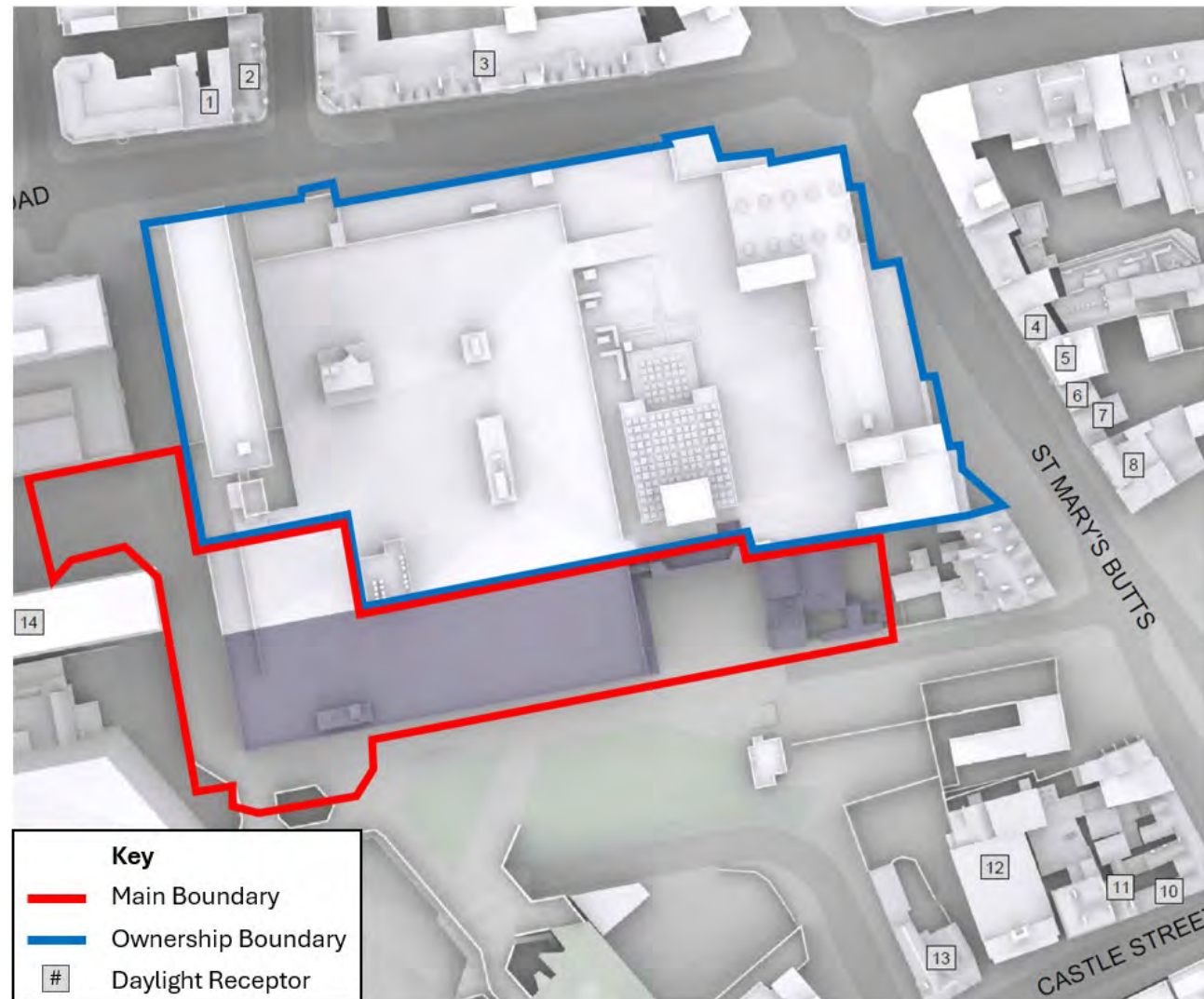
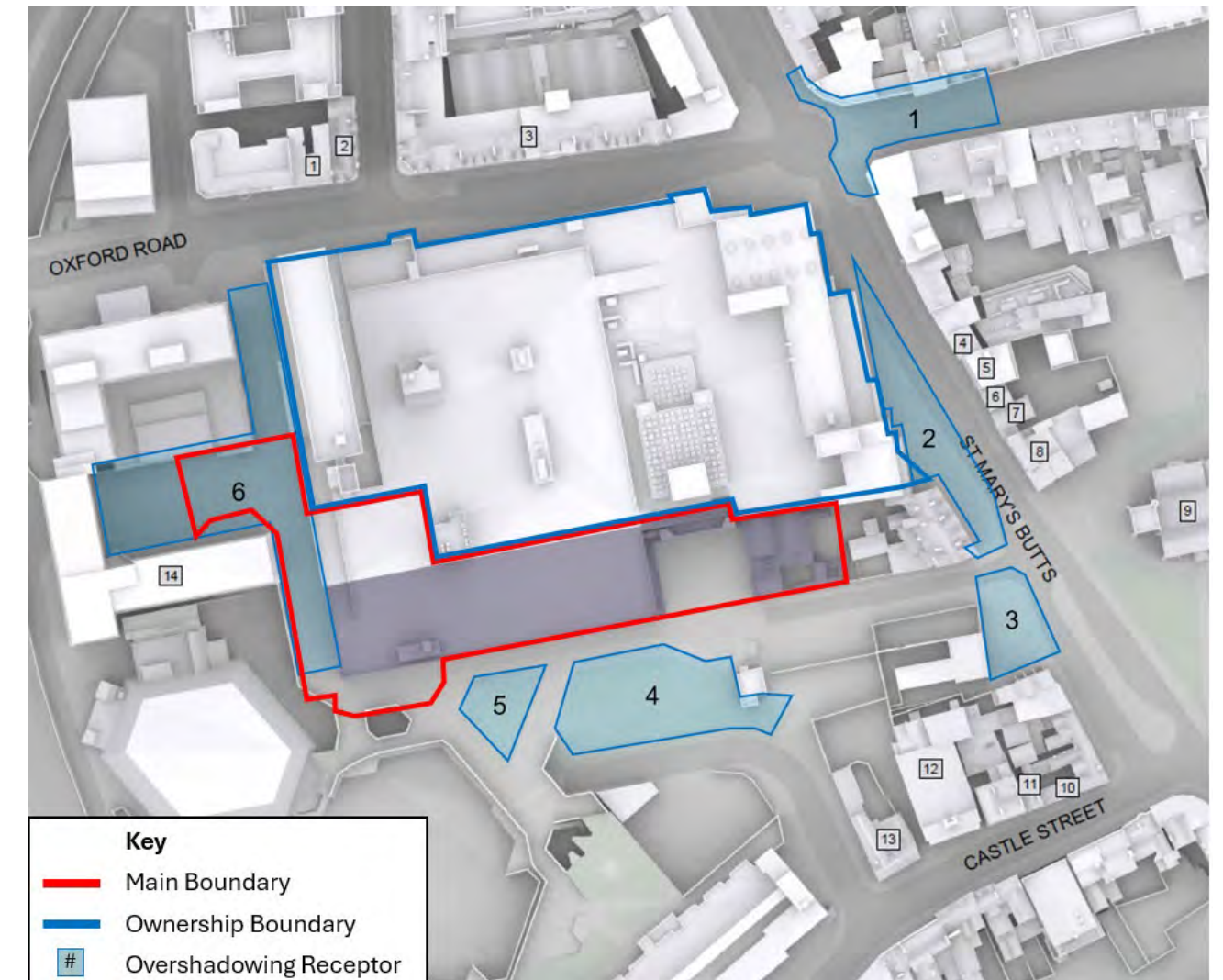


Figure 9.3 Location of Sensitive Receptor location for Overshadowing Assessment



BASELINE CONDITIONS

9.77 14 properties has been assessed, giving rise to 691 windows serving 366 rooms which have been assessed for daylight and 442 windows have been assessed for sunlight. A summary of the Baseline scenario results is set out below and outlined in Table 9.8. The full set of baseline daylight, sunlight and overshadowing results are provided in **ES Volume 3, Appendix: DSO – Annex 3**.

Daylight

9.78 A total of 436 (63%) of the 691 windows assessed enjoy a VSC of 27% or above and as such meet the BRE Guidelines recommended criteria for VSC.

9.79 A total of 276 (75%) of the 366 rooms assessed enjoy a NSL of 80% or above and as such meet the BRE Guidelines recommended criteria for NSL.

Sunlight

9.80 With regard to sunlight, of the 243 rooms assessed, 232 (95%) meet the BRE Guidelines achieving at least 5% or more winter and 25% or more total sunlight in the baseline condition.

Table 9.8 Baseline for Daylight and Sunlight

Receptor Address	Daylight				Sunlight	
	Total No. Windows	Total No. Windows that achieve ≥27%	Total No. Rooms	Total No. Rooms that achieve ≥80% NSL	Total No. Rooms	Total No. Rooms that achieve ≥25% Total and ≥5% Winter sunlight
40-42 Oxford Road	12	0	6	6	6	6
38 Oxford Road	92	23	12	7	8	8
Mcilroys Building	197	174	67	64	67	67
61-62 St Mary's Butts	10	10	6	6	6	6
59-60 St Mary's Butts	6	6	6	3	6	6
58 St Mary's Butts	4	4	4	0	4	4
57 St Mary's Butts	2	2	2	0	2	2
55-56 St Mary's Butts	14	14	10	6	10	10
Reading Minster	17	15	5	5	5	4
2-6 Castle Street	4	0	4	0	N/A	N/A
8 Castle Street	1	1	1	1	N/A	N/A
St Mary's Church	27	23	7	7	N/A	N/A
16 Castle Street	12	7	11	6	N/A	N/A
15 Queens Walk (Queens Court)	293	157	225	165	129	119
Totals	691	436	366	276	243	232
Totals (%)		63%		75%		95%
*N/A means that no windows within the property are relevant for the sunlight assessment (i.e. no windows face within 90° of due south)						

Overshadowing

9.81 The BRE Guidelines criteria for Overshadowing recommend that amenity areas achieve 2 hours direct sunlight to 50% of the area. The amenity areas (Table 9.7) have been assessed to understand which achieve 2 hours of direct sunlight to 50% of their area and as such meet the BRE Guidelines recommendation. A total of 5 of the 6 amenity areas adhere to the BRE recommendation in the existing condition, the remaining area, Amenity Area 6, achieves 2 hours of direct sunlight to 44% of the area and therefore is short of BRE Guideline recommendation (50%).

POTENTIAL EFFECTS

Completed Development

Daylight

9.82 Full drawings of the existing baseline and site are located in **ES Volume 3, Appendix: DSO – Annex 2**. Figure 9.4 below illustrates a 3D image of the Proposed Development, in the surrounding existing context. The full daylight technical assessment is located within **ES Volume 3, Appendix: DSO – Annex 2**. A summary of this data is presented in Table 9.9.

9.83 In total 691 windows serving 366 rooms were assessed within 14 neighbouring properties.

9.84 In relation to VSC, 626 (91%) of the 691 windows assessed would meet the BRE Guidelines. Furthermore, 670 windows (97%) will either meet the BRE criteria for VSC or experience a Minor Adverse effect.

9.85 18 windows (3%) will experience a Moderate Adverse effect and 3 windows (<1%) will experience a Major Adverse effect.

9.86 In terms of NSL, 356 (97%) of the 366 rooms assessed, will meet the BRE criteria for NSL and 7 rooms (2%) will experience a Minor Adverse effect.

9.87 Overall, 8 properties (57%) highlighted grey within Table 9.9 and listed below, would not experience a noticeable alteration in the levels of daylight (VSC and NSL) they receive with the completed Proposed Development site in place in so far as the significance criteria does not alter. The properties are:

- 40-42 Oxford St;
- 38 Oxford Road;
- 61-62 St Mary's Butts;
- 58 St Mary's Butts;
- 57 St Mary's Butts;
- 55-56 St Mary's Butts;
- Reading Minster; and
- 8 Castle Street.

9.88 Therefore, it is considered that these 8 properties would experience a Negligible effect, which is considered not significant. The remaining 6 properties that would experience noticeable effects and are discussed in more detail below.

Mcilroys Building

9.89 A total of 197 windows serving 67 rooms were assessed for daylight within this building.

9.90 For VSC, 189 (96%) of the windows assessed would meet the BRE criteria and are considered to experience a Negligible effect.

9.91 Of the 8 windows (4%) that fall below the recommended BRE VSC criteria, 8 windows will experience alterations between 20%-29.9%, which is considered a minor adverse effect..

9.92 For NSL, 67 (100%) of the 67 rooms assessed would meet the BRE criteria and are considered to experience a Negligible effect.

9.93 In consideration of the above and the retained daylight values, overall the effect to daylight within this property is considered to be direct, long-term, local and Minor Adverse (**significant**).

Figure 9.4 Proposed Development in Existing Surrounding Context



Table 9.9 Summary of VSC and NSL Levels with the Proposed Development

Receptor Number	Receptor Address	Total No. Windows	No. Windows that meet BRE criteria for VSC (≥27% VSC and/or ≤20% alteration)	%	Below BRE Guidelines			Total No. Windows below BRE Guidelines	%	Total No. Rooms	No. Rooms that meet BRE criteria for NSL (≤20% alteration)	%	Below BRE Guidelines			Total No. Rooms below BRE Guidelines	%
					>20 - <29.99% alteration	≥30 - <39.99% alteration	≥40% alteration						>20 - <29.99% alteration	≥30 - <39.99% alteration	≥40% alteration		
1	40-42 Oxford Road	12	12	100%	0	0	0	0	0%	6	6	100%	0	0	0	0	0%
2	38 Oxford Road	92	92	100%	0	0	0	0	0%	12	12	100%	0	0	0	0	0%
3	McIlroys Building	197	189	96%	8	0	0	8	4%	67	67	100%	0	0	0	0	0%
4	61-62 St Mary's Butts	10	10	100%	0	0	0	0	0%	6	6	100%	0	0	0	0	0%
5	59-60 St Mary's Butts	6	6	100%	0	0	0	0	0%	6	5	83%	1	0	0	1	17%
6	58 St Mary's Butts	4	4	100%	0	0	0	0	0%	4	4	100%	0	0	0	0	0%
7	57 St Mary's Butts	2	2	100%	0	0	0	0	0%	2	2	100%	0	0	0	0	0%
8	55-56 St Mary's Butts	14	14	100%	0	0	0	0	0%	10	10	100%	0	0	0	0	0%
9	Reading Minster	17	17	100%	0	0	0	0	0%	5	5	100%	0	0	0	0	0%
10	2-6 Castle Street	4	4	100%	0	0	0	0	0%	4	3	75%	1	0	0	0	25%
11	8 Castle Street	1	1	100%	0	0	0	0	0%	1	1	100%	0	0	0	0	0%
12	St Mary's Church	27	24	89%	3	0	0	3	11%	7	7	100%	0	0	0	0	0%
13	16 Castle Street	12	9	75%	3	0	0	3	25%	11	9	82%	1	1	0	2	18%

59-60 St Mary's Butts

- 9.94 A total of 6 windows serving 6 rooms were assessed for daylight within this building.
- 9.95 For VSC, all 6 windows (100%) would meet the BRE criteria and are therefore considered to experience a Negligible effect.
- 9.96 For NSL, 5 (83%) of the 6 rooms assessed would meet the BRE criteria and are considered to experience a Negligible effect.
- 9.97 The room that falls below the recommended BRE criteria experience alterations of 23% which is considered Minor Adverse. The room is notably deep at 7-9m's (see contour drawing BRE 339 located within **ES Volume 3, Appendix: DSO – Annex 4**. The BRE Guidelines (2.2.12) state where 'rooms lit from one side only and greater than 5m deep, then a greater movement of the no sky line may be unavoidable'.
- 9.98 In consideration of the above, the overall the effect to daylight within this property is considered to be a direct, long-term, local and Minor Adverse effect (**significant**).

2-6 Castle Street

- 9.99 A total of 4 windows serving 4 rooms were assessed for daylight within this building.
- 9.100 For VSC, all 4 windows (100%) would meet the BRE criteria and are therefore considered to experience a Negligible effect.
- 9.101 For NSL, 3 (75%) rooms assessed would meet the BRE criteria and are considered to experience a Negligible effect.
- 9.102 The room that falls below the recommended BRE criteria experience alterations of 21% which is considered Minor Adverse.
- 9.103 In consideration of the above, overall the effect to daylight within this property is considered to be a direct, long-term, local and Minor Adverse effect (**significant**).

Receptor Number	Receptor Address	Total No. Windows	No. Windows that meet BRE criteria for VSC ($\geq 27\%$ VSC and/or $\leq 20\%$ alteration)	%	Below BRE Guidelines			Total No. Windows below BRE Guidelines	%	Total No. Rooms	No. Rooms that meet BRE criteria for NSL ($\leq 20\%$ alteration)	%	Below BRE Guidelines			Total No. Rooms below BRE Guidelines	%
					>20 - <29.99% alteration	≥ 30 - <39.99% alteration	$\geq 40\%$ alteration						>20 - <29.99% alteration	≥ 30 - <39.99% alteration	$\geq 40\%$ alteration		
14	15 Queens Walk (Queens Court)	293	242	83%	30	18	3	51	17%	225	219	97%	4	2	0	0	3%
Total		691	626	91%	44	18	3	65	9%	366	356	97%	7	3	0	10	3%
*Properties highlighted in grey comply with both the VSC and NSL Daylight criterion and therefore will experience a Negligible effect (not significant)																	

St Mary's Church

9.104 A total of 27 windows serving 7 rooms were assessed for daylight within this building.

9.105 For VSC, 24 windows (89%) would meet the BRE criteria and are therefore considered to experience a Negligible effect.

9.106 Of the 3 windows that fall below the recommended BRE criteria, 3 will experience alterations between 20%-29.99%, which is considered a Minor Adverse effect.

9.107 For NSL, all 7 (100%) rooms assessed would meet the BRE criteria and are considered to experience a Negligible effect.

9.108 In consideration of the above, overall the effect to daylight within this property is considered to be a direct, long-term, local and Minor Adverse effect (**significant**).

16 Castle Street

9.109 A total of 12 windows serving 11 rooms were assessed for daylight within this building.

9.110 For VSC, 9 windows (78%) would meet the BRE criteria and are therefore considered to experience a Negligible effect.

9.111 Of the 3 windows that fall below the recommended BRE criteria, 3 will experience alterations between 20%-29.99%, which is considered a Minor Adverse effect.

9.112 For NSL, 9 (82%) rooms assessed would meet the BRE criteria and are considered to experience a Negligible effect.

9.113 One of the two rooms that falls below the recommended BRE criteria experience alterations of 25% which is considered a Minor Adverse effect with the second room experiencing alterations of 31% which is considered a Moderate Adverse effect.

9.114 In consideration of the above, overall the effect to daylight within this property is considered to be a direct, long-term, local and Minor Adverse effect (**significant**).

15 Queens Walk (Queens Court)

9.115 A total of 293 windows serving 225 rooms were assessed for daylight within this building.

9.116 For VSC, 242 windows (83%) would meet the BRE criteria and are therefore considered to experience a Negligible effect.

9.117 Of the 51 windows that fall below the recommended BRE criteria, 30 will experience alterations between 20%-29.99%, which is considered a Minor Adverse effect; 15 of these retain a VSC between 15-19% which is considered commensurate with an urban location. A further 5 rooms experience a minor adverse alteration in VSC however the rooms they serve meet the BRE criteria in NSL terms.

9.118 18 of the remaining 21 windows experience alterations between 30%-39.99% which is considered to be a Moderate Adverse effect with the remaining 3 windows experiencing alterations of >40% which is considered to be a Major Adverse effect.

9.119 For NSL, 219 (97%) rooms assessed would meet the BRE criteria and are considered to experience a Negligible effect.

9.120 4 of the remaining 6 rooms experience alterations between 20%-29.99% which is considered to be a Minor Adverse effect with the remaining 2 rooms experiencing alterations of 30%-39.99% which is considered a Moderate Adverse effect.

9.121 In consideration of the above, overall the effect to daylight within this property is considered to be a direct, long-term, local and Minor to Moderate Adverse (**significant**).

Sunlight

9.122 The full sunlight assessment is presented within **ES Volume 3, Appendix: DSO – Annex 3**.

9.123 A total of 243 rooms have been assessed for sunlight within 10 neighbouring properties that are relevant for the sunlight assessment. Of the 243 rooms assessed, 238 (98%) would meet the BRE criteria for both winter and annual sunlight (APSH).

9.124 The BRE Guidelines state (3.2.2) that obstruction to sunlight may become an issue if some part of the new development is situated within 90 degrees due south of a main window wall of an existing building. 4 properties, 2-6 Castle Street, 8 Castle Street, St Mary's Church and 16 Castle Street have not been assessed for sunlight as the Proposed Development is wholly north of the properties meaning sunlight amenity is not expected to be affected.

9.125 In relation to winter sunlight, 243 rooms (100%) meet the BRE criteria.

9.126 In relation to annual sunlight (APSH) 238 (98%) meet the BRE criteria. Of the 5(2%) that do not meet the BRE criteria (APSH), 5 experience an alteration above 40% which is considered to be an Major Adverse effect.

9.127 Overall, 9 out of 10 properties will meet BRE Criteria for winter and annual sunlight. The one property which experiences an adverse effect is discussed below. The 9 properties which experience a Negligible (not significant) effect are:

- 40-42 Oxford St;
- 38 Oxford Road
- McIlroys Buildings
- 61-62 St Mary's Butts
- 59-60 St Mary's Butts
- 58 St Mary's Butts
- 57 St Mary's Butts
- 55-56 St Mary's Butts

Table 9.10 Summary of APSH levels with the Proposed Development

Receptor Number	Receptor Address	Total No. Rooms	No. Rooms that meet Total & Winter BRE criteria for Sunlight (≥5% winter and/or ≤20% alteration AND ≥25% total and/or ≤20% alteration)	%	No. Rooms that meet Winter BRE criteria for Sunlight (≥5% winter and/or ≤20% alteration)	%	Below BRE Guidelines for Winter Sunlight			Total no. Windows below BRE Guidelines for Winter Sunlight	%	No. Rooms that meet Total BRE criteria for Sunlight (>25% total and/or ≤20% alteration)	%	Below BRE Guidelines for Total Sunlight			Total no. Rooms below BRE Guidelines for Total Sunlight	%
							>20 - <29.99% alteration	≥30 - <39.99% alteration	≥40 alteration					>20 - <29.99% alteration	≥30 - <39.99% alteration	≥40 alteration		
1	40-42 Oxford Road	6	6	100%	6	100%	0	0	0	0	0%	6	100%	0	0	0	0	0%
2	38 Oxford Road	8	8	100%	8	100%	0	0	0	0	0%	8	100%	0	0	0	0	0%
3	McIlroys Building	67	67	100%	67	100%	0	0	0	0	0%	67	100%	0	0	0	0	0%
4	61-62 St Mary's Butts	6	6	100%	6	100%	0	0	0	6	0%	6	100%	0	0	0	0	0%
5	59-60 St Mary's Butts	6	6	100%	6	100%	0	0	0	0	0%	6	100%	0	0	0	0	0%
6	58 St Mary's Butts	4	4	100%	4	100%	0	0	0	0	0%	4	100%	0	0	0	0	0%
7	57 St Mary's Butts	2	2	100%	2	100%	0	0	0	0	0%	2	100%	0	0	0	0	0%
8	55-56 St Mary's Butts	10	10	100%	10	100%	0	0	0	0	0%	10	100%	0	0	0	0	0%
9	Reading Minster	5	5	100%	5	100%	0	0	0	0	0%	5	100%	0	0	0	0	0%
14	15 Queens Walk (Queens Court)	129	124	96%	129	100%	0	0	0	0	0%	124	96%	0	0	5	5	4%
Totals		243	238	98%	245	100%	0	0	0	0	100%	238	98%	0	0	5	5	2%
*Properties highlighted in grey comply with both the APSH and WPSH Daylight criterion and therefore will experience a Negligible effect (not significant)																		

Reading Minster15 Queens Walk (Queens Court)

- 9.128 129 rooms have been assessed at this property.
- 9.129 Of these, 124 (96%) will meet the BRE criteria for winter and total sunlight.
- 9.130 In relation to winter sunlight, all 129 (100%) windows will meet the BRE criteria for winter sunlight.
- 9.131 In terms of total sunlight (APSH) 124 windows (96%) will comply with the BRE Guidelines for annual probable sunlight hours. As such, these windows should receive acceptable sunlight amenity throughout the course of the year.
- 9.132 The remaining 5 experience an alteration of >40% and therefore the impact is classified as a Major Adverse effect.
- 9.133 The orientation therefore means that the windows are limited in relation to sunlight access. The building form means that many windows face east and are restricted in sunlight by another part of the building to the south of the windows.
- 9.134 In consideration of the orientation of many of the windows and the minority of windows adversely affected the effect to sunlight amenity within this property is considered to be a direct, long-term, local and Minor Adverse (significant).

Overshadowing

Sun Hours on Ground

- 9.135 The full Sun Hours on Ground (SHOG) assessment (Overshadowing) is presented within **ES Volume 3, Appendix: DSO – Annex 6**.
- 9.136 A total of six amenity areas have been considered for the assessment.
- 9.137 In summary, five amenity areas (1, 2, 3, 4 and 5) meet the BRE criteria for overshadowing with the Proposed Development. These areas achieve the recommended 2 hours of Sunlight to 59%-100% of the respective areas which is in excess of the 50% BRE recommendation. The likely effect on these areas is considered to be a direct, long-term, local and Negligible (Not Significant).
- 9.138 The area which receives two Hours of sunlight at Amenity Area 6 (Public space – Queens Walk (pedestrian shopping street)) in the existing condition experiences an alteration of 33% which is technically a moderate alteration. However it is important to note that in the existing condition only 44% of the area achieving two hours of sunlight. As such, the part affected by the Proposed Development is relatively small in relation to the overall size of the amenity area. This can be seen in drawing SHD/001 within **ES Volume 3, Appendix: DSO – Annex 6 (Volume 3)**.
- 9.139 Whilst there is a 33% change when this space is assessed on March 21st, this space comfortably meets the two hours of sunlight on June 21st when the sun is at its highest as shown in drawing SHD/002 within **ES Volume 3, Appendix: DSO – Annex 6**.

9.140 Overall in consideration of nature of the loss to Amenity Area 6 the alteration is considered to be a direct, long-term, local and Minor Adverse (**significant**) effect.

Transient Overshadowing

9.141 The full Transient Overshadowing assessment is presented within **ES Volume 3, Appendix: DSO – Annex 7**.

9.142 Six amenity areas have been considered for the assessment of the transient overshadowing on the 21st March, 21st June and 21st December, comments in relation to each date are given below.

21st March

9.143 In general the six amenity areas are considered to remain unaffected. The analysis has identified some increased shadow to Amenity Area 6 which will occur between 8am-11am, however after this period the area is unaffected.

9.144 It is the case that in the existing condition Amenity Area 6 does not enjoy large amounts sunlight during this period, this is considered to be due to the architectural form of the existing surrounding buildings which make it difficult for sunlight to reach ground level. As such whilst the increase in shadow from the Proposed Development affects a relatively small area of the amenity space this area does represent the limited sunlit area between 8-11am.

9.145 Overall, in consideration of the existing buildings which reduce the sunlit area in the existing condition and that the increased shadow from the Proposed Development only affecting a small part of the amenity area and for a limited time, the effect upon Amenity Area 6 on 21st March is considered to be Minor Adverse.

9.146 The effect of the Proposed Development on amenity areas 1-5 is considered Negligible (not significant) and there is considered to be a Minor Adverse (**significant**) effect to Amenity Area 6. These effects are considered to be a direct, long-term and local.

21st June

9.147 With regards the 21st June assessment In general the six amenity areas are considered to remain unaffected with instances of increased shadow for limited periods of time. The analysis has identified some increased shadow for limited periods of time to Amenity Areas 3, 4, 5 and 6. Amenity Areas 1 and 2 are not affected.

9.148 Amenity Area 3 experiences increased shadow coverage between 5pm and 6pm however remains unaffected prior and after this period. Overall in consideration the effect to the area throughout the day is considered Negligible.

9.149 Amenity Areas 4 and 5 experience increased shadow between 5pm and 7pm although the areas remain unaffected prior and after this period (Negligible effect).

9.150 Amenity Area 6, as with 21st March experiences increased shadow coverage between 8-11am. In the existing condition the sunlit area during this time is limited and as such the increased shadow does affect this remaining sun-lit area at this time. When considered over the course of the day the effect is considered to be a Minor Adverse impact.

9.151 Overall, in consideration of the Transient overshadowing impact throughout 21st June the effect to Amenity Area 6 is considered to be Minor Adverse (**significant**). The effect to Amenity Areas 1, 2, 3, 4 and 5 is considered to be Negligible (not significant). These effects are considered to be a direct, long-term and local.

21st December

9.152 As with the 21st March assessment, in general the five amenity areas remain unaffected, aside from Amenity Area 6 which experiences increased show coverage for a limited time between 9-11am.

9.153 In consideration of the existing buildings to the immediate south of the amenity area, which artificially reduce sunlight access in the existing condition and the limited time (circa 2 hours) in which the area is affected by the Proposed Development, the overall impact is considered to be Minor Adverse (**significant**). The effect to Amenity Areas 1, 2, 3, 4 and 5 is considered to be Negligible (not significant). These effects are considered to be a direct, long-term and local.

MITIGATION AND MONITORING MEASURES

Demolition and Construction

9.154 No technical analysis of the likely significant effects on the surrounding properties and amenity spaces during the demolition and construction phases were carried out.

9.155 During construction works, a number of tall cranes are likely to be on-site. The presence of such machinery is temporary, and due their proportions, any impact upon daylight, sunlight or sun-on-ground (overshadowing) amenity is likely to be very minor, and imperceptible in nature.

9.156 The potential effects of the construction of the Proposed Development will vary during demolition and construction and likely gradually increase to the maximum effect identified by the completed Development assessments, as the superstructure is built and then clad.

9.157 It is therefore considered that no mitigation is required as the completed Proposed Development represents the worst-case assessment in terms of likely daylight, sunlight, and overshadowing effects.

Completed Development

Daylight and Sunlight

9.158 In relation to daylight and sunlight amenity the majority of neighbouring sensitive receptors will experience negligible or minor effects, with instances of moderate and major alterations.

9.159 Given the scale of the massing proposed and the urban context of the site, these effects are likely to be unavoidable in relation to new development.

9.160 A certain amount of mitigation has been embedded into the design to minimise the potential effects on sensitive receptors.

Overshadowing

9.161 Whilst there will be a Minor Adverse effect in terms of sun hours on ground (overshadowing) to Amenity Area 6 for a limited time, the majority of external neighbouring Amenity Areas 1, 2, 3, 4 and 5 are not likely to experience significant effects as a result of the Proposed Development.

9.162 Furthermore, the transient overshadowing assessment indicates that additional overshadowing is likely to be experienced only during isolated periods of the day and thus the areas should remain unaffected for the majority of the day.

9.163 Given the assessment, no mitigation is considered necessary to address the potential impact of overshadowing.

RESIDUAL EFFECTS

9.164 The residual effects resulting from the Proposed Development are summarised in Table 9.11.

Table 9.11 Summary of Residual Effects

Receptor	Receptor Sensitivity	Residual Effect (Nature and Scale)	Significance	Geo	D I	P T	St Mt Lt
Completed Development							
Daylight							
40-42 Oxford Road	High	Negligible	Not Significant	L	D	P	Lt
38 Oxford Road	High	Negligible	Not Significant	L	D	P	Lt
McIlroys Building	High	Minor Adverse	Significant	L	D	P	Lt
61-62 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
59-60 St Mary's Butts	High	Minor Adverse	Significant	L	D	P	Lt
58 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
57 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
55-56 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
Reading Minster	High	Negligible	Not Significant	L	D	P	Lt
2-6 Castle Street	High	Minor Adverse	Significant	L	D	P	Lt
8 Castle Street	High	Negligible	Not Significant	L	D	P	Lt

Receptor	Receptor Sensitivity	Residual Effect (Nature and Scale)	Significance	Geo	D I	P T	St Mt Lt
St Mary's Church	High	Minor Adverse	Significant	L	D	P	Lt
16 Castle Street	High	Minor Adverse	Significant	L	D	P	Lt
15 Queens Walk (Queens Court)	High	Minor to Moderate Adverse	Significant	L	D	P	Lt
Sunlight							
40-42 Oxford Road	High	Negligible	Not Significant	L	D	P	Lt
38 Oxford Road	High	Negligible	Not Significant	L	D	P	Lt
McIlroys Building	High	Negligible	Not Significant	L	D	P	Lt
61-62 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
59-60 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
58 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
57 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
55-56 St Mary's Butts	High	Negligible	Not Significant	L	D	P	Lt
Reading Minster	High	Negligible	Not Significant	L	D	P	Lt
2-6 Castle Street	High	Negligible	Not Significant	L	D	P	Lt
8 Castle Street	High	Negligible	Not Significant	L	D	P	Lt
St Mary's Church	High	Negligible	Not Significant	L	D	P	LT
16 Castle Street	High	Negligible	Not Significant	L	D	P	Lt
15 Queens Walk (Queens Court)	High	Minor Adverse	Significant	L	D	P	Lt
Transient Overshadowing							
Transient Overshadowing 21 st March Amenity Areas 1-5	High	Negligible	Not Significant	L	D	P	Lt
Transient Overshadowing 21 st March Amenity Area 6	High	Minor Adverse	Significant	L	D	P	Lt
Transient Overshadowing 21 st June Amenity Areas 1-5	High	Negligible	Not Significant	L	D	P	Lt
Transient Overshadowing 21 st June Amenity Areas 6	High	Minor Adverse	Significant	L	D	P	Lt
Transient Overshadowing 21 st December Amenity Area 1-5	High	Negligible	Not Significant	L	D	P	Lt
Transient Overshadowing 21 st December Amenity Area 6	High	Minor Adverse	Significant	L	D	P	Lt
Overshadowing – Sun Hours On Ground							
Sun Hours on Ground Amenity Areas 1-5	High	Negligible	Not Significant	L	D	P	IR
Sun Hours on Ground	High	Minor Adverse	Significant	L	D	P	IR

Receptor	Receptor Sensitivity	Residual Effect (Nature and Scale)	Significance	Geo	D I	P T	St Mt Lt
Amenity Area 6							
Notes: Residual Effect Scale = Negligible / Minor / Moderate / Major Nature = Beneficial or Adverse Geo (Geographic Extent) = Local (L), Borough (B), Regional (R), National (N) D = Direct / I = Indirect P = Permanent / T = Temporary St = Short Term / Mt = Medium Term / Lt = Long Term N/A = not applicable / not assessed							

LIKELY SIGNIFICANT EFFECTS

- 9.165 The daylight analysis indicates that the majority of neighbouring residential receptors would not experience significant effects to the levels of daylight they receive with the Proposed Development site in place. Whilst alterations are predominantly negligible, there are discrete instances of minor, moderate and major alterations seen to windows or rooms at several properties. When considering the properties as a whole, the potential impact on 8 properties are considered to give rise to likely Negligible effects, with the remaining 5 properties experiencing an overall likely effect considered Minor Adverse and 1 property experiencing a Minor to Moderate Adverse effect.
- 9.166 It has been identified that for several properties alongside the alterations to the daylight amenity, factors such as retained values, room use and architectural design features are relevant to the consideration of the overall impact to the property.
- 9.167 In relation to sunlight, the modelling of the Proposed Development has shown the potential impact on 9 of the 10 properties assessed would give rise to likely Negligible effects. There are discrete instances of minor, moderate and major alterations to the remaining property. When considering this property as a whole, it is considered to experience a minor adverse effect.
- 9.168 With regards to the overshadowing (sun hours on ground) assessment, 5 out of 6 amenity areas are unaffected and therefore the impact from the Proposed Development is considered to be negligible. Amenity Area 6 does experience a reduction in the area which receives 2 hours of sunlight and overall the overshadowing impact is considered to be Minor Adverse.
- 9.169 The transient overshadowing exercises have demonstrated that in general the 6 Amenity Areas will remain unaffected. The assessments have been undertaken on 21st March, 21st June and 21st December, it has been identified that some increased shadow coverage will be present for Amenity Areas 3, 4, 5 and 6 although only for limited periods of time.
- 9.170 Overall, the transient overshadowing impact upon Amenity Area 6 is considered to be Minor Adverse and Areas 1-5 is considered to be negligible.

ASSESSMENT OF FUTURE ENVIRONMENT

Evolution of the Baseline Condition Scenario

- 9.171 From a daylight, sunlight and overshadowing assessment perspective, evolution of the baseline condition can only occur with further schemes being built in the local area. Should the Proposed Development not come forward, but a neighbouring scheme built out first, then there could be increased daylight, sunlight and overshadowing effects to the surrounding sensitive receptors considered.

Cumulative Effects

- 9.172 A number of cumulative schemes within the surrounding area (identified in **ES Volume 1, Chapter 2: EIA Methodology** which have been reviewed with regards to potential cumulative effects. Overall, given the distance of these cumulative schemes to the site, they have not been considered relevant for inclusion as part

of a cumulative assessment for daylight, sunlight and overshadowing as a cumulative effect is not likely to result. However, consideration has still been given qualitatively to the Minster Quarter Area Development Framework which is located to the southwest of the Development Site. This can be seen in Figure 9.5.

Figure 9.5 MQADF area



Minster Quarter Area Development Framework

- 9.173** Given the Minster Quarter Area Development Framework (MQADF) massing is at concept stage, the likely significant cumulative effects have been qualitatively assessed.
- 9.174** In general, it is considered that Minister Quarter Area Development Framework (MQADF) massing would not create significant cumulative effects in relation to sensitive receptors considered against the Proposed Development in terms of daylight and sunlight. This is primarily due to the location of the MQAD Framework massing to the southwest of the site which is away from the majority of residential neighbours. Any cumulative effects that could occur to the receptors are likely be limited and minor in nature.
- 9.175** In terms of overshadowing, the closest amenity spaces which were identified for assessment against the Proposed Development (SHOG) are set to be redeveloped as part of the MQADF (Amenity Area 4 and 5) and so have been scoped out of a cumulative consideration. The only other area which has been considered and could experience a cumulative effect is Amenity Area 6 which is located to the north of the MQADF. Any potential cumulative effects to this area are likely to be limited and minor in nature.
- 9.176** On the basis that both the Proposed Development and the proposals for MQADF are built out at the same time will naturally result in some cumulative effects in daylight and sunlight terms to any residential units within the MQADF.
- 9.177** There is likely to be some minor to moderate effects in daylight terms to some of the residential amenity which may be located within the northern elevations of Plot A. There are plots located further afield from the Proposed Scheme and the likely cumulative effects to these are considered to be negligible in nature.
- 9.178** In regard to sunlight, given the Proposed Development is situated to the north of the MQADF, it is anticipated that any cumulative effects would be negligible given the sun's path.

- 9.179** Given that the Proposed Development site is part of the MQADF and ear marked for buildings of such scale will invariably give rise to some levels of harm on adjacent sites which have also been identified for development as part of the framework.

Overall Conclusion

- 9.180** On the basis of the daylight, sunlight and overshadowing technical assessment the majority of properties assessed will experience negligible impacts, with instances of minor, moderate and major adverse impacts. It is generally considered that most meaningful development within an urban location will result in instances of moderate and major effects to sensitive neighbours and therefore may be unavoidable. Where transgressions of BRE guidance do occur in general the retained levels are considered to be close to the BRE Guideline criteria, considered commensurate with an urban location or as a result of low existing levels. Furthermore, in several instances significant changes in light are considered to be mitigated by additional lighting sources to the particular room or losses are located to bedrooms which are considered to be less significant in terms daylight and sunlight.
- 9.181** It is clear that the majority of properties assessed will not experience significant adverse effects.
- 9.182** Whilst there will be an instance of a Minor Adverse effect in terms of sun hours on ground (overshadowing) to Amenity Areas 6, the majority of external neighbouring amenity areas will not experience significant overshadowing (Sun on Ground) effects as a result of the Proposed Development. Furthermore, the transient overshadowing assessments indicate that additional overshadowing will be experienced during isolated periods of the day and thus these areas should remain unaffected for the majority of the day. As such, no mitigation is considered necessary.
- 9.183** It is anticipated that the cumulative effects on neighbouring sensitive receptors would be minor in nature with potential minor to moderate effects to any immediate residential amenity within the cumulative proposals located directly to the south of the Proposed Development. Overall, it is Delva Patman Redler's professional opinion that the Proposed Development is considered to be acceptable in consideration of the daylight, sunlight and overshadowing amenity to neighbouring sensitive receptors.

Chapter 10: Wind Microclimate

WIND MICROCLIMATE	
AUTHOR	FD Global Limited (FDG)
SUPPORTING APPENDIX	ES Volume 3, Appendix: Wind Microclimate Annex 1: Wind Microclimate Report, December 2023
KEY CONSIDERATIONS	This chapter assesses the wind microclimate effects of the Proposed Development on the site and within the surrounding areas and considers whether the resulting changes in wind speeds would be suitable, in regard to comfort and safety, for the intended usage of sensitive locations in and around the site. A combination of Computational Fluid Dynamics (CFD) analysis and wind tunnel assessments have been conducted to assess the wind microclimate conditions.

ASSESSMENT METHODOLOGY

Defining the Baseline

Current Baseline Conditions

- 10.1** The baseline conditions across the existing site and the surroundings have been defined using wind tunnel testing to provide a detailed, quantitative assessment.
- 10.2** Mean and peak wind speeds have been measured (for both the windiest season (normally winter) to show the worst case scenario, and summer season for amenity spaces (amenity spaces are assessed during the summer season as these areas are expected to be used most frequently during this period with an expectation of calmer conditions compared to other times of the year) at locations across the existing site and at other surrounding buildings, paths, roads and areas of open spaces for 36 wind directions in 10° increments within a 360m radius of the site which is considered a large enough scale to ensure all wind effects are captured. Details of the tunnel test methodology is presented in the section '*Wind Tunnel Testing and CFD Methodology*' of this ES chapter.
- 10.3** The results have been combined with long-term meteorological climate data appropriate for the local Reading area (London Heathrow Airport). The meteorological data used in this assessment is deemed to be representative of the local wind microclimate for the Reading area. The meteorological data used is presented within '*Baseline Conditions – Meteorological Data*' section and shown in Figure 10.1.

Evolution of the Baseline

- 10.4** The evolution of the baseline condition (in the event that the Proposed Development does not come forward) has been considered using professional judgement informed by the results of the Baseline Scenario (test Configuration 1) and the wind tunnel results undertaken as part of the cumulative effects assessment (see section '*Assessment of Future Environment – Cumulative Effects Assessment*' of this ES chapter).
- 10.5** The cumulative scenario provides information on the general changes, if any, in wind conditions around the site as a result of the cumulative schemes. This cumulative effect assessment takes account of the other future schemes within the area surrounding the site (presented within **ES Volume 1, Chapter 2: EIA Methodology**).

Impact Assessment Methodology

Demolition and Construction

- 10.6** The potential microclimate impacts during demolition and construction works have not been directly assessed within the wind tunnel or using CFD analysis, as this is a temporary condition and would be highly variable as the relevant parts of the existing buildings are demolished and the Proposed Development is constructed. The potential impacts are assessed using the professional judgement of an experienced wind engineer, based on an assessment of the background wind climate at the site (the results of the tested configurations for the baseline and completed development scenarios) and an understanding of the likely effects based on FDG's experience of assessing wind in the built environment.
- 10.7** This approach is taken assuming that the activity on-site during this time (i.e. construction activity) is less sensitive to wind conditions (due to protection from site hoarding, and site access being restricted to site workers) than when the Proposed Development is completed and occupied (which would include new building entrances and outdoor seating with amenity spaces, for example). In addition, there would be appropriate health and safety measures implemented to ensure that the construction workers were adequately protected.

- 10.8** Windier conditions (in terms of pedestrian comfort) will be tolerable across the active demolition and construction site as this area is not for typical pedestrian use.

Completed Development

- 10.9** To predict the local wind environment associated with the completed Proposed Development, and the resulting pedestrian comfort within and surrounding the site, wind tunnel testing of the Proposed Development has been undertaken within the wind tunnel. The wind tunnel testing has been supplemented with CFD analysis.
- 10.10** Wind tunnel testing and CFD allow the pedestrian level wind microclimate at the site and in the surrounding area to be quantified and classified in accordance with the accepted criteria (refer to '*Assessment Criteria*' section of this ES chapter).
- 10.11** Wind tunnel testing and CFD deliver a detailed assessment of the mean and gust wind conditions in and around the site for the tested wind directions in terms of pedestrian comfort and safety and provides a basis to assess the potential wind microclimate impacts and likely effects of the Proposed Development with regards to its intended use.
- 10.12** It is acknowledged that a direct comparison with the baseline conditions would be useful to understand changes from the existing (baseline) wind conditions across the site due to the Proposed Development. However, a comparison of the measured wind environment for the Proposed Development with the existing conditions does not take into account any change in pedestrian activity that would usually accompany development. Comparisons between the baseline scenario and 'completed development' scenario have therefore been made where possible and relevant to the consideration of wind microclimate impacts and effects.

Wind Tunnel Testing and CFD Methodology

- 10.13** The methodology for quantifying the pedestrian level wind environment is outlined below within four steps. Further details of the assessment methodology are presented within **ES Volume 3, Appendix: Wind Microclimate**.
- Step 1: The site's induced wind speeds are physically measured in the wind tunnel and computationally measured in CFD for the appropriate configuration(s) at the appropriate pedestrian level(s);
 - Step 2: Standard meteorological data is adjusted to account for conditions at a subject site (for this assessment, meteorological data has been derived from the meteorological station of London Heathrow Airport);
 - Step 3: Data from Step 1 and Step 2 is combined to obtain the expected frequency and magnitude of wind speed for the appropriate configuration(s) and at the appropriate pedestrian level(s); and
 - Step 4: The results of Step 3 are compared with the Lawson Comfort Criteria (and where relevant, the change in the wind microclimate conditions between appropriate test configuration(s)) to 'grade / score' the conditions within and around the site.
- 10.14** To produce the results within the wind tunnel, a 1:400 scale model comprising the site and the surrounding area (including relevant existing buildings and other topographical features) was constructed on a 3.0m diameter disc allowing for the surrounding area within a 600 metre (m) radius of the centre of the site of the Proposed Development to be modelled (the radius is determined based on the scale model and due to the physical constraints of the modelling in the wind tunnel). This radius is considered a large enough scale to ensure all likely wind effects are captured.
- 10.15** Wind is unsteady, or gusty, and this 'gustiness' or turbulence, varies depending upon the site. In order to model the likely effects of gustiness or turbulence (which depends on the geographical location), a combination of spires and floor roughness elements have been employed in the wind tunnel in order to create a 'boundary layer' that is representative of the urban location of the site. The detailed wind tunnel model around the Proposed Development is used to fine-tune the flow and create conditions similar to those expected at full scale.
- 10.16** Other developments outside the 600m radius of the site would not individually be expected to modify the wind approaching the site and as such have been included within the analysis of the surrounding terrain.
- 10.17** To test the impact of the Proposed Development, a scale model of the buildings comprising the completed Proposed Development has been constructed (*Configuration 2: Proposed Development with Existing Surrounding Buildings*).

- 10.18** Wind speed measurements within and around the site for the tested configurations were established using ‘Irwin probes’. These sensors can measure the mean and gust wind speeds at a full-scale height of approximately 1.5m above the surface upon which the probe is located.
- 10.19** The wind speed was measured at up to 167 locations under the configurations for all wind directions in equal increments, with 0° representing wind blowing from the north and 90° wind from the east and so on.

Model Configurations Assessed

- 10.20** The assessment of the wind microclimate is based on the results from a series of tests of physical models within the wind tunnel to provide a detailed, quantitative assessment. The existing landscaping to the south of the site has been included to provide an accurate representation of the environmental context and the wind microclimate across the site. The tests with the Proposed Development in the existing surrounds and in cumulative surrounds have incorporated existing and also proposed soft landscaping measures to ensure that their local effects on the wind comfort and safety are duly captured.
- 10.21** Configurations tested within the wind tunnel include, which were tested without landscaping as a worst case:
- Configuration 1: Existing Site with Existing Surrounding Buildings;
 - Configuration 2: Proposed Development with Existing Surrounding Buildings;
 - Configuration 3: Proposed Development with Cumulative Surrounding Buildings (cumulative schemes).
- 10.22** Configuration 2 was subsequently re-run with the addition of mitigation measures (as described in the ‘Residual Effects and Mitigation Measures’ section), were adverse or unsuitable conditions were identified. These mitigation measures are considered in the final residual effects identified.
- 10.23** All cumulative schemes that fall within the 600m radius of the nominal centre of the site at full scale have been included in the wind tunnel proximity for test Configuration 3 such that their potential effects on the cumulative wind microclimate impacts are quantified in the assessment. Cumulative schemes that have been considered are listed below:
- 52-55 Friar Street Reading and 12 Greyfriars Road, RG1 1DX (Planning Reference 162210);
 - Station Hill, Reading (Planning Reference 130436), including Plot E and Telecom House (Planning Reference 151426);
 - Land between Weldale Street and Chatham Street Reading (Planning Reference 170326);
 - Former Sorting Office, Caversham Road / Vastern Road (Planning Reference 110024);
 - 29 Station Road, Reading, RG1 1LG (Planning Reference 181930);
 - Bristol & West Arcade Market Place Reading RG1 1JL (Planning Reference 180358);
 - Former Car Park East Street Reading RG1 4QH (Planning Reference 181849);
 - 55 Vastern Road Reading RG1 8BU (Planning Reference 200188).
- 10.24** In addition to the above, consideration has been given to the Minster Quarter. A framework for the Minster Quarter area has been prepared. This provides a comprehensive masterplan and urban design framework for the area with a particular emphasis on creating high quality public realm around which various mixed uses will be located. The MQADF was presented to the Council’s Strategic Environment Planning and Transport Committee on 12 December 2018 where it was formally adopted.
- 10.25** The Cumulative Assessment section within this ES chapter presents the consideration of the cumulative schemes as ‘Scenario 1’ and the scenario taking into account the Minster Quarter Street Area Development Framework (MQADF) is presented as ‘Scenario 2’.
- Assessment Criteria
- Lawson Comfort Criteria
- 10.26** The assessment of the wind conditions requires a standard against which the measurements can be compared. This assessment of the wind tunnel results presented in this ES chapter adopts the Lawson Comfort Criteria

(‘the Lawson Criteria’)¹, which have been established for over 30 years. In particular, the assessment is based on the 2001 London Dockland Development Corporation (LDDC) variant of the Lawson criteria.

- 10.27** The Lawson Criteria described in Table 10.1 is presented to define the reaction of an average pedestrian to the wind. If the measured wind conditions exceed the threshold wind speed for more than 5% of the time, then they are unacceptable for the stated pedestrian activity and the expectation is that there may be complaints of nuisance or people will not use the area for its intended purpose.
- 10.28** The Lawson Criteria set out four pedestrian activities (comfort categories) and reflect the fact that less active pursuits require more benign wind conditions. The four categories are: sitting, standing, strolling, and walking, in ascending order of activity level, with a fifth category for conditions that are uncomfortable for all uses. In other words, the wind conditions in an area required for sitting need to be calmer than a location that people merely walk past. The distinction between strolling and walking is that in the strolling scenario pedestrian are more likely to take on a leisurely pace, with the intention of taking time to move through the area, whereas in the walking scenario pedestrians are intending to move through the area quickly and are therefore expected to be more tolerant of stronger winds.
- 10.29** The coloured key in Table 10.1 corresponds to the presentation of wind tunnel test results.

Table 10.1 Lawson Comfort Criteria

Key	Comfort Category	Threshold	Description
	Uncomfortable	>10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.
	Walking	8-10 m/s	Relatively high speeds that can be tolerated if the objective is to walk, run or cycle without lingering.
	Strolling ²	6-8 m/s	Moderate breezes that would be appropriate for strolling along a city/town centre street, plaza, or park.
	Standing	4-6 m/s	Gentle breezes suitable for main building entrances, pick- up/drop-off points and bus stops.
	Sitting	0-4 m/s	Light breezes desired for outdoor restaurants and seating areas where one can read a paper or comfortably sit for long periods.

Target Wind Conditions

- 10.30** For a mixed-use urban environment, such as the site and surrounding area, the desired wind microclimate for the Proposed Development would typically need to have areas suitable for sitting, standing/entrance use and strolling (Table 10.1).
- 10.31** The walking and uncomfortable classifications may be acceptable in isolated areas, but these classifications are also associated with occasional strong winds (which are described below) and so the aim has been to avoid conditions falling into these categories.

Amenity Areas

- 10.32** The target condition for seating in amenity areas is a wind microclimate that is suitable for sitting during the summer season. This is because these areas are more likely to be frequently used during the summer when pedestrians would expect to be able to sit comfortably. If an area is classified as suitable for sitting in the summer, the windier conditions that occur during the winter season usually mean that the area would be classified as suitable for standing in the windiest season, unless additional shelter was provided.
- 10.33** Large upper level terraces and large amenity spaces (mixed use amenity) are assessed on the basis that are intended for good weather use only (and is therefore also assessed during the summer season). A mix of sitting and standing conditions during the summer would be acceptable provided that any desired seating areas are situated in areas having sitting use wind conditions. This also applies to the residential balconies that have been assessed through CFD.

¹ Building Aerodynamics, (2001); Lawson T.

Entrances

- 10.34** Areas in proximity of building entrances, a wind environment suitable for standing or calmer is desired, as pedestrians will transition from the calm indoors to the windier outdoors throughout the year. The assessment for building entrances therefore focuses on the windiest season result.
- 10.35** An entrance which is recessed, then the recessed zone provides a transition area for pedestrians existing the building. If strolling conditions are observed on the pavement outside a recessed entrance, acceptable standing conditions would be expected at the recessed entrance.

Secondary Entrances

- 10.36** Considered as entry points to a building which are not primary entrances and used for alternative purposes, like fire entrances or emergency exits, a wind environment for strolling or calmer is desired. The assessment focuses on the windiest season.

Thoroughfares

- 10.37** A pedestrian thoroughfare should be suitable for strolling during the windiest season. The assessment for pedestrian thoroughfares therefore focuses on the windiest season result.
- 10.38** Localised occurrence of walking conditions may be acceptable in areas with limited footfall, or service areas, as long as the strong wind criteria (see section ‘Strong Winds’) is not exceeded.

Bus stops

- 10.39** Bus stops should be suitable for standing during the windiest season.

Crossings

- 10.40** Crossings should be suitable for walking during the windiest season.

Car Park

- 10.41** Car Park should be suitable for walking during the windiest season.

Roadways

- 10.42** The Lawson Criteria does not specify criteria for acceptable wind conditions for cyclists; however, the occurrence of winds exceeding the strong winds threshold (as described below) would be considered unsuitable for cyclists.

Off-Site Locations

- 10.43** Wind conditions at off-site locations are only considered beneficial if they are unsuitable for the intended use in the existing scenario and are improved by the Proposed Development to be calmer than required for the intended use. Wind conditions which are suitable for the intended use in the existing scenario and remain suitable or calmer than required for the intended use after construction of the Proposed Development will be negligible since the usability of the location is not affected.
- 10.44** Should an off-site location be windier than required in the baseline scenario, and does not change with the Proposed Development completed, the wind conditions would be negligible as the Proposed Development has not made the wind conditions worse than the existing scenario.

Strong Winds

- 10.45** The Lawson Criteria also specifies a strong wind threshold when winds exceed 15m/s for more than 0.025% of the time (approximately 2.2 hours of the year) would have the potential to cause distress to pedestrians and cyclists. Exceedance of this threshold may indicate a need for remedial measures or a careful assessment of the expected use of that location, e.g. is it reasonable to expect older adults or young children to be present at the location on the windiest day of the year?
- 10.46** Wind Speeds that exceed 20m/s for more than 0.022% of the time (approximately 2.2 hours of the year) represent safety issue for all members of the population, which would require mitigation to provide an appropriate wind microclimate environment.
- 10.47** Strong winds are generally associated with areas which would be classified as acceptable for walking or conditions considered uncomfortable. In a mixed-use urban development scheme, walking and uncomfortable conditions would not usually form part of the ‘target’ wind environment and would usually require mitigation due

to pedestrian comfort considerations. This mitigation would also have the impact of reducing the frequency of, or even eliminate, any strong winds.

Assumptions

- 10.48** This assessment is based on worst-case wind speeds, expected to be encountered during the winter season (December, January, and February) in the UK. Additional consideration has been made for summer wind conditions due to the presence of ground floor public amenity space. This complies with the standard methodology set out by Lawson for wind-microclimate assessments.
- 10.49** It is expected that use of outdoor amenity spaces and rooftop terraces for sitting will be limited to the summer season. During the winter, it would be expected that these spaces would increase a criteria level to standing or strolling use.

Methodology for Defining Effects

Receptors and Receptor Sensitivity

- 10.50** The sensitivity of receptors is related to the intended pedestrian usage at each location; there are no definitions for sensitivity, as the important consideration is whether the wind conditions experienced at a particular receptor location are suitable for the intended use (in terms of comfort and strong winds) at that particular location. All receptors are considered to be highly sensitive to the local wind microclimate conditions and are given an equal weighting.

Defining Effect Classification

- 10.51** The assessment of the potential effects is based on the desired pedestrian uses (as defined by the Lawson Criteria) in relation to the wind conditions measured at a particular probe location with the Proposed Development in place. This allows for the assessment to take into account any changes in pedestrian activity that might accompany the Proposed Development.
- 10.52** The assessment criteria for the modelled wind microclimate, as shown in Table 10.2, comprise a stepped scale to reflect the change in magnitude of impact.
- 10.53** In line with Lawson's overall methodology, any strong winds (i.e. affecting pedestrian safety) would be unsuitable, and therefore as any strong wind exceedance is inherently ‘significant’. The occurrence of strong winds is reported as a separate category from the Lawson Criteria assessment. Where strong winds are identified, mitigation is required (as per adverse effects related to pedestrian comfort).

Table 10.2 Effect Classification Criteria

Modelled Wind Microclimate Criteria	Effect Classification
Wind Conditions are 3-steps calmer / windier than desired.	Major
Wind Conditions are 2-steps calmer / windier than desired	Moderate
Wind Conditions are 1-step calmer / windier than desired	Minor
Wind Conditions are similar to those desired.	Negligible

- 10.54** The minor, moderate and major categories indicate the severity of the change in wind condition between the desired wind microclimate and the wind microclimate presented in the modelled results. As an example, if the desired wind conditions at a location are required to be suitable for ‘Standing’, but the predicted wind conditions are suitable for ‘Strolling’, the difference between the desired and predicted wind condition is one category windier than desired. In this case, the scale of the effect would be identified as ‘minor adverse’.
- 10.55** The effect classification criteria must also account for comparison against the Baseline conditions and the predicted (modelled) wind conditions for the Proposed Development. Where predicted wind conditions are windier than the Baseline conditions, yet remain calmer than required, these would be identified as negligible effect (rather than minor beneficial effect). Additionally, if wind conditions remain suitable for the intended use, these would also be classified as negligible effect (i.e. if a thoroughfare location in the baseline condition has standing wind conditions but increase to a strolling condition when the Proposed Development is in situ, although windier than the baseline scenario, these wind conditions would remain suitable for the intended use and therefore represent a negligible effect.

- 10.56 An adverse effect implies that a location has a wind environment that is windier than the desired conditions and mitigation should therefore be considered. Where potential adverse effects are identified, consideration is provided in the 'Mitigation and Monitoring Measures' section of this ES chapter to discuss the remedial measures required to mitigate the potential impact and the resultant residual effects are then presented.
- 10.57 In light of the above, any adverse effect or residual adverse effect are considered to be 'significant'. Any beneficial effects are considered to not be significant as they are calmer than the desired condition.
- 10.58 Strong winds (affecting pedestrian safety) are not assigned a scale of effect and so overall significance but are reported separately. This is due to the fact that any strong wind exceedance is considered to be significant.
- 10.59 Effects once the Proposed Development is completed are direct, local, and long-term (permanent) and irreversible unless there is a change in the Proposed Development's massing on-site or the local wind microclimate.

BASELINE CONDITIONS

Baseline Conditions

Meteorological Data

- 10.60 The UK Meteorological Office supplies records of the number of hours that wind occurs for ranges of wind speed (using the Beaufort Scale) and by direction. Meteorological data for London Heathrow Airport is shown in Figure 10.1 and provides a representation of the local wind microclimate for the Reading area.
- 10.61 The meteorological data for the London Heathrow area indicates that the prevailing wind throughout the year is from the southwest (i.e. 210 to 240 degrees on the compass). This is typical for many areas of southern England. There is a secondary peak from the northeast during the late spring and early summer. The winds from the northeast are not as strong as the prevailing winds from the southwest, although the winds are colder.
- 10.62 The meteorological data was corrected to standard conditions of 10m above open flat level country terrain to remove the influence of terrain surrounding the meteorological station. The meteorological model was then adjusted to the site conditions taking account of the terrain roughness (see section 'Wind Tunnel Testing Methodology') using the Engineering Data Science Unit (ESDU) Data Item ESDU 82026. Strong winds in the atmospheric boundary layer software package which models the wind characteristics caused by changes in the terrain roughness at the stated reference height of 120m above the surface. The results are incorporated in the wind rose plots above. Configuration 1: Existing Site with Existing Surrounding Buildings.

Configuration 1: Existing Site with Existing Surrounding Buildings

- 10.63 Wind conditions for Configuration 1 (baseline scenario) are presented in Figure 10.2 and Figure 10.3 for the windiest season, while Figure 10.4 and Figure 10.5 depict the wind condition at the site during the summer season. Figure 10.6 and Figure 10.7 report the strong winds exceedances for Configuration 1.

Pedestrian Comfort

- 10.64 Within the baseline scenario, wind conditions at the site and within the surrounding area are suitable for 'sitting' use to 'strolling' use during the windiest season (Figure 10.2 and Figure 10.3).
- 10.65 During the summer season (Figure 10.4 and Figure 10.5), wind conditions at the site and the surrounding area are also suitable for 'sitting' use to 'strolling' use.

Strong Winds

- 10.66 None of the locations experience strong winds exceeding 15m/s for more than 0.022% of the time (Figure 10.6 and Figure 10.7)

Figure 10.1 Seasonal Wind Roses for London Heathrow Airport

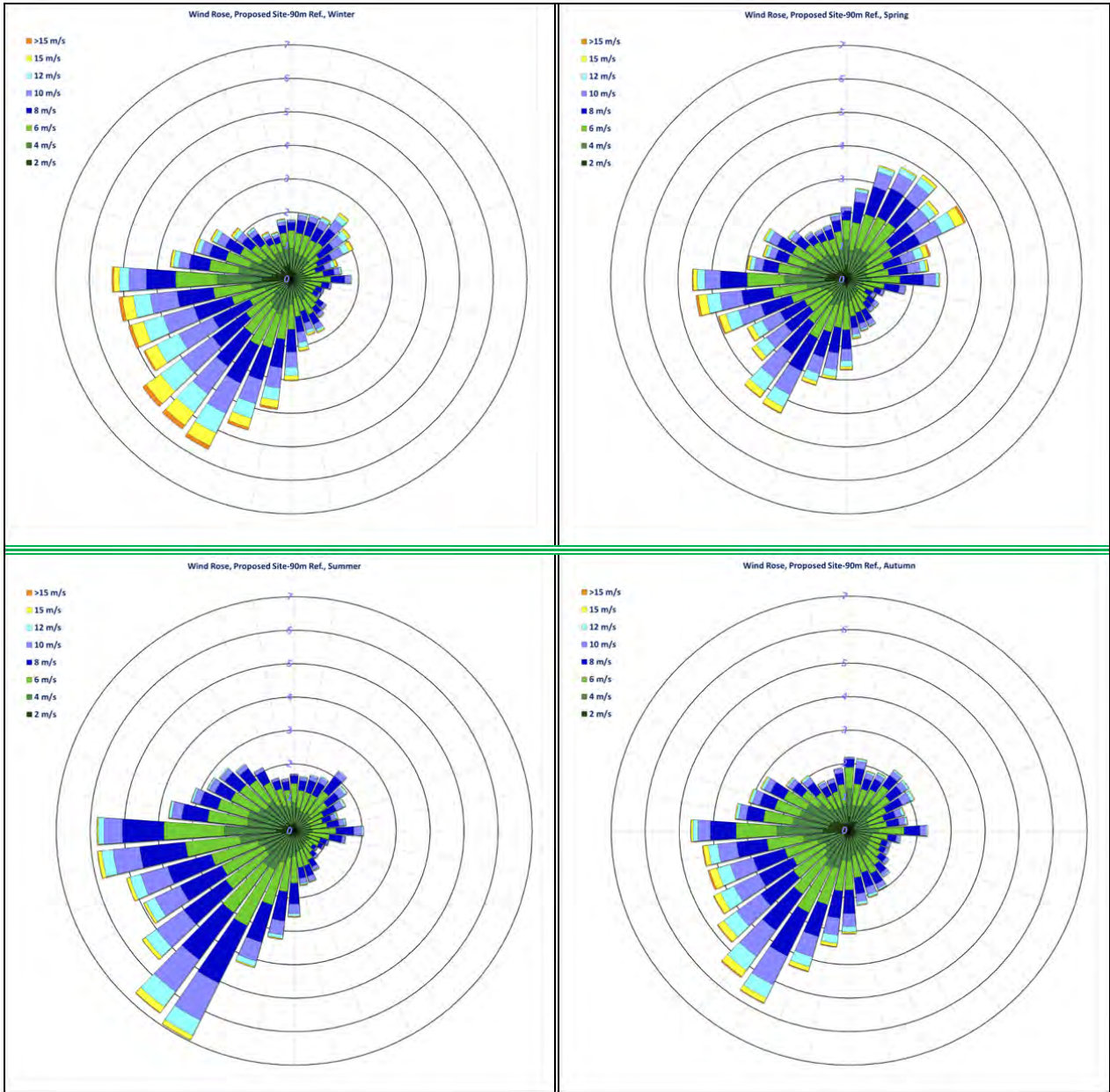


Figure 10.2 Configuration 1: Existing Site with Existing Surrounding Buildings – Ground Level – Windiest Season

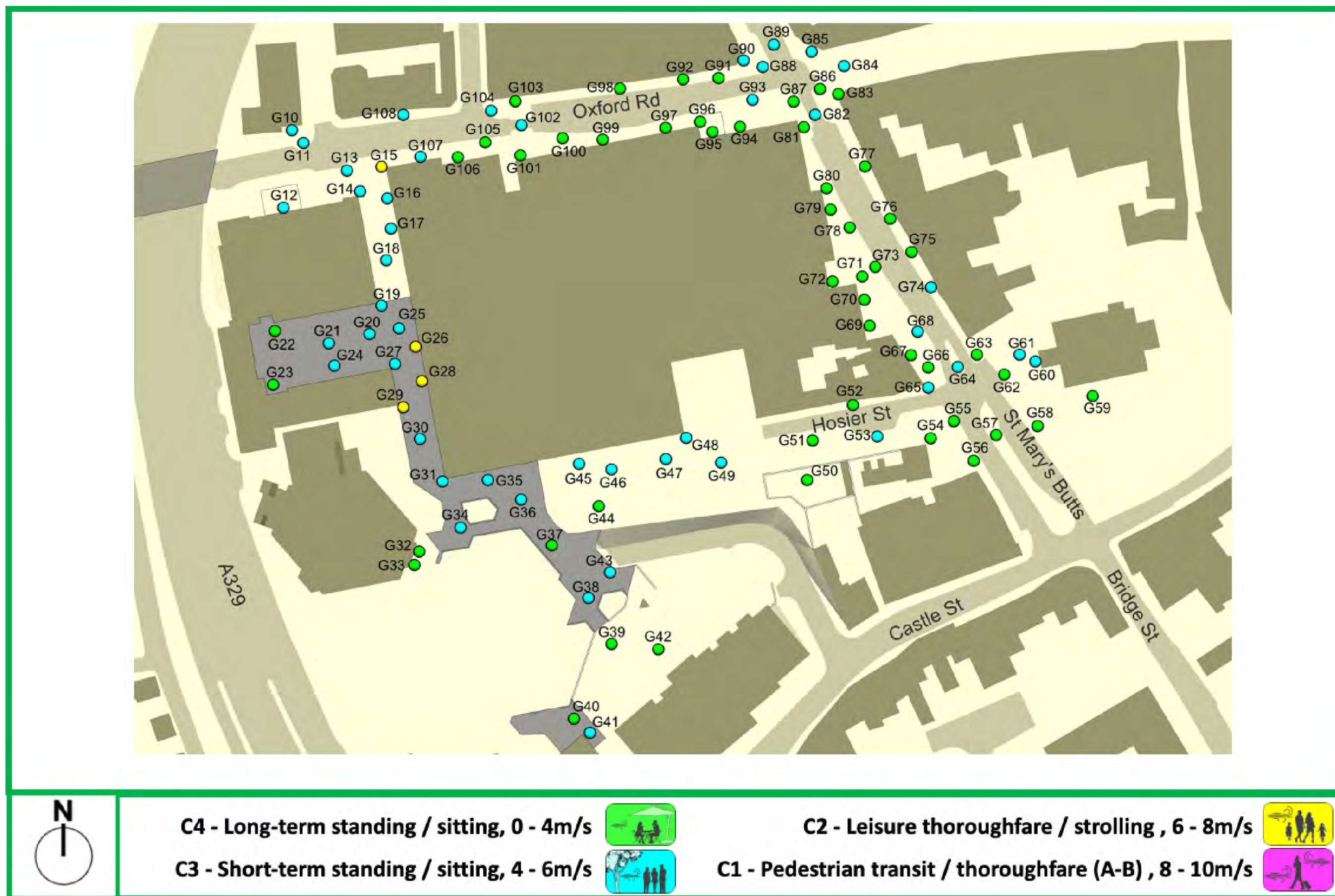


Figure 10.3 Configuration 1: Existing Site with Existing Surrounding Buildings – Roof Level – Windiest Season

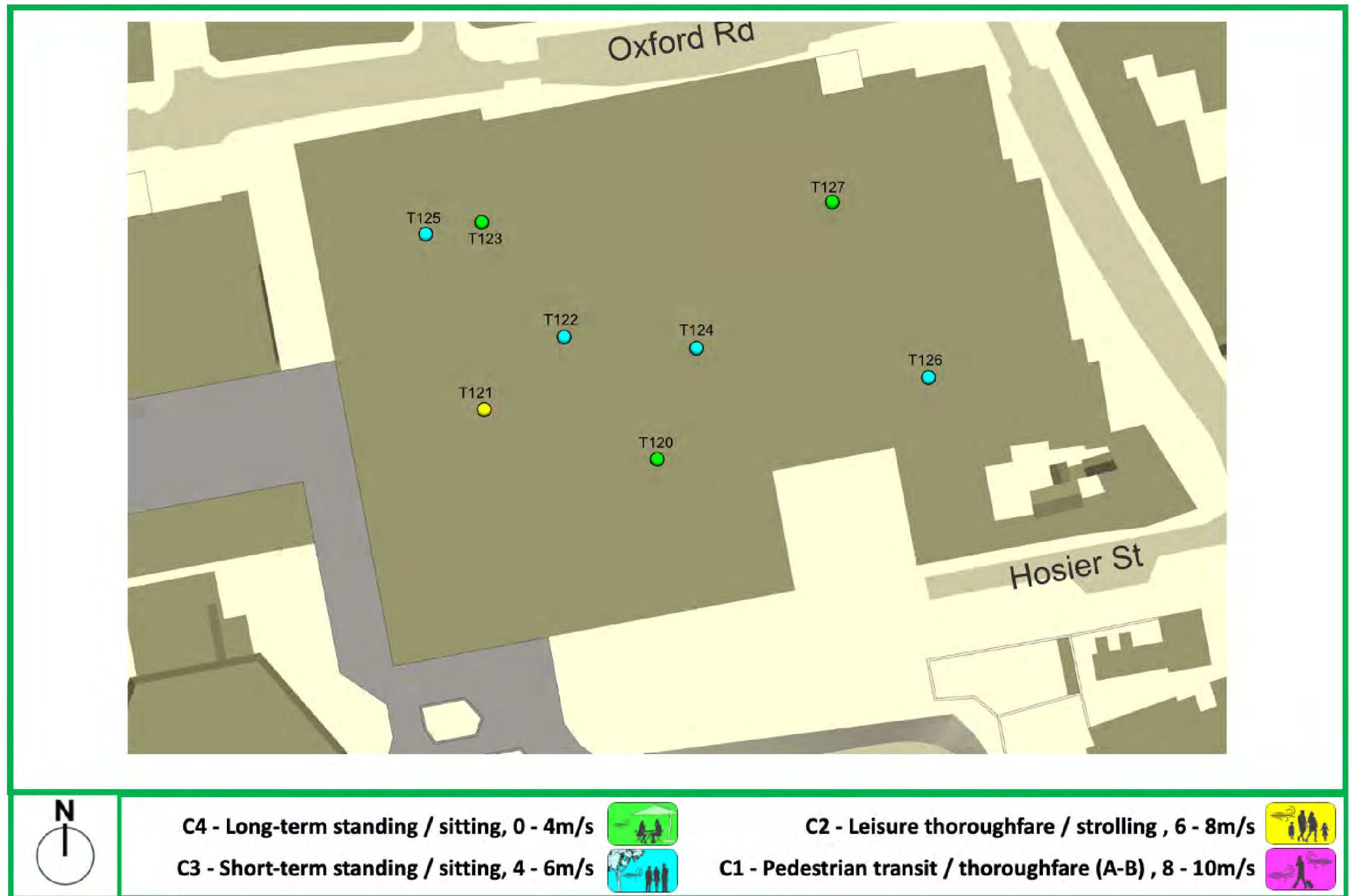


Figure 10.4 Configuration 1: Existing Site with Existing Surrounding Buildings – Ground Level – Summer Season

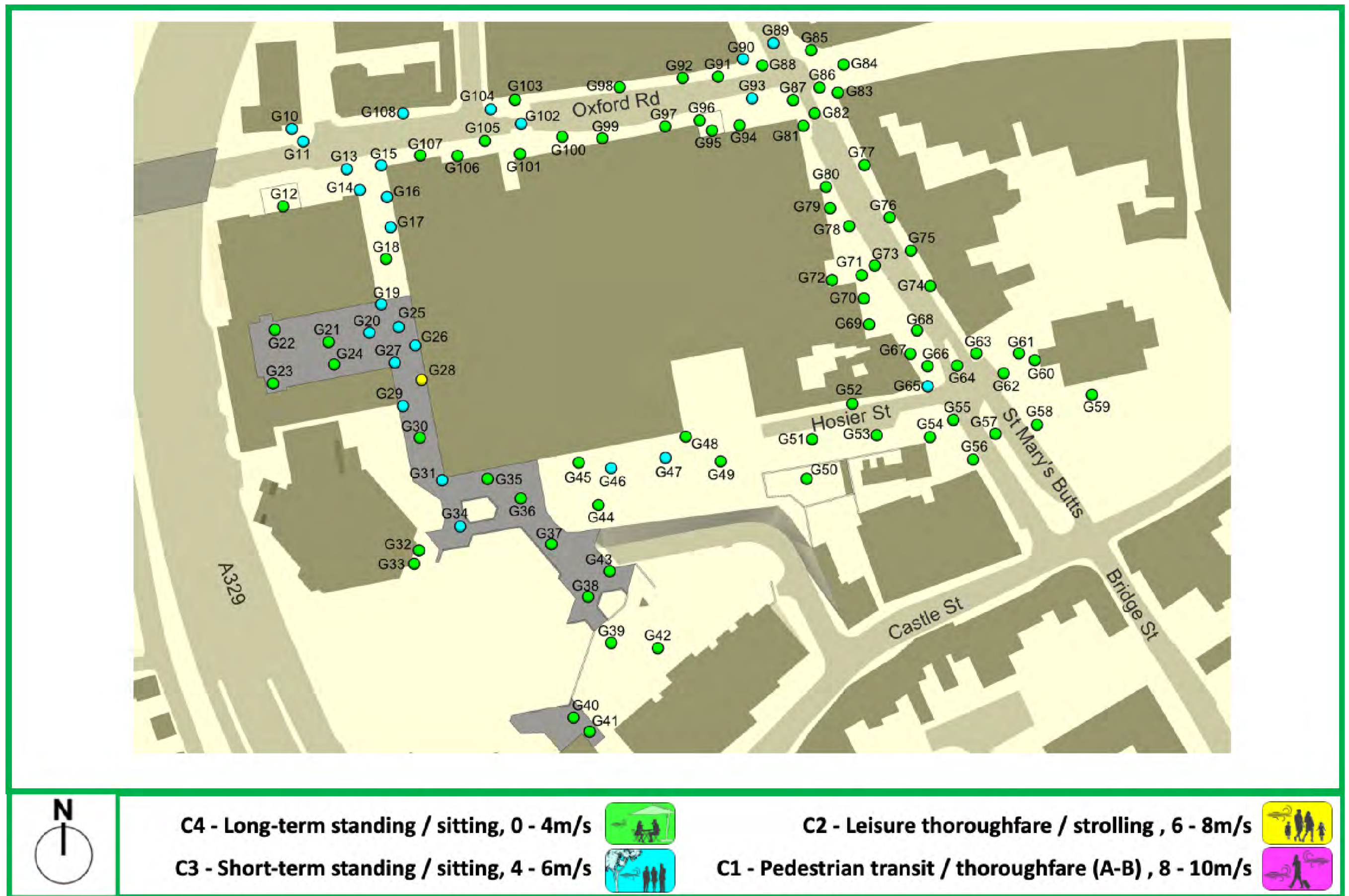


Figure 10.5 Configuration 1: Existing Site with Existing Surrounding Buildings – Roof Level – Summer Season

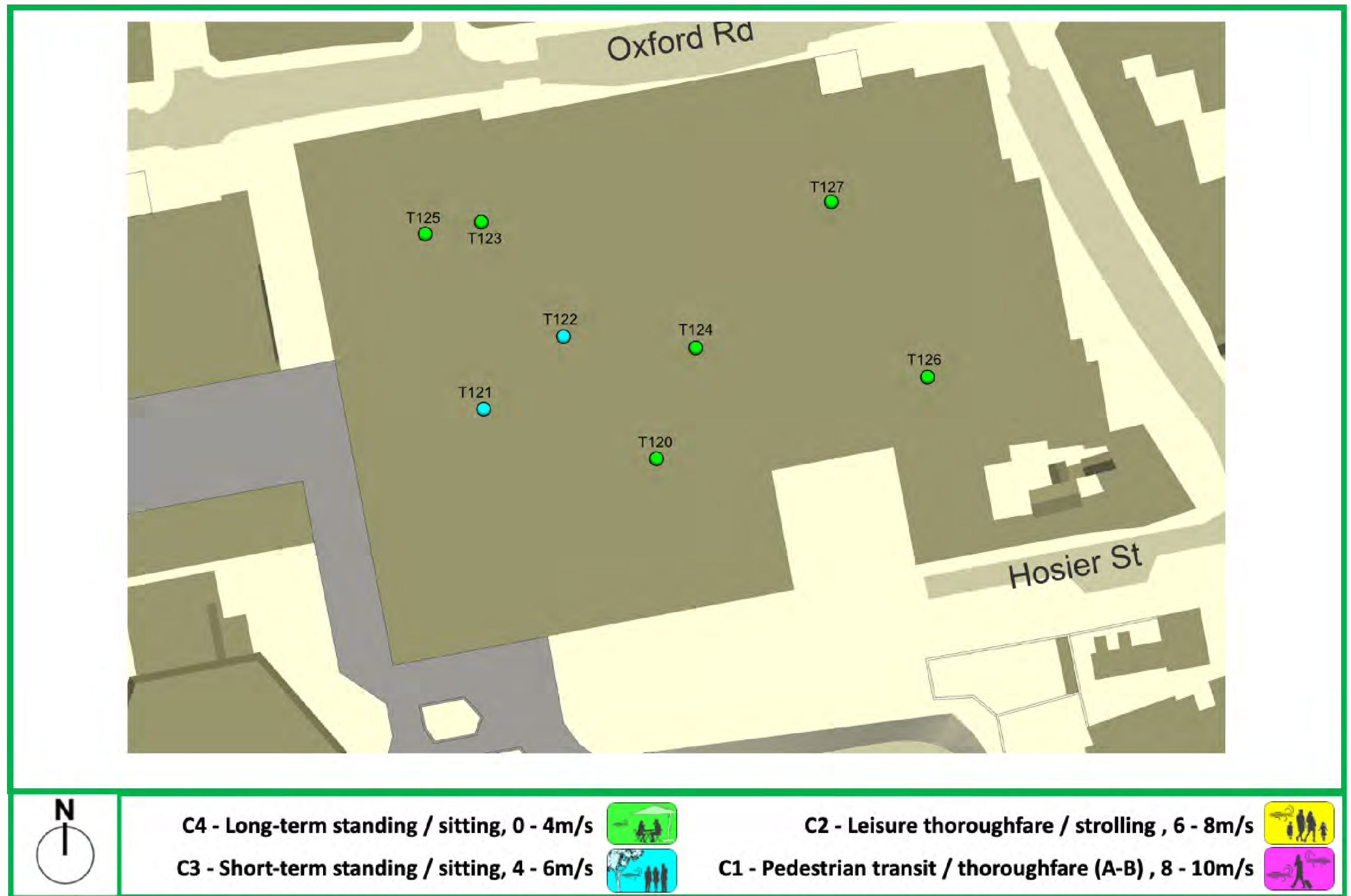


Figure 10.6 Configuration 1: Existing Site with Existing Surrounding Buildings – Ground Level – Safety

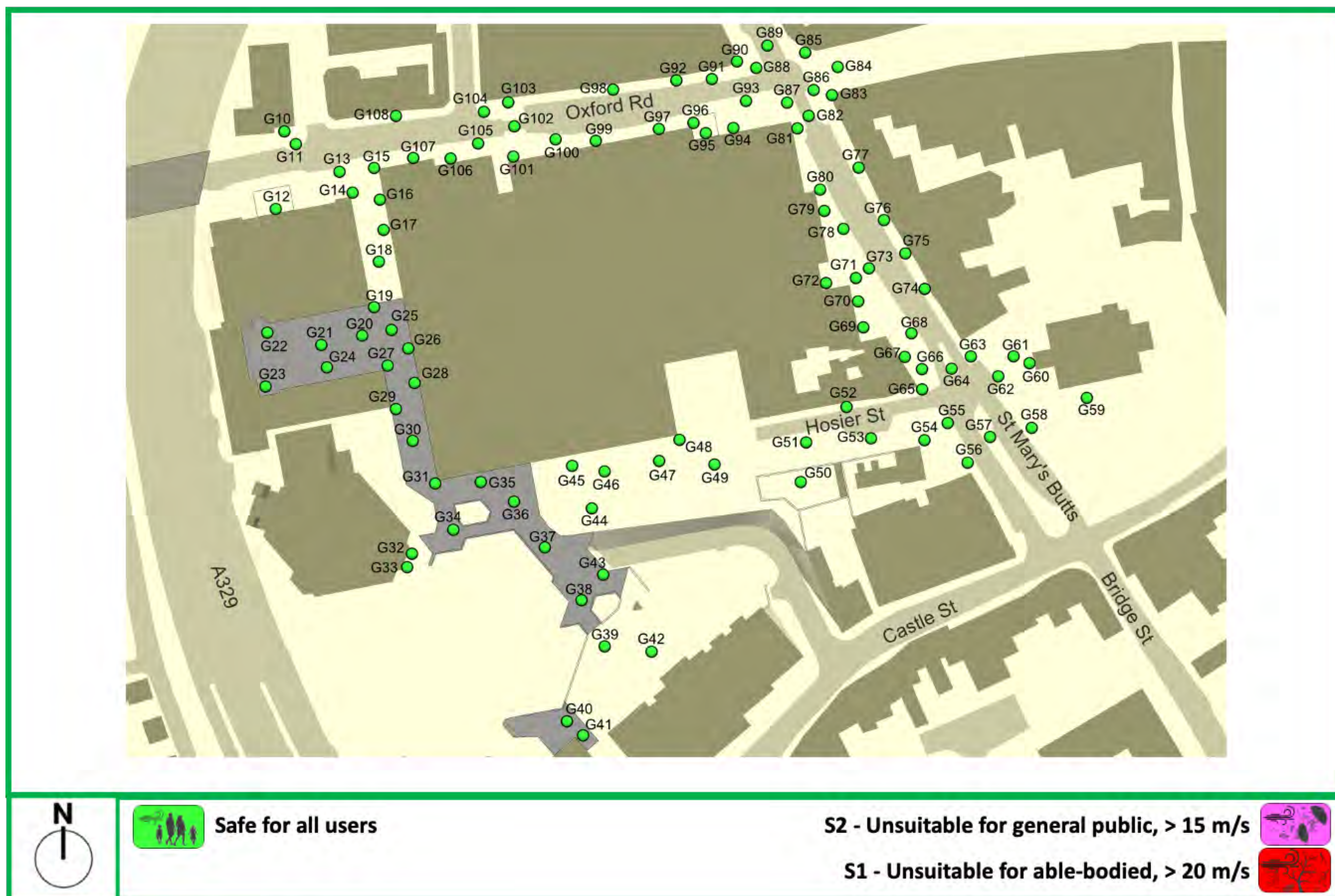
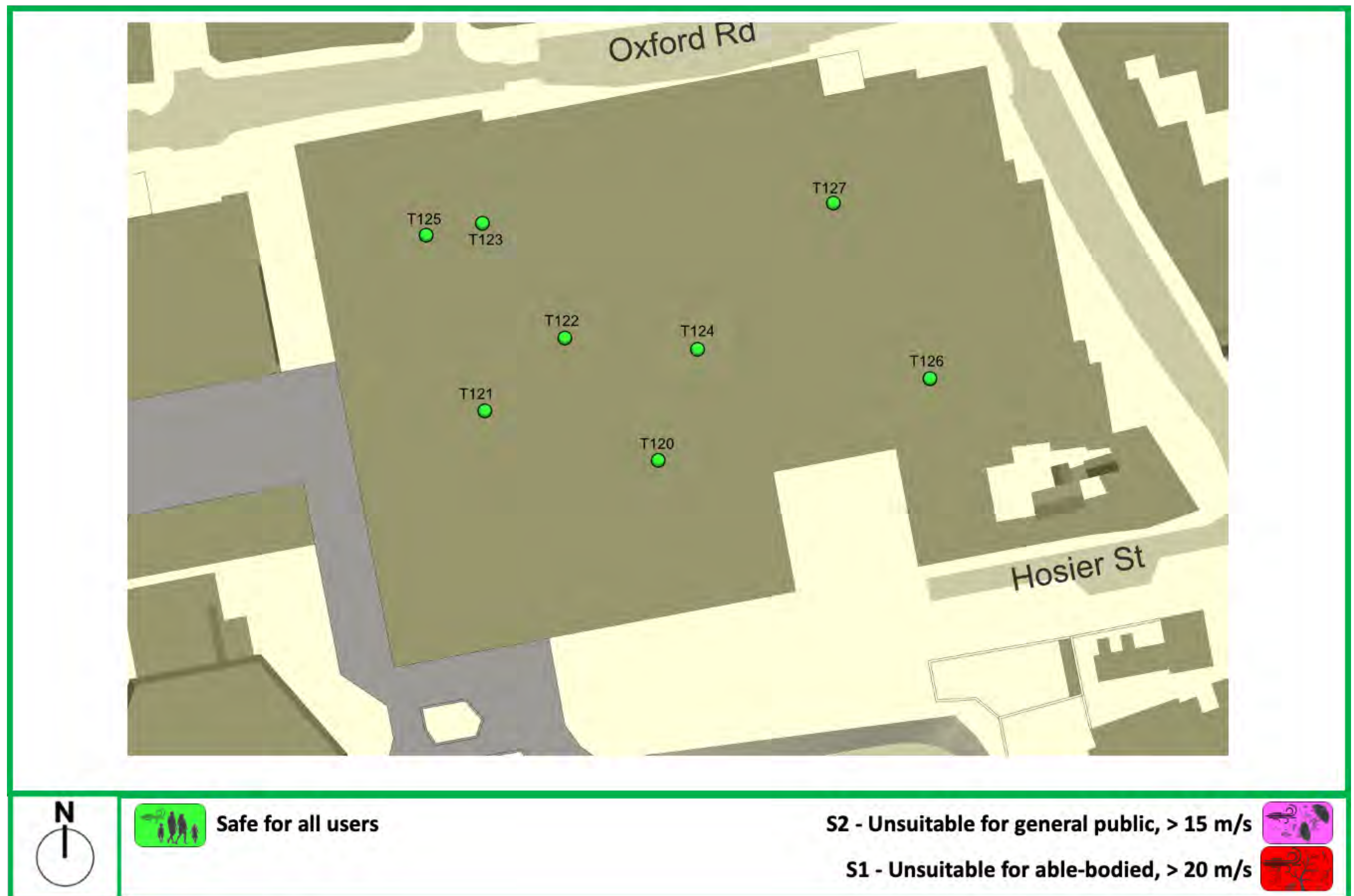


Figure 10.7 Configuration 1: Existing Site with Existing Surrounding Buildings – Roof Level – Safety



RECEPTORS AND RECEPTOR SENSITIVITY

- 10.67** In assessing the wind microclimate there are no definitions for the sensitivity of receptors, with each receptor being highly sensitive to changes to the local wind microclimate conditions. Receptors likely to be affected by the Proposed Development include all pedestrians using/visiting the Proposed Development and the surrounding areas, as well as pedestrians and cyclists on surrounding thoroughfares, entrances to the Proposed Development and those of surrounding buildings and surrounding amenity spaces, including areas with outdoor seating.
- 10.68** There is an overall total of 167 measurement locations (refer to Table 10.3) across the site and surrounding area, which have been assessed. The locations of the probes are fixed and have been subjectively determined based on examination of architectural drawings, reflecting the expected use of the Proposed Development. The residential balconies have been assessed from CFD and as such do not have receptor numbers because the CFD is not based on point measurements.
- 10.69** The following description of receptor categories for the site and the approach taken to the allocation of the probe locations to the categories is as follows:
- On-site:
 - Pedestrian Thoroughfares: includes areas that are immediately adjacent to the Proposed Development. This also includes thoroughfares within the Proposed Development;
 - Entrances: includes entrances at ground level;
 - Amenity areas: podium level and roof terrace (includes terraces located on the upper levels of the buildings);
 - Residential balconies;
 - Car Park;
 - Roadways; and
 - Off-site locations: includes all receptors falling outside the definition of the boundary of the site, such as along roadways, surrounding building entrances and amenity areas.
- 10.70** In regards of the residential balconies, it is noted that these have been assessed using CFD only, as such they do not have specific receptor locations due to the fact that – different from wind tunnel testing – CFD provides an area based assessment rather than a point based assessment.

Table 10.3 Likely Resource / Receptor

Receptor Type (Season)	Receptor Reference (Measurement location numbers; Orientation within the site)
On-Site	
Thoroughfares	G14, G15, G17, G18, G19 G25, G26, G27, G28, G30, G31, G35, G45, G47, G48, G52, G65, G66, G68, G71, G78, G80, G82, G87, G93, G96, G100, G102, G105, G130, G131, G132,
Entrances	G67, G69, G70, G72, G73, G79, G81, G94, G95, G96, G99, G101, G106, G107, G133, G134, G135, G136, G137, G138
Car Park	T120, T121, T122, T123, T124, T125, T126, T127
Amenity Areas Upper Levels	T140, T141, T142, T143, T144, T145, T146, T147, T148, T149, T150, T151, T152, T153, T154, T155, T156, T157, T158, T159, T160, T161, T162, T163, T164, T165, T166, T167
Balconies	n/a – assessed using CFD analysis.
Off-Site	
Thoroughfares	G11, G13, G20, G22, G23, G24, G36, G37, G38, G39, G40, G41, G44, G49, G51, G53, G54, G56, G57, G59, G63, G64, G76, G84, G86, G88, G89, G91, G103, G104,
Entrances	G10, G12, G32, G33, G55, G58, G60, G62, G74, G75, G77, G83, G85, G90, G92, G98, G103, G108,

Receptor Type (Season)	Receptor Reference (Measurement location numbers; Orientation within the site)
Amenity Areas Ground Level	G21, G42, G43, G50, G61

POTENTIAL EFFECTS

Demolition and Construction

- 10.71** Wind conditions during the demolition and construction works would be expected to gradually adjust from those of the Baseline Scenario (Configuration 1) to the likely wind conditions identified for the Proposed Development with the Existing Surrounding Buildings (Configuration 2).
- 10.72** The demolition phase is not expected to alter wind conditions from the Baseline Scenario presented in Configuration 1. Therefore, the likely effect is expected to be Negligible (not significant).
- 10.73** It is expected that the wind conditions during the period of construction works will gradually transition from the Baseline Scenario (existing site wind microclimate - Configuration 1) to the completed Proposed Development wind microclimate (Configuration 2) (as described on 'Potential Effects – Completed Development').
- 10.74** It assumed that there will be restricted access (i.e. not accessible to the general public) to the site during demolition and construction, and therefore windier conditions will be tolerable as the area is not for typical pedestrian use where the tolerable wind speed threshold would be lower.

Completed Development

Configuration 2: Proposed Development with the Existing Surrounding Buildings

- 10.75** The discussion of wind conditions at the Proposed Development with the existing surrounding buildings is based on the results presented in Figure 10.8 and Figure 10.9 for the windiest season at ground and elevated levels respectively; and in Figure 10.10 and Figure 10.11 for the summer season at ground and elevated levels respectively. Figure 10.12 and Figure 10.13 represent the safety exceedances for ground and elevated levels respectively. Figure 10.14 to Figure 10.16 provide the results for windiest season and summer comfort and for safety for the residential balconies.

Pedestrian Comfort

- 10.76** Wind conditions at the Proposed Development at ground level would generally be suitable for 'sitting' use to 'strolling' use during the windiest season.
- 10.77** During the summer season, wind conditions would be generally one category calmer, with all locations suitable for 'sitting' to 'standing' use, with the exception of two sensitive receptors on Queens Walk. (Probe G28 and G29).

Thoroughfares

On-site

- 10.78** Thoroughfare locations within the site would have wind conditions ranging from suitable for 'sitting' use (2 categories calmer than desired) to 'strolling' use (target condition) during the windiest season (Figure 10.8). This would represent a Moderate Beneficial (not significant) (particularly along Oxford Road and St. Mary's Butts) to Negligible (not significant) effect. The exception to this is receptor G28 where in the windiest season the rating marginally exceeds 'strolling' and is rated as 'Walking' in the winter season. In summer the rating at G28 improves to 'strolling'.

Off-site

- 10.79** Off-site thoroughfare locations would have wind conditions ranging from suitable for 'sitting' use to 'strolling' use (target conditions) during the windiest season (Figure 10.8). This is a Negligible (not significant) effect.

Entrances

On-site

- 10.80** All of the locations to the Proposed Development would have wind conditions ranging from a 'sitting' use to 'standing' use (target conditions) classification representing a Minor Beneficial (not significant) to Negligible (not significant) effect (Figures 10.8 and Figure 10.9).

Off-site

- 10.81** Off-site entrances to the surrounding buildings would have wind conditions ranging from suitable for 'sitting' use to 'standing' use (target conditions) during the windiest season (Figure 10.8), representing a Negligible (not significant) effect.

Car park

- 10.82** All car park locations (target as 'walking' use wind conditions) would have 'strolling' use or calmer use wind conditions during the windiest season (Figure 10.8), representing a Negligible (not significant) effect.

Off-site

- 10.83** Wind conditions at Off-Site amenity locations G21, G42, G43, G50, G61 would be suitable for 'sitting' use (target conditions) during the summer season, representing a Negligible (not significant) effect (Figure 10.10).

Upper Level Amenity Spaces and Balconies

- 10.84** Wind conditions at podium level amenity spaces would range from suitable for 'sitting' use (target conditions) to 'strolling' use during the summer season (Figure 10.11). Measurement locations T140, T142, T147 at podium level and T157, T158 and T160 at roof terrace level of Block B would have 'strolling' use wind conditions in the windiest season and in the case of T140, T157 and T158 also in summer season, representing a Moderate Adverse (**significant**) effect. Wind mitigation would be required at podium level to provide shelter at these locations.
- 10.85** Wind conditions within the balconies are within the 'sitting' use (target conditions) for the windiest season and for summer (Figures 10.14 and 10.15), representing a Negligible (not significant) effect.

Strong Winds

- 10.86** Strong winds exceeding 15 m/s for more than 2.2 hours per year would not occur at the podium level, at the level of the resident's roof terraces or at any of the residential balconies (Figure 10.12, Figure 10.13 and Figure 10.16)

Figure 10.8 Configuration 2: Proposed Development with Existing Surrounding Buildings– Ground Level - Windiest Season

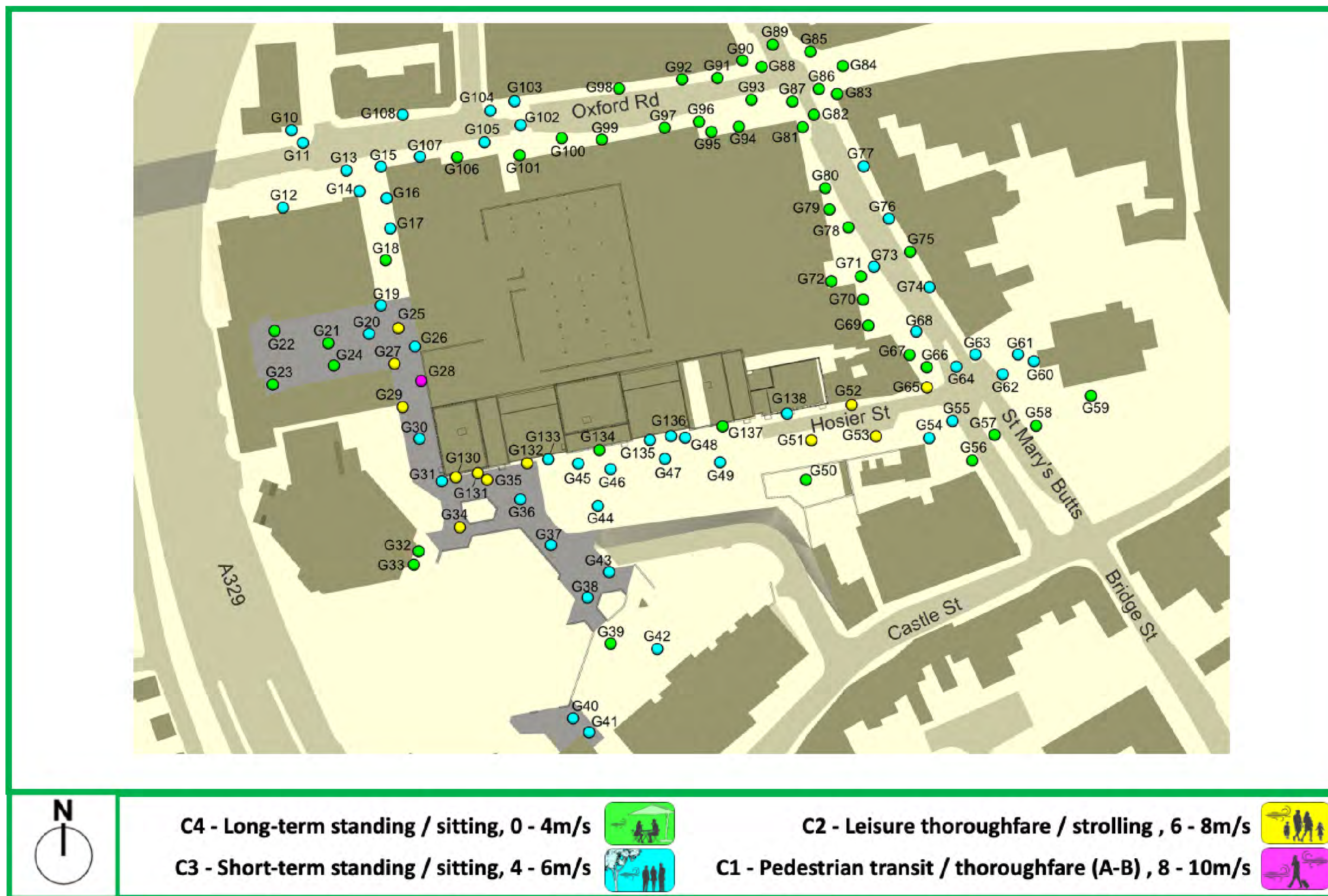


Figure 10.9 Configuration 2: Proposed Development with Existing Surrounding Buildings – Podium and Roof Levels – Windiest Season

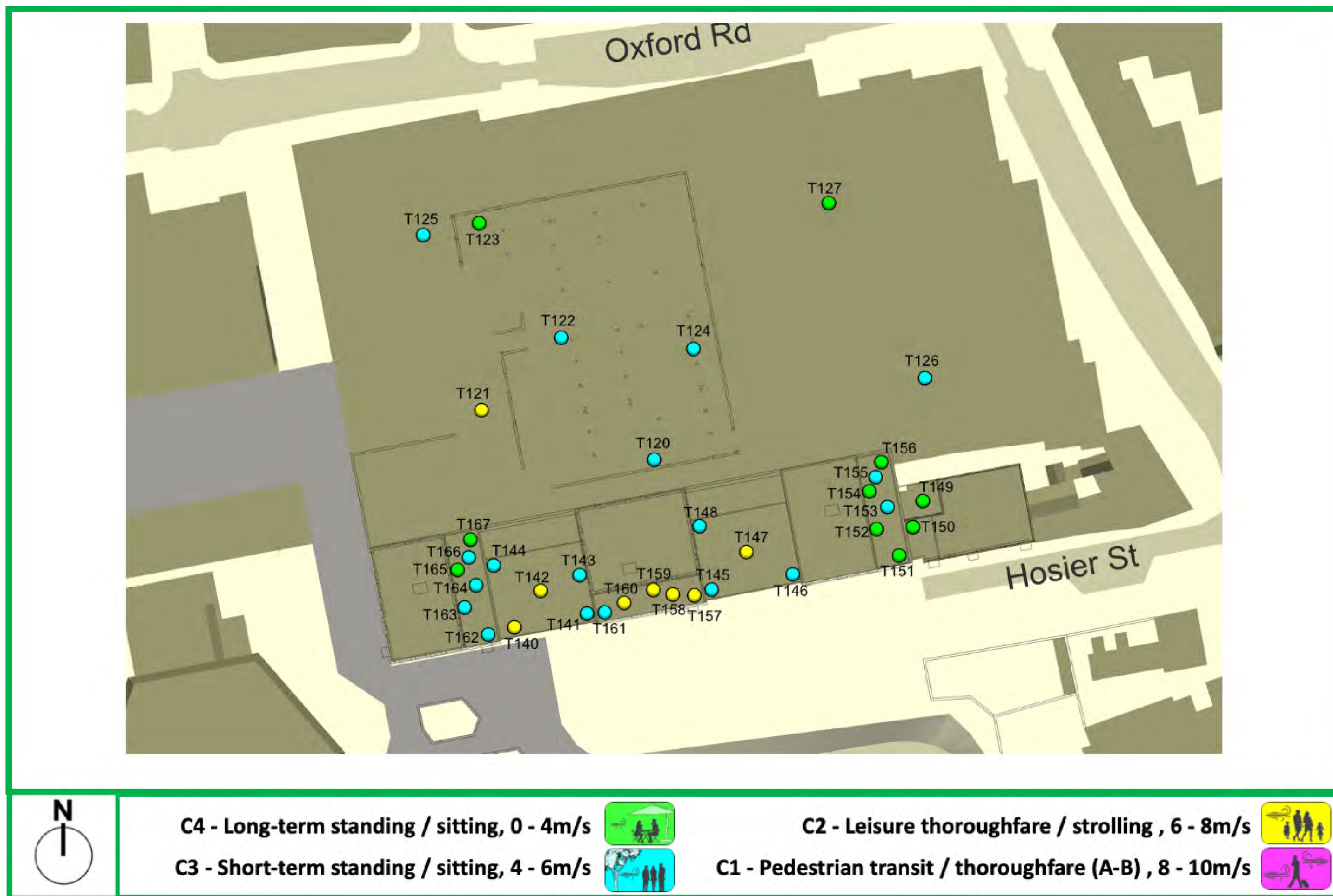


Figure 10.10 Configuration 2: Proposed Development with Existing Surrounding Buildings – Ground Level – Summer Season

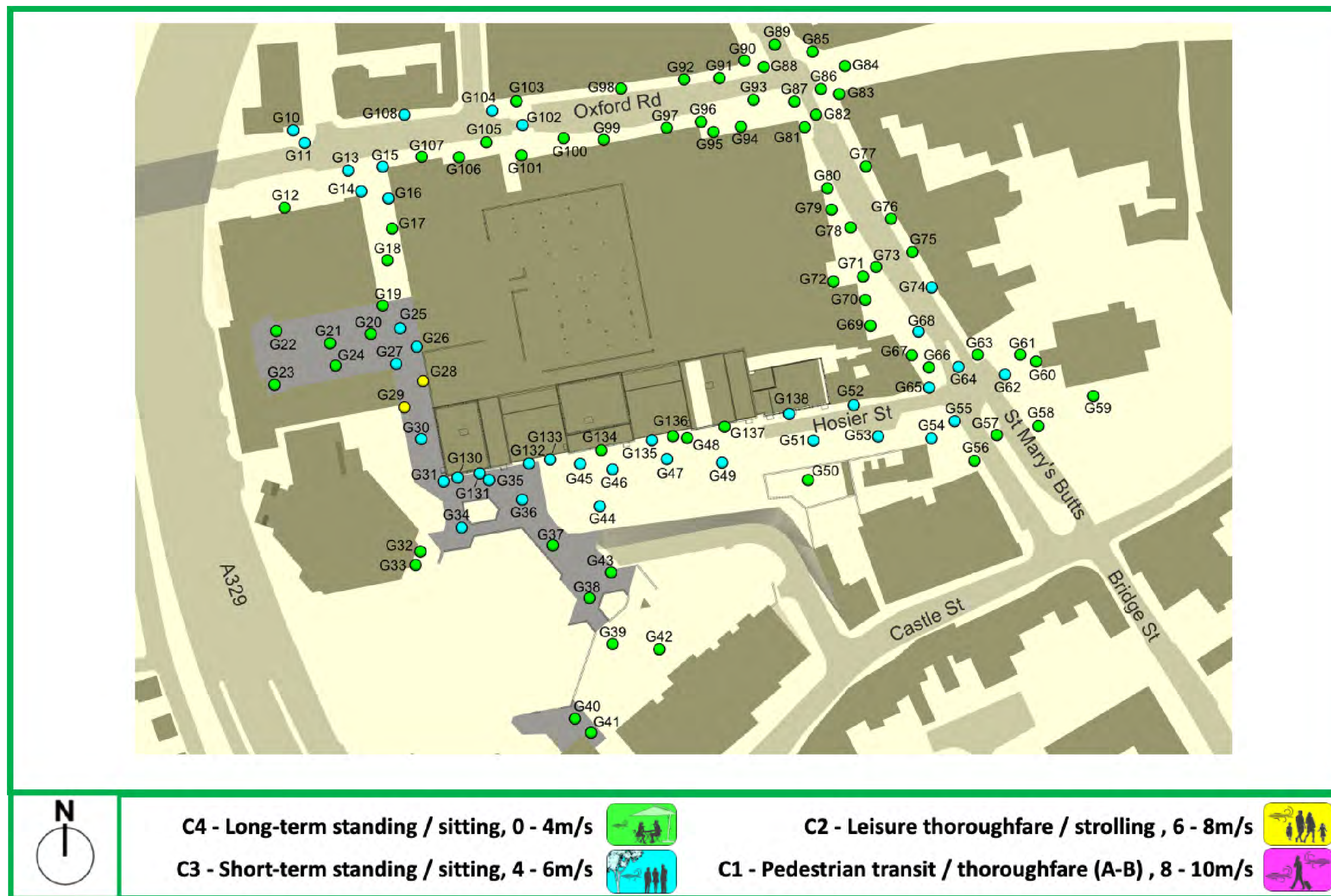


Figure 10.11 Configuration 2: Proposed Development with Existing Surrounding Buildings – Podium and Roof Levels – Summer Season

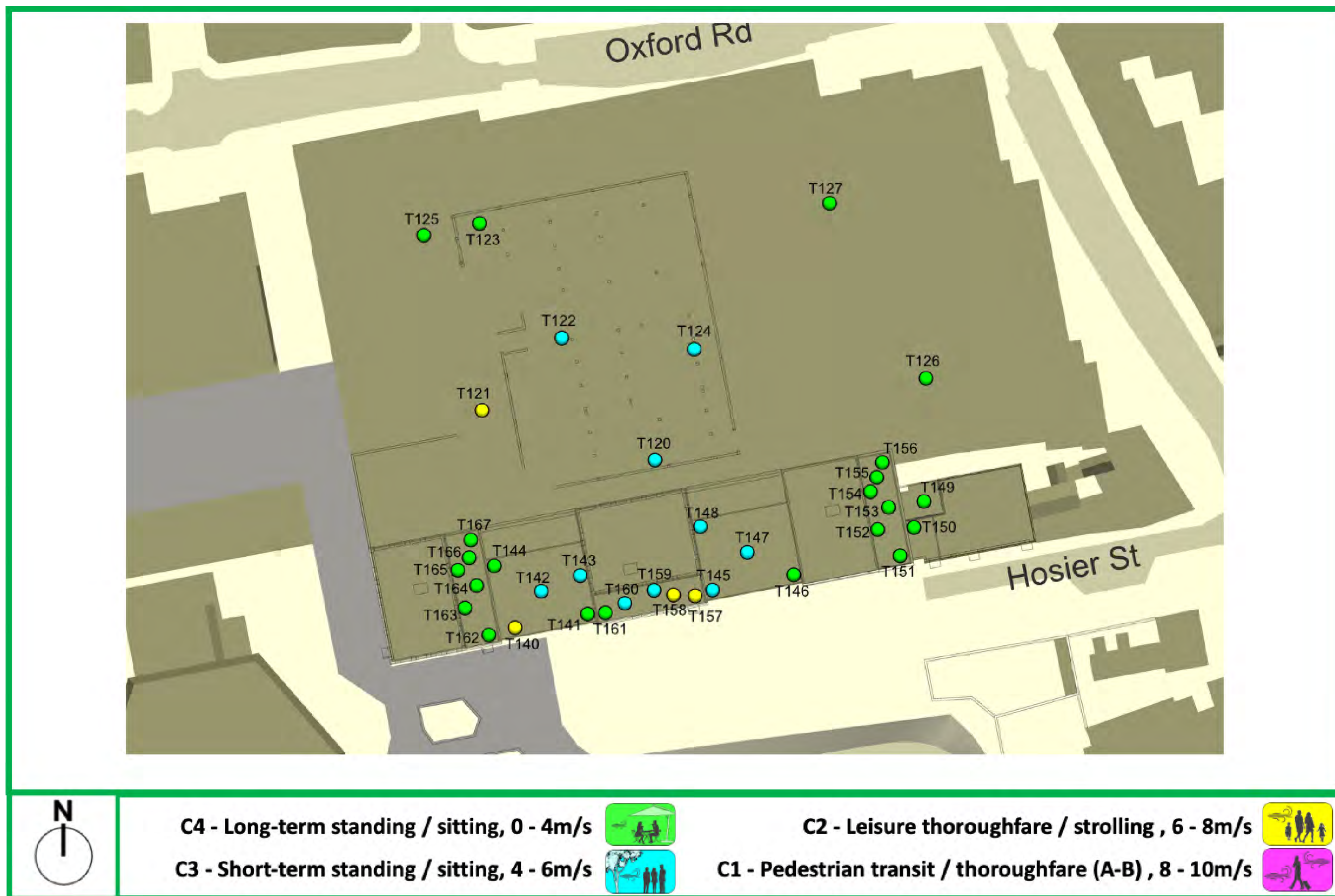


Figure 10.12 Configuration 2: Proposed Development with Existing Surrounding Buildings – Ground Level – Safety

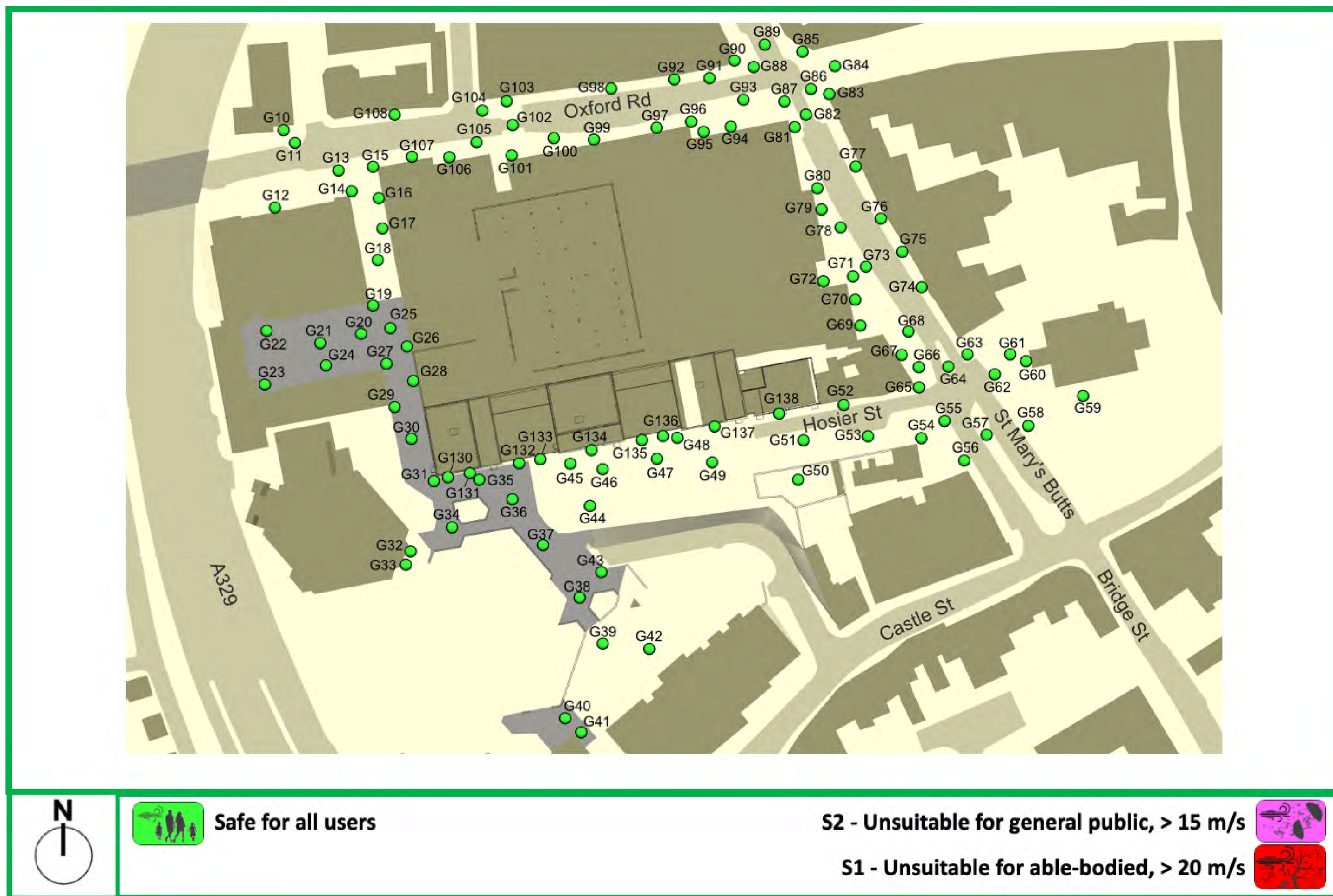


Figure 10.13 Configuration 2: Proposed Development with Existing Surrounding Buildings – Podium and Roof Levels – Safety

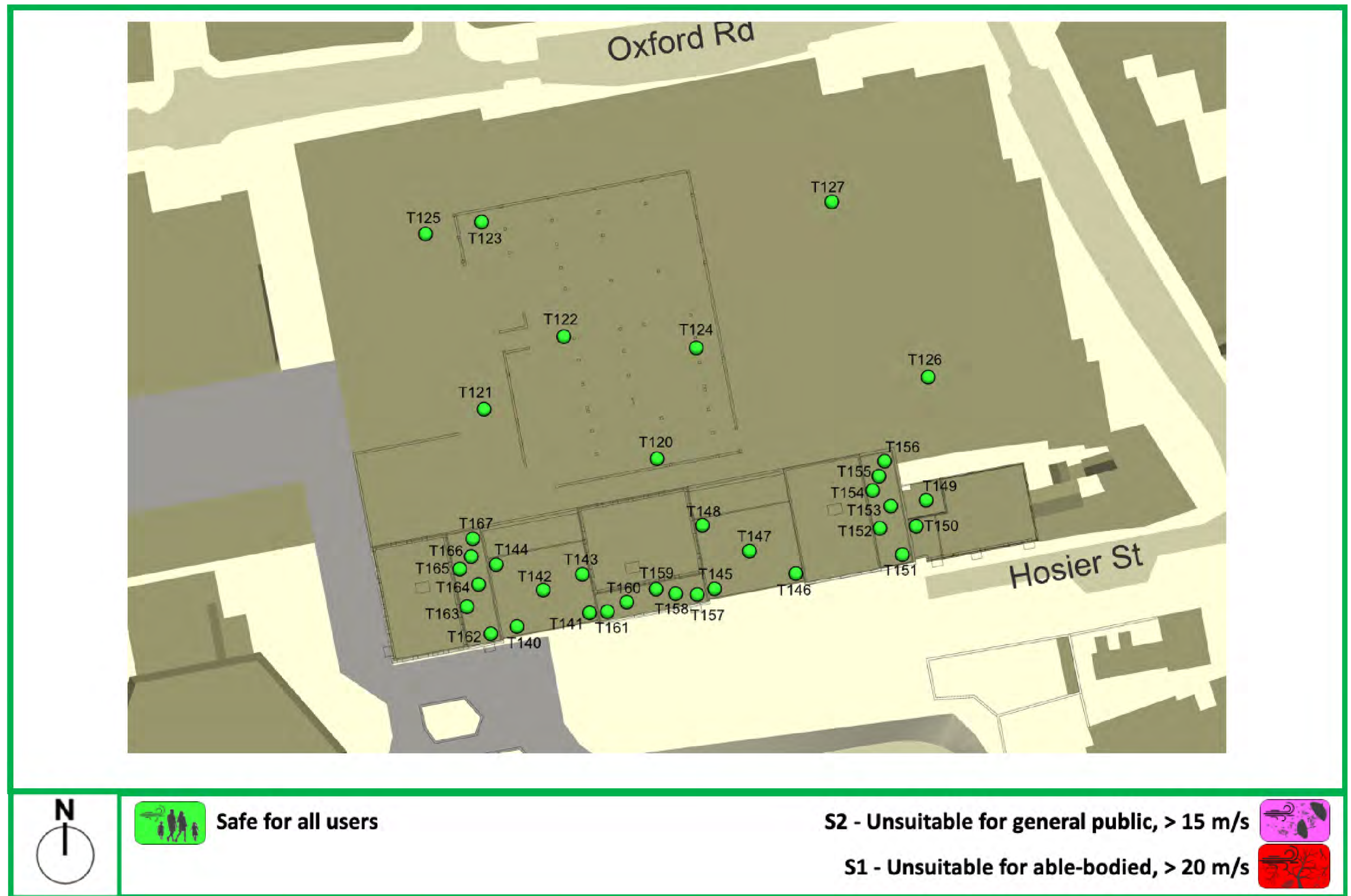


Figure 10.14 Configuration 2: Proposed Development with Existing Surrounding Buildings – Residential Balconies – Worst Season

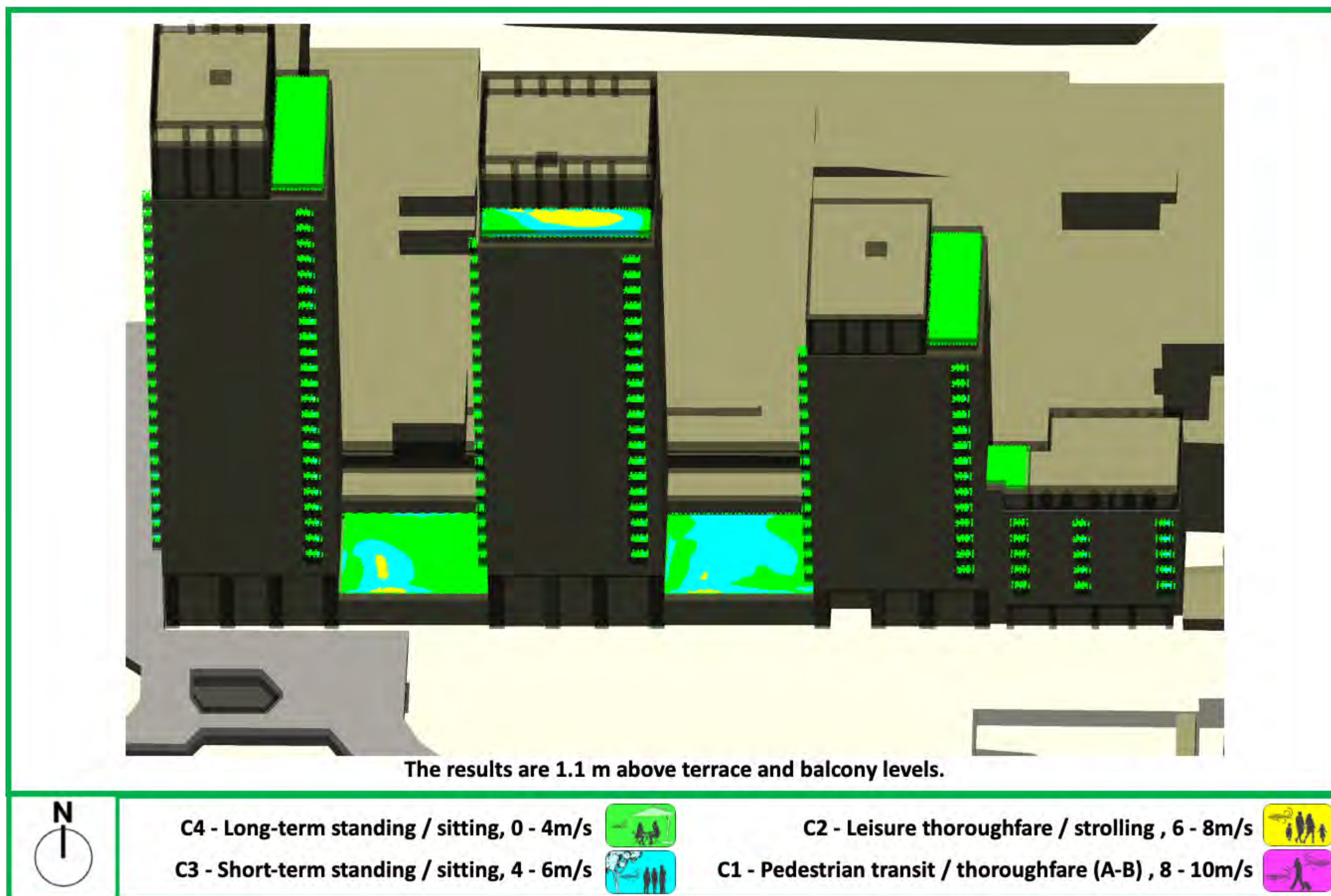


Figure 10.15 Configuration 2: Proposed Development with Existing Surrounding Buildings – Residential Balconies – Summer

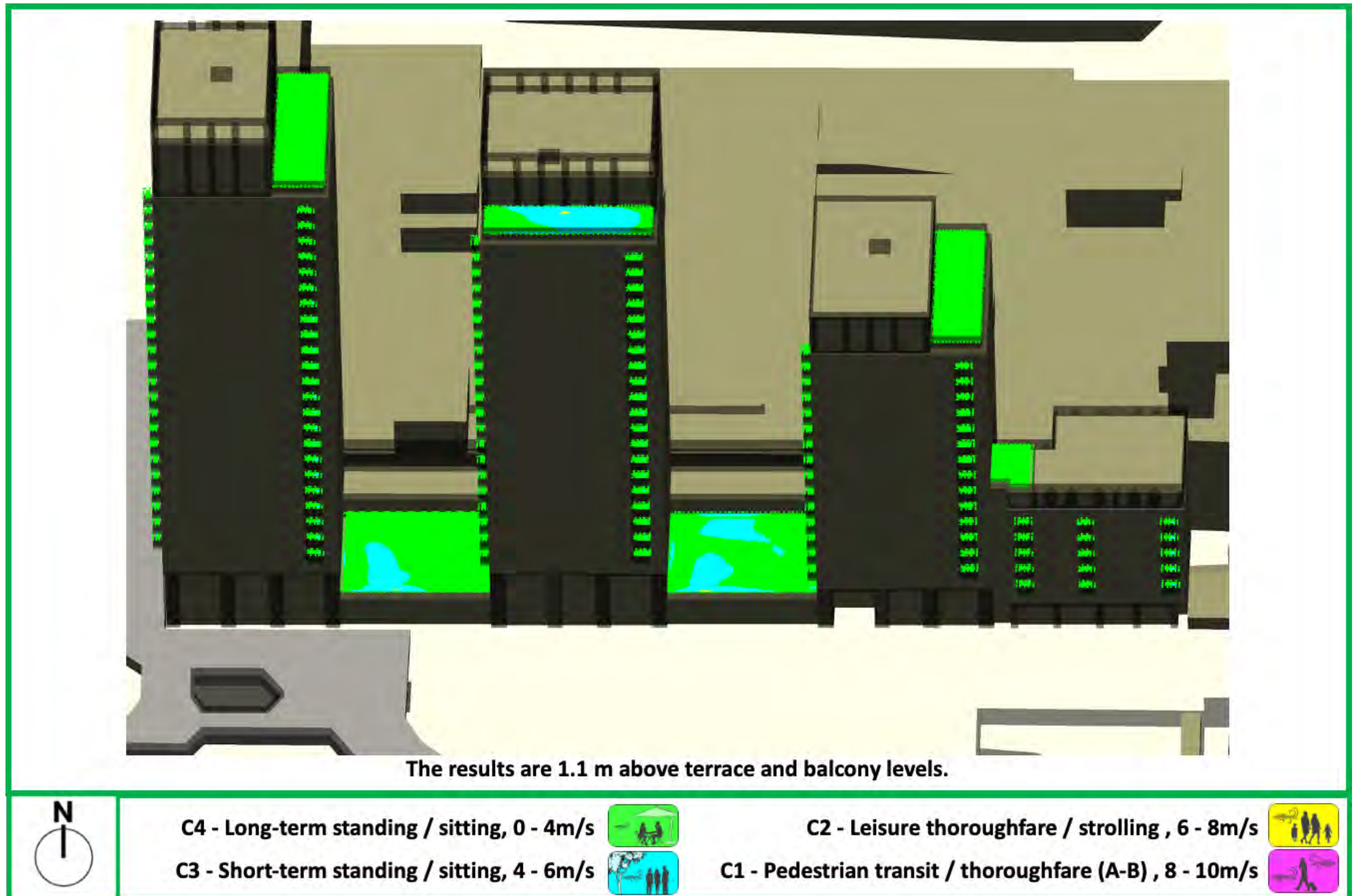


Figure 10.16 Configuration 2: Proposed Development with Existing Surrounding Buildings – Residential Balconies – Safety

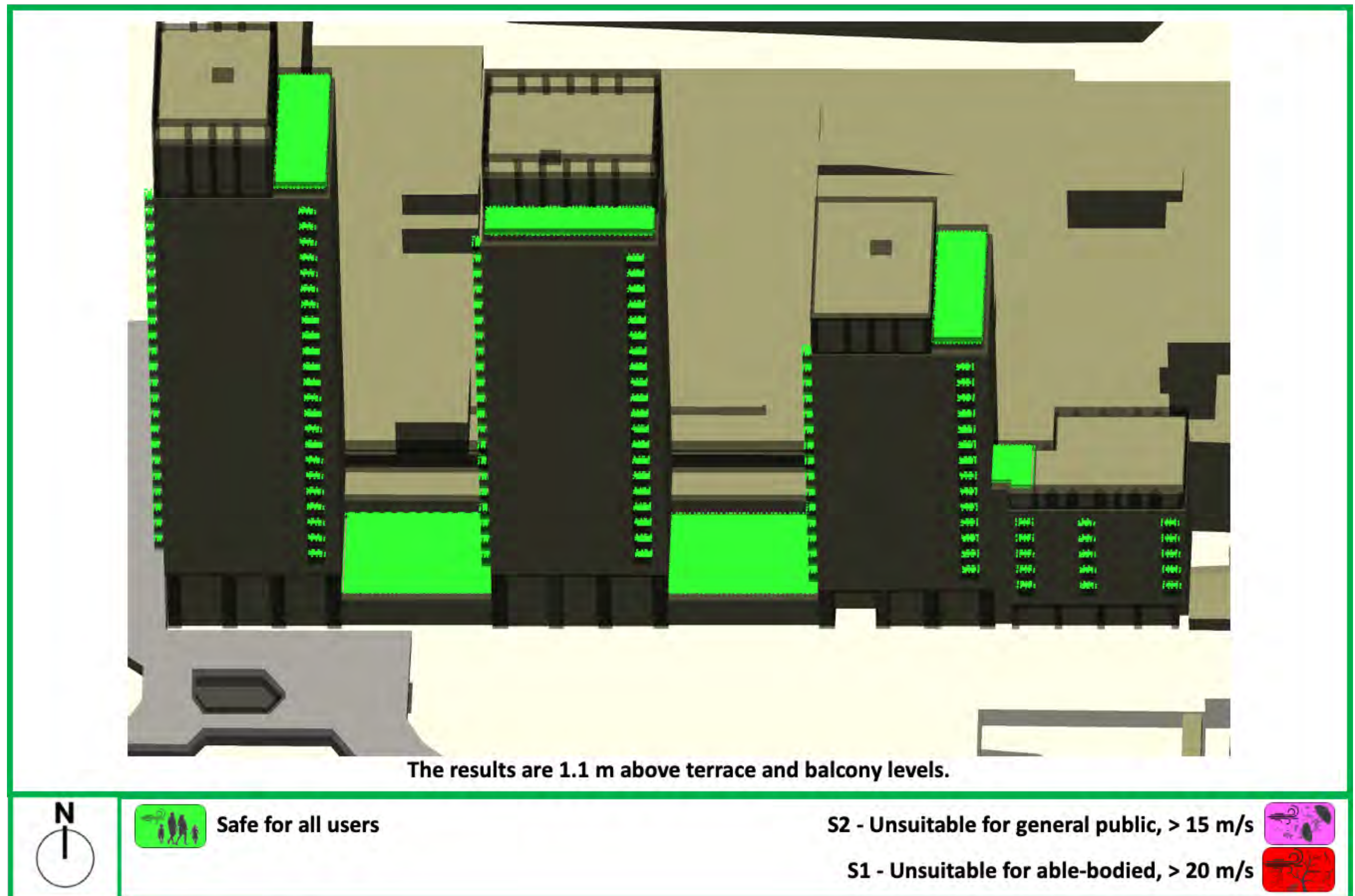


Figure 10.17 Configuration 2: Proposed Development with Existing Surrounding Buildings – Podium and Roof Levels – With Mitigation Measures - Windiest Season

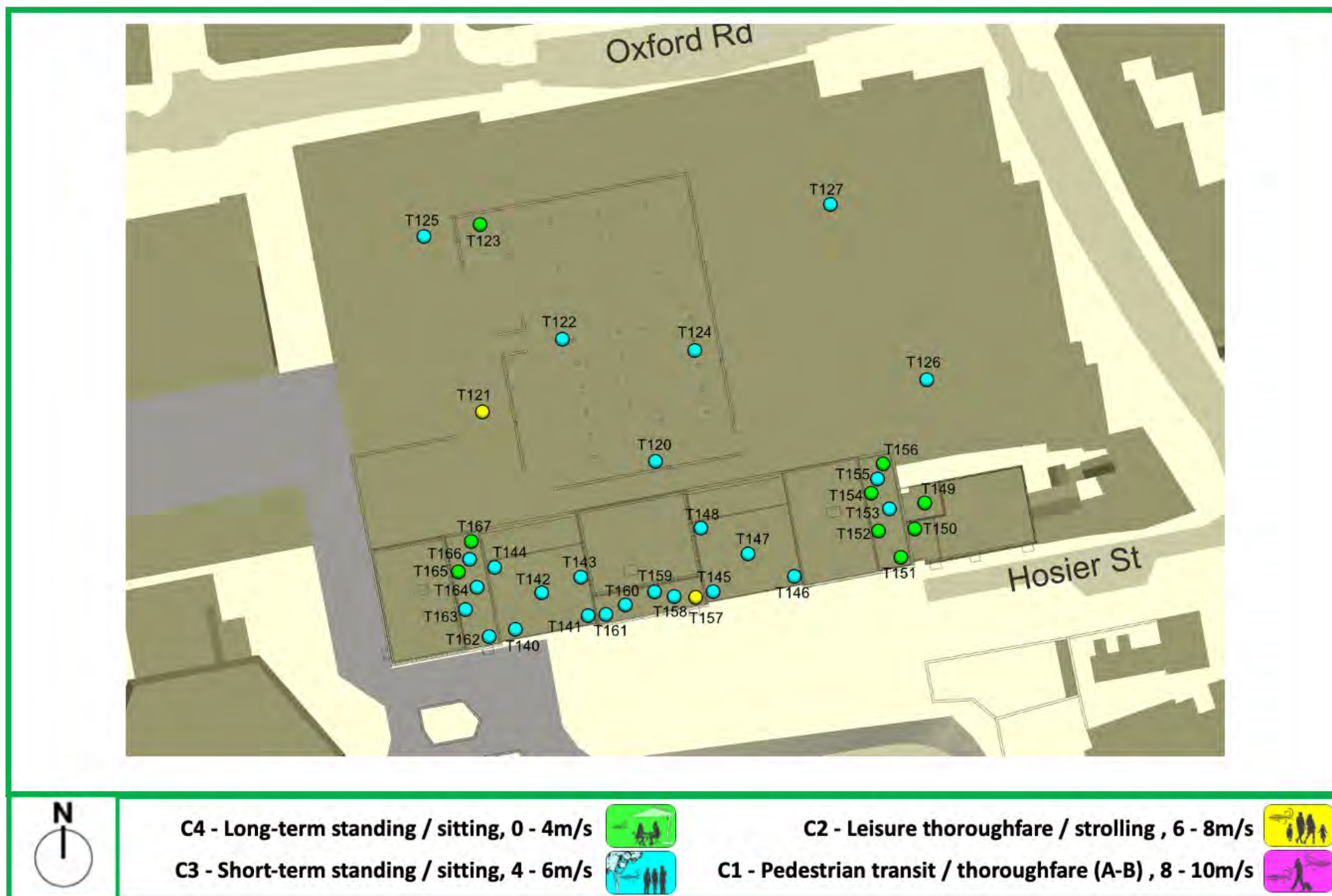


Figure 10.18 Configuration 2: Proposed Development with Existing Surrounding Buildings – Podium and Roof Levels – With Mitigation Measures - Summer

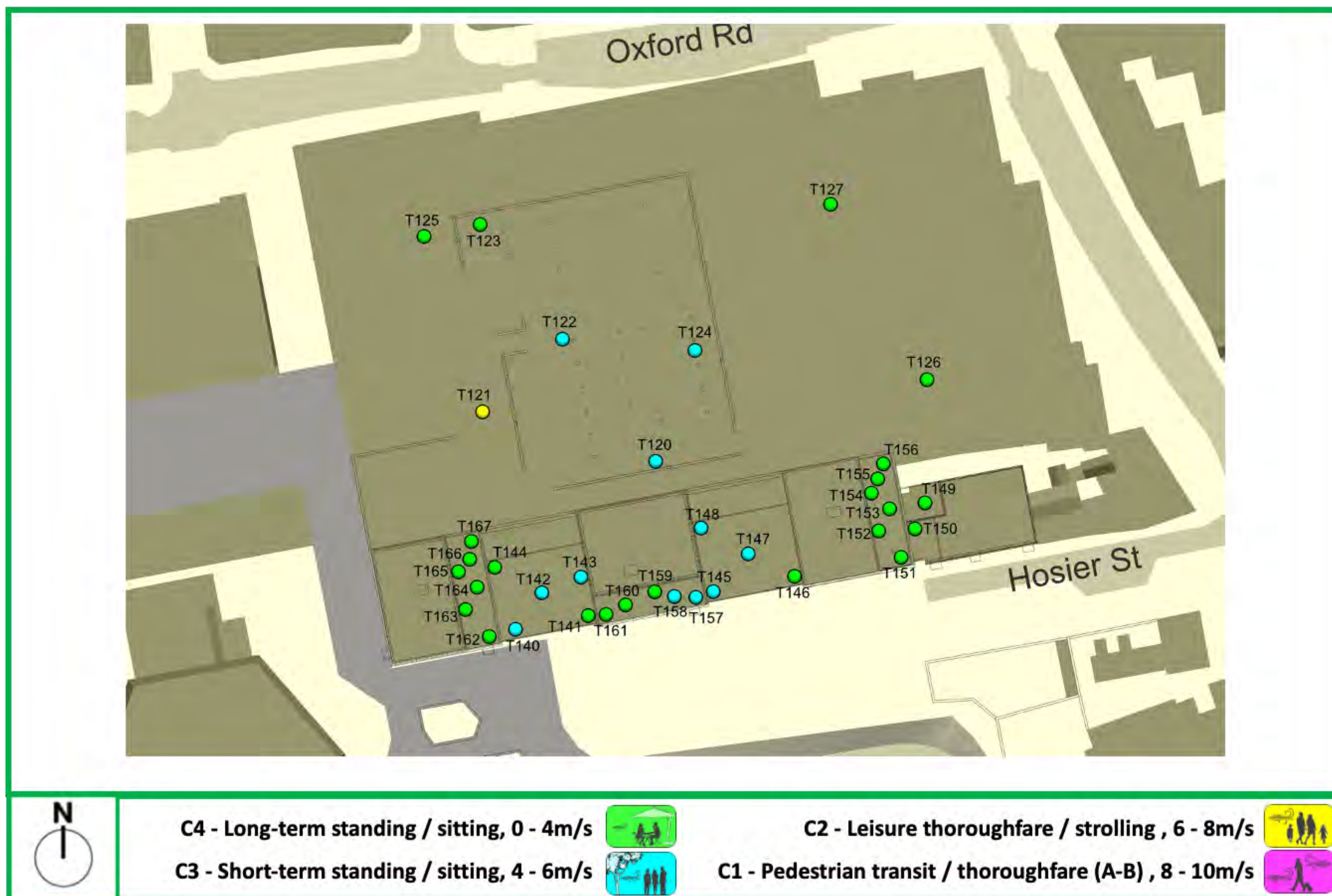
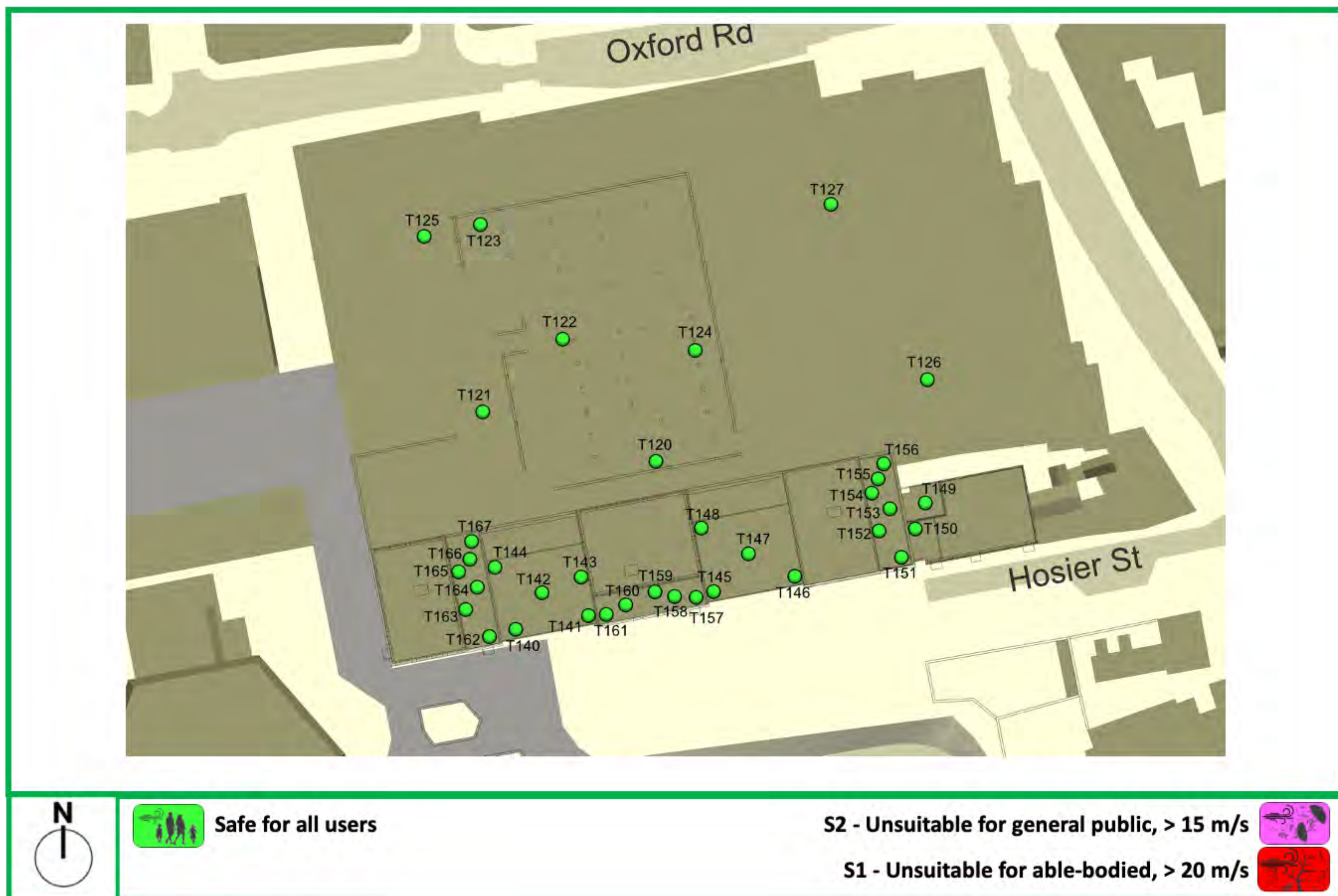


Figure 10.19 Configuration 2: Proposed Development with Existing Surrounding Buildings – Podium and Roof Levels – With Mitigation Measures - Safety



MITIGATION AND MONITORING MEASURES

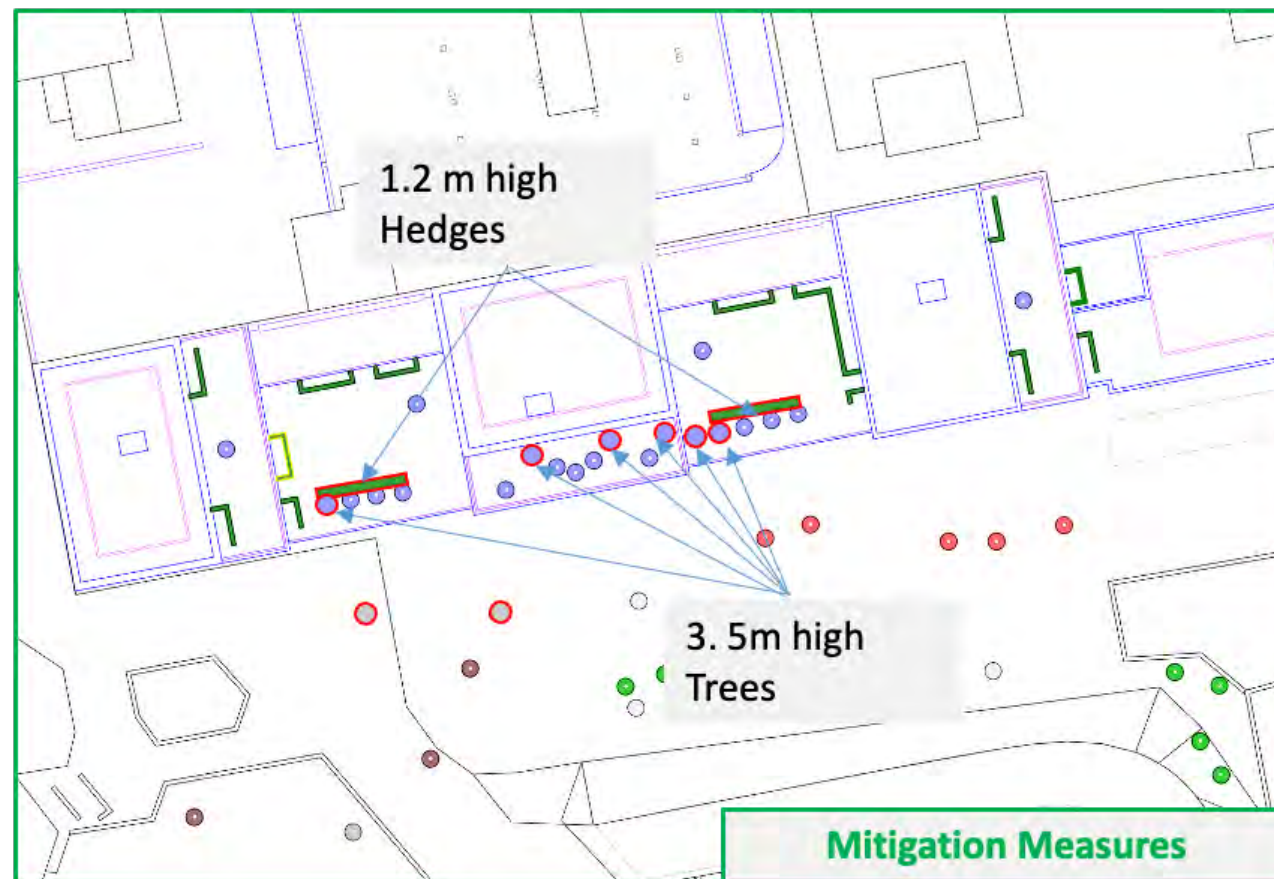
Demolition and Construction

- 10.87** During construction works, the areas under construction will be hoarded off until the point where the building becomes occupied.
- 10.88** No further mitigation is required during the demolition and construction of the Proposed Development.

Completed Development

- 10.89** The Proposed Development incorporates landscaping details which have been tested and form part of the results presented for Configuration 2. Further wind mitigation measures would be required at podium level (measurement locations T140, T142, T147, and Building B roof terrace location T157, T158 and T160)
- 10.90** A wind mitigation strategy is therefore required to provide safe and comfortable wind conditions at the Proposed Development in both the context of the existing and cumulative surrounding buildings. A strategy has been developed based on enhancing the soft landscaping measures locally on the podium and the Building B resident's roof terrace. These have been validated for effectiveness through repeat wind tunnel testing. There is a residual adverse impact at location T158 that requires further development and validation of the wind mitigation strategy. It should be noted that mitigation measures required for the completed development would need to be installed during construction prior to completion.
- 10.91** A wind mitigation strategy has been developed that is based on local enhancements to the soft landscaping measures by way of additional planting of hedges and trees on the podiums between Building A and B and Building B and C, and on the roof terrace of Building B. This is shown in Figure 10.20..

Figure 10.20 Mitigation Measures



- 10.92** Figure 10.17, to Figure 10.19 show the comfort and safety ratings that have been established through repeat wind tunnel testing with these wind mitigation measures in place. With wind mitigation measures in place the wind conditions at podium level measurement locations T140, T142, T147 and Building B roof terrace locations T157 and T160 improve to 'sitting' in the windiest season and in summer. The wind conditions at

measurement location T158 remains in the 'strolling' category and would require either further wind mitigation or a change of local use away from sitting.

RESIDUAL EFFECTS

- 10.93** The residual effects resulting from the Proposed Development are summarised in Table 10.4.

Table 10.4 Summary of Residual Effects

Receptor (Season)	Residual Effect (Nature and Scale)	Effect Significance	Geo	D I	P T	St Mt Lt
Demolition and Construction						
Demolition and Construction Site	Negligible	Not Significant	L	D	T	LT
Completed Development						
On-Site						
Thoroughfares (Windiest)	Negligible to Moderate Beneficial	Not Significant	L	D	P	LT
Entrances (Windiest)	Negligible to Minor Beneficial	Not Significant	L	D	P	LT
Ground Level Amenity (Summer)	Negligible	Not Significant	L	D	P	LT
Podium and Roof Amenity Levels (Summer)	Negligible	Not Significant	L	D	P	LT
Podium and Roof Amenity Levels (Summer) (Locations: T158)	Moderate Adverse	Significant	L	D	P	LT
Strong Winds	Negligible	Not Significant	L	D	P	LT
Off-Site						
Thoroughfares (Windiest)	Negligible	Not Significant	L	D	P	LT
Road (Windiest)	Negligible	Not Significant	L	D	P	LT
Entrances (Windiest)	Negligible	Not Significant	L	D	P	LT
Ground Level Amenity (Summer)	Negligible	Not Significant	L	D	P	LT
Notes: Residual Effect - Scale = Negligible / Minor / Moderate / Major - Nature = Beneficial or Adverse Geo (Geographic Extent) = Local (L), Borough (B), Regional I, National (N) D = Direct / I = Indirect P = Permanent / T = Temporary R = Reversible / IR= Irreversible St = Short Term / Mt = Medium Term / Lt = Long Term N/A = not applicable / not assessed						

LIKELY SIGNIFICANT EFFECTS

- 10.94** The wind conditions around the Proposed Development at ground level would be generally suitable for the intended pedestrian use and there are no significant residual effects.

- 10.95** The wind conditions at elevated level and at the balconies are generally suitable for the intended uses with the exception of sensitive receptors T140, T142, T147 at podium level and T157, T158 and T160 at the Block B roof terrace, where local wind mitigation measures are required.
- 10.96** With wind mitigation measures in place the wind conditions in these locations are suitable for the intended uses with the exception of location T158 where further wind mitigation measures need to be developed and validated through repeat quantitative analysis using either wind tunnel testing or CFD.

ASSESSMENT OF FUTURE ENVIRONMENT

Evolution of the Baseline Scenario

- 10.97** In the absence of the Proposed Development, the wind microclimate conditions across the majority of the site would remain as defined for the current baseline conditions (Configuration 1). This assumes that generally the wind microclimate conditions (as defined by metrological data) for Reading and the southeast of England remain as presented within this assessment.
- 10.98** The wind conditions for the future baseline scenario have been informed by the baseline wind tunnel testing scenario (Configuration 1) and the wind tunnel testing of the Proposed Development with the surrounding cumulative schemes (Configuration 3 – Scenario 1). Should the Proposed Development not come forward, the wind conditions, in combination with the cumulative schemes, show that the site and surrounding area will have conditions suitable for their intended use as the cumulative schemes would not significantly change the wind conditions at and surrounding the site.

Cumulative Effects Assessment – Scenario 1

- 10.99** This section identifies the effects of the Proposed Development in combination with the effects of other cumulative schemes within the surrounding area – Scenario 1 (identified in **ES Volume 1, Chapter 2: EIA Methodology**).
- 10.100** A cumulative assessment scenario (Configuration 3) was tested (wind tunnel test, see section ‘*Assessment Methodology*’) to predict the wind conditions within the site and surrounding area in the presence of the surrounding cumulative schemes.
- 10.101** With regards to Cumulative Scheme 2 (Station Hill, Reading, including Plot E and Telecom House), the subsequent section 73 applications (references 192032, 201532 and 201536) were not tested quantitatively in the wind tunnel. However, the testing has shown that the spatial extent of potential impacts of the Proposed Development in cumulative context is such that it does not extend as far as the Station Hill site. Therefore, the impact will remain negligible (Not Significant) irrespective of changes made through these section 73 applications.
- 10.102** The potential impact of the proposed Station Hill development on this Proposed Development has also been shown to be negligible, because it is not located upwind of winds approaching from the prevailing wind sectors that dominate the wind comfort ratings.
- 10.103** As such, the conclusions set out in the following sections remain valid and robust.

Demolition and Construction

- 10.104** The cumulative schemes are not considered to have a material impact on the majority of areas around the site but there is the potential for the southeast corner of site to get windier.
- 10.105** That said, wind conditions during the demolition and construction works at the site and surrounding area would still represent a likely Negligible effect (not significant).

Completed Development

Configuration 3: Proposed Development with Cumulative Schemes

- 10.106** The discussion of wind conditions in Configuration 3 are based on the results presented in Figure 10.21 and Figure 10.22 for the windiest season, while Figure 10.23 and Figure 10.24 refer to the wind conditions during the summer season. Figure 10.25 and Figure 10.26 show the strong wind exceedances respectively at ground and upper levels. The wind conditions for windiest season and summer and for strong winds for the balconies are given in Figure 10.27, Figure 10.28 and Figure 10.29 respectively.
- 10.107** Configuration 3 included the Proposed Development in the context of the cumulative schemes with the proposed landscaping scheme in place.

Pedestrian Comfort

- 10.108** Wind conditions at the Proposed Development would be suitable for ‘sitting’ use to ‘strolling’ use during the windiest season (Figure 10.21 and Figure 10.22).
- 10.109** During the summer season, wind conditions would be suitable for ‘standing’ use or calmer (Figure 10.23 and Figure 10.24). This represents a Negligible (not significant) effect.

Thoroughfares

On-site

- 10.110** Wind conditions at all thoroughfare locations would be similar to Configurations 2, ranging from ‘sitting’ use to ‘strolling’ use (target conditions) during the windiest season (Figure 10.21). This represents a Negligible (not significant) effect.

Off-site

- 10.111** All off-site thoroughfare locations would have wind conditions ranging from ‘sitting’ use to ‘strolling’ use (target conditions) during the windiest season (Figure 10.21). This represents a Negligible (not significant) effect.

Entrances

On-site

- 10.112** The majority of the on-site entrance locations would have ‘standing’ use (target conditions) or calmer wind conditions during the windiest season, representing a Minor Beneficial (not significant) to Negligible (not significant) effect (Figures 10.21 and Figure 10.22).

Off-site

- 10.113** All the off-site entrances would have the required ‘standing’ use (target conditions) or calmer wind conditions during the windiest season, representing a Negligible (not significant) effect.

Car park

- 10.114** All car park locations would have ‘strolling’ use or calmer use wind conditions during the windiest season (Figure 10.22), representing a Negligible (not significant) effect.

Ground Level Amenity Areas

Off-site

- 10.115** Wind conditions at Off-Site amenity locations G21, G42, G43, G50 and G61 would be suitable for ‘sitting’ use during the summer season, representing a Negligible (not significant) effect (Figure 10.21).

Upper Level Amenity Spaces and Balconies

- 10.116** Wind conditions at podium level amenity spaces would range from suitable for ‘sitting’ use (target conditions) to ‘strolling’ use during the summer season (Figure 10.22). Measurement locations T140, T142, T147 at podium level and T157, T158 and T160 at roof terrace level of Block B would have ‘strolling’ use wind conditions in the windiest season and in the case of T140, T157 and T158 also in summer season, representing a Moderate Adverse (**significant**) effect. As discussed above for configuration 2 (Proposed Development in existing surrounding context) a wind mitigation strategy has been developed and tested that provides suitable conditions at all of these locations other than location T158, where further mitigation measures are required.

Strong Winds

- 10.117** Strong winds exceeding 15m/s for more than 2.2 hours per year would not occur at the podium level, the level of the resident’s roof terraces or at the residential balconies (Figure 10.25, Figure 10.26 and Figure 10.29)

Figure 10.21 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Ground Level – Windiest Season

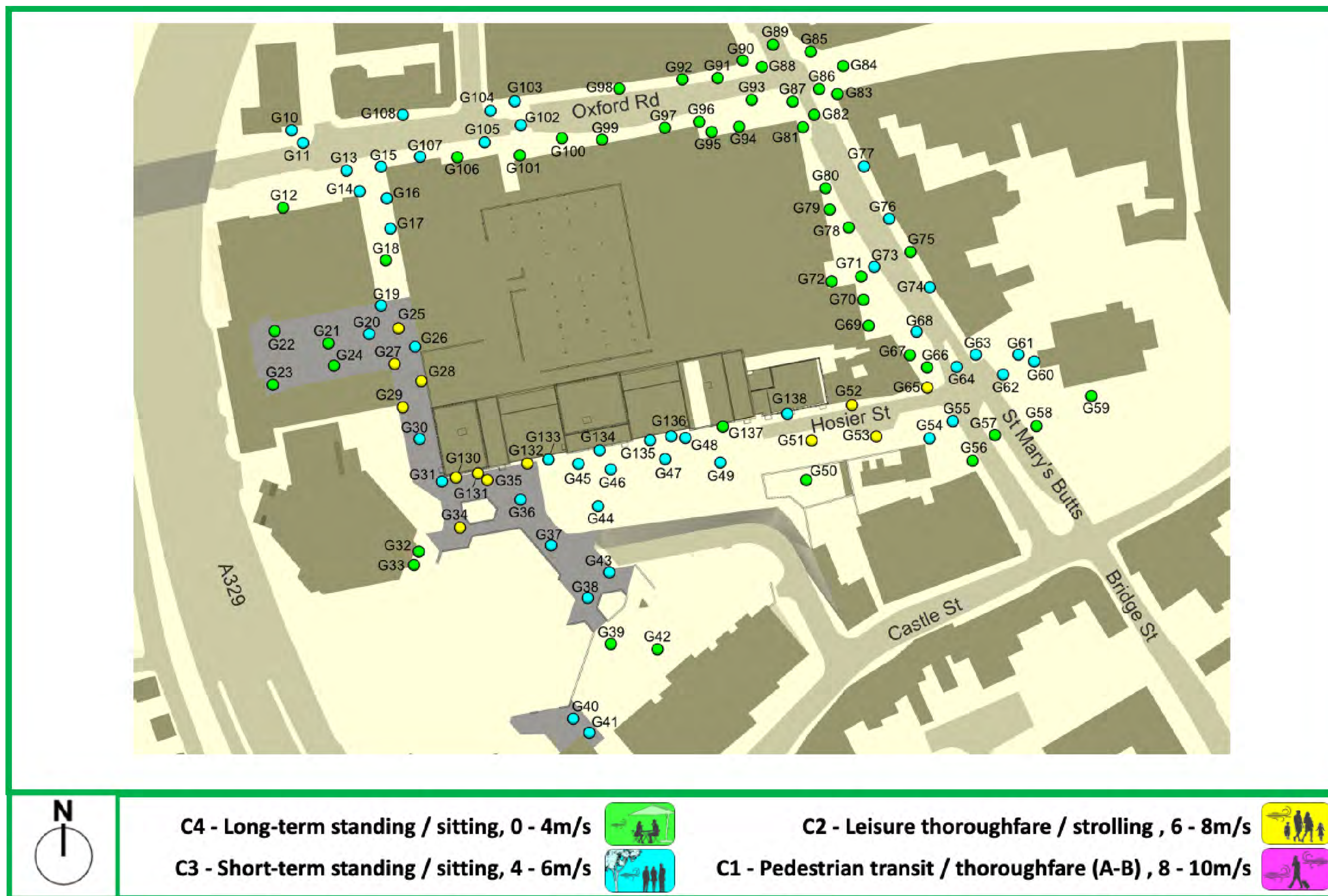


Figure 10.22 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Podium and Roof Levels – Windiest Season

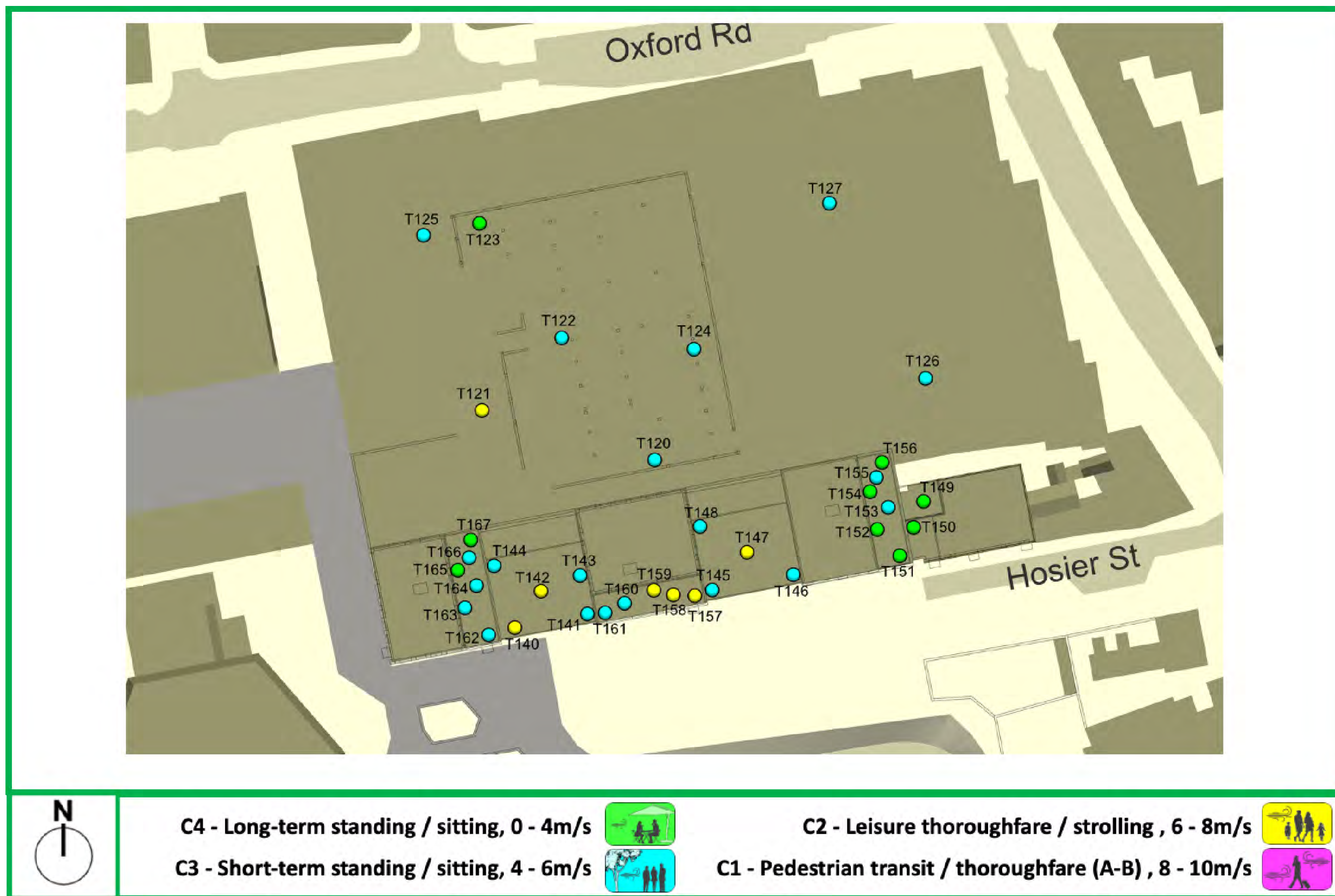


Figure 10.23 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Ground Level – Summer Season

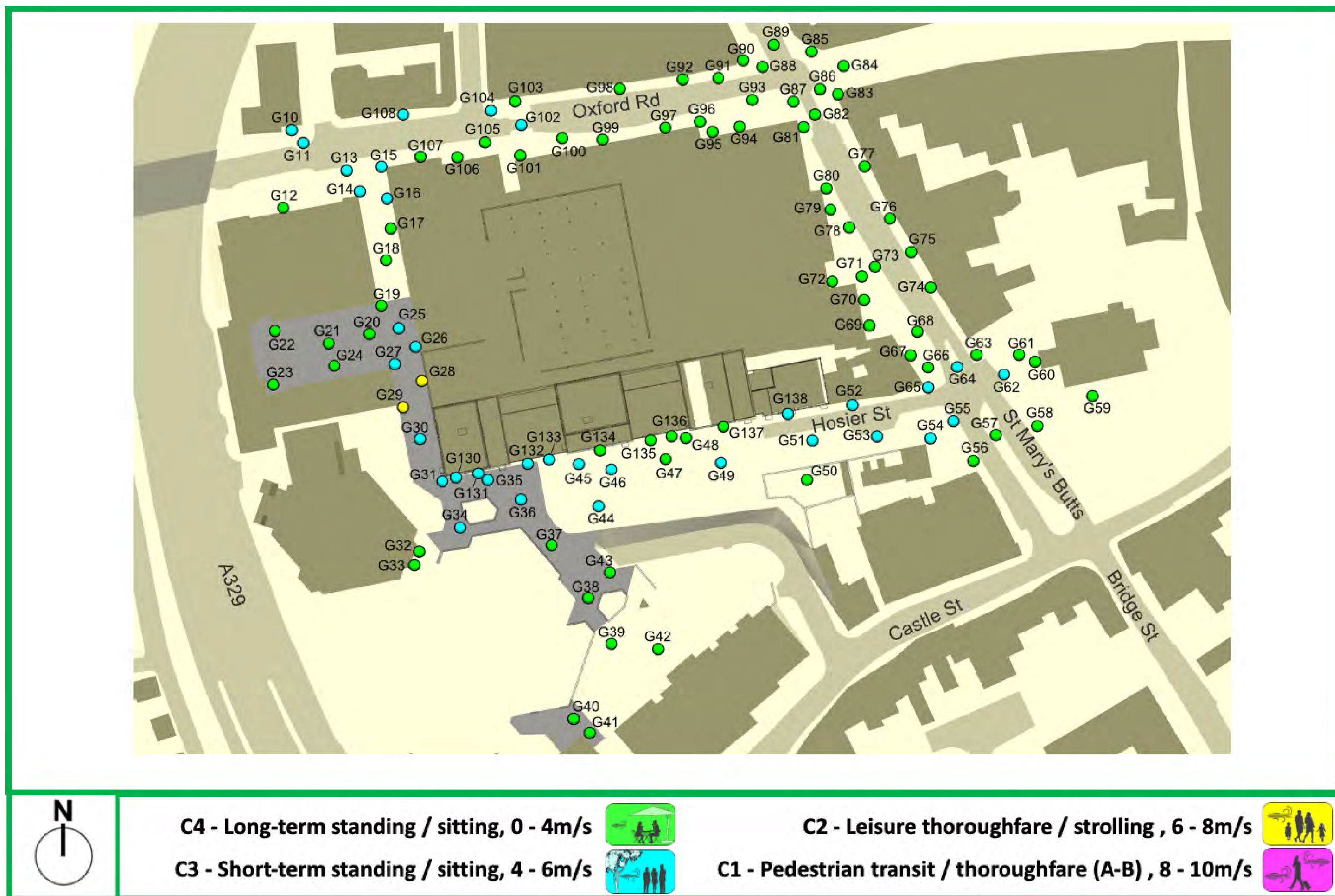


Figure 10.24 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Podium and Roof Levels – Summer Season

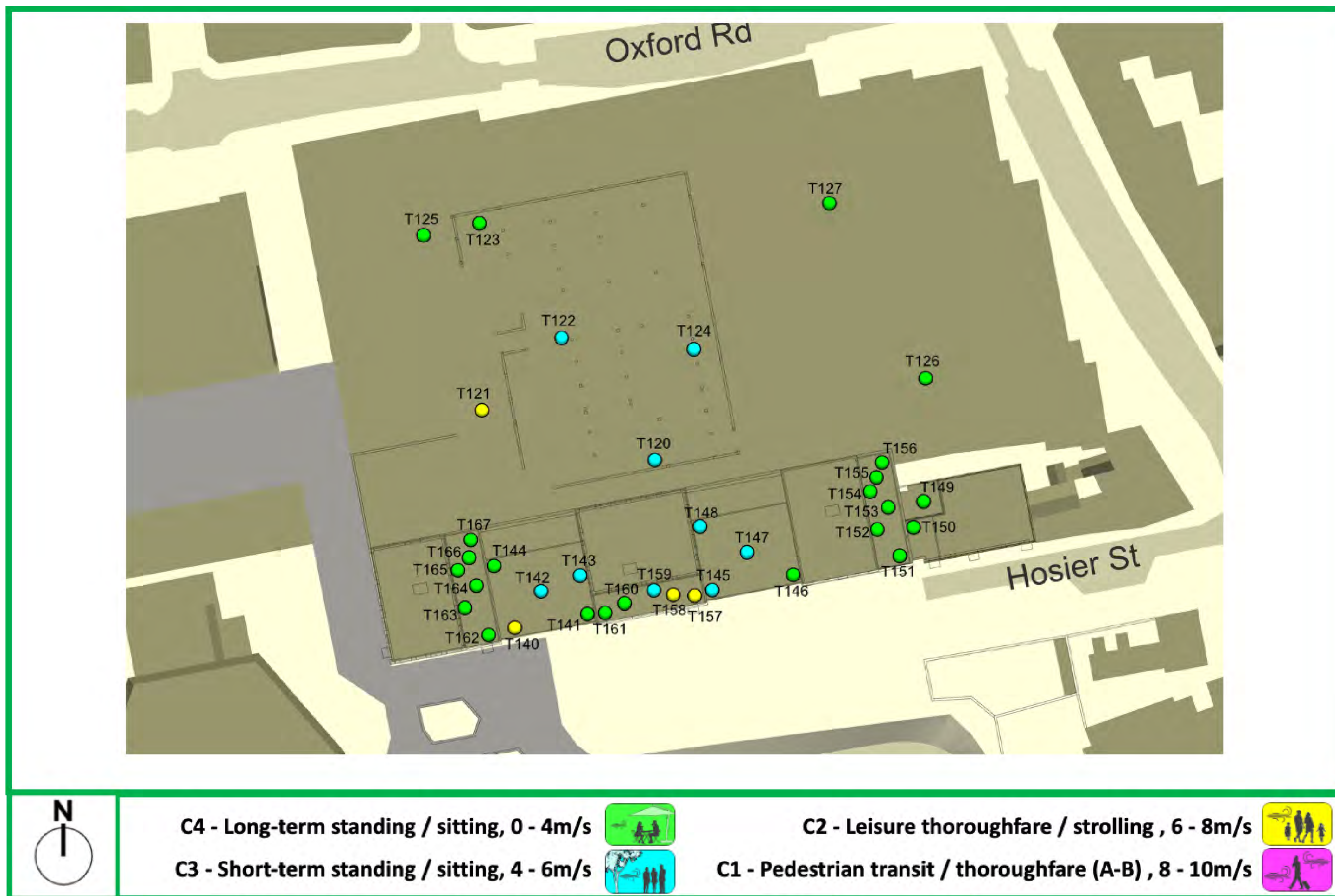


Figure 10.25 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Ground Level – Safety

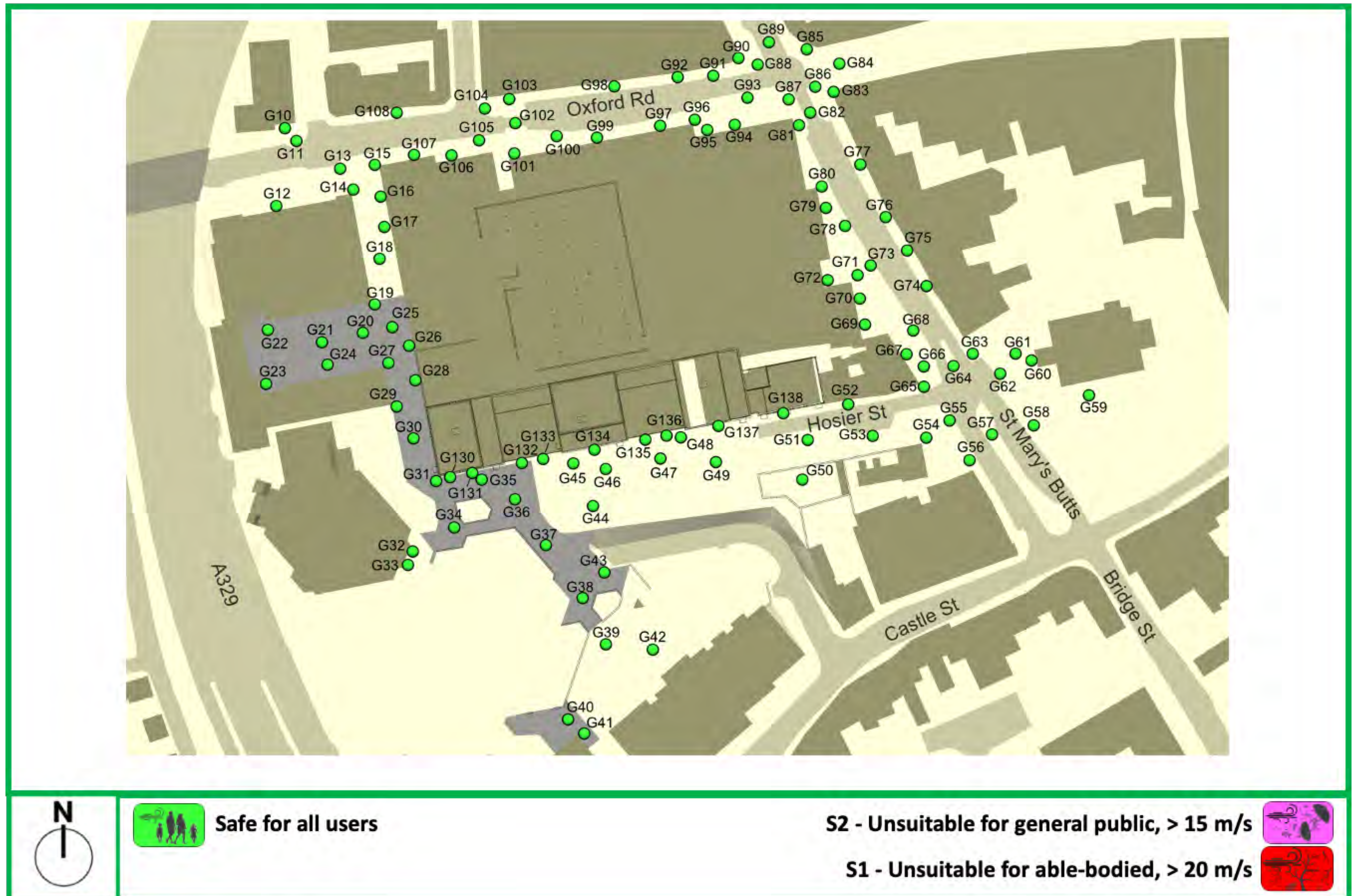


Figure 10.26 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Podium and Terrace level – Safety

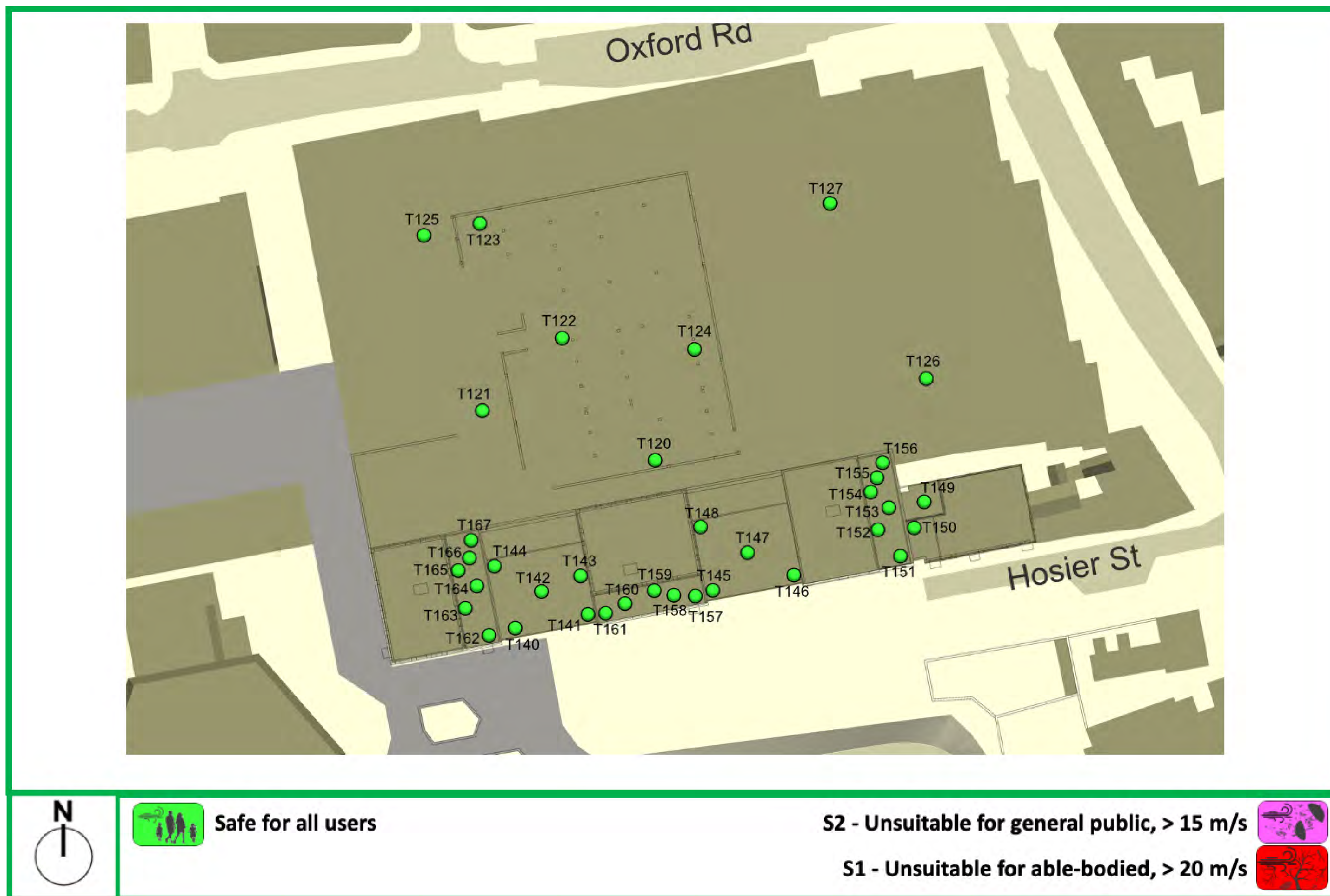


Figure 10.27 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Residential Balconies – Worst Season

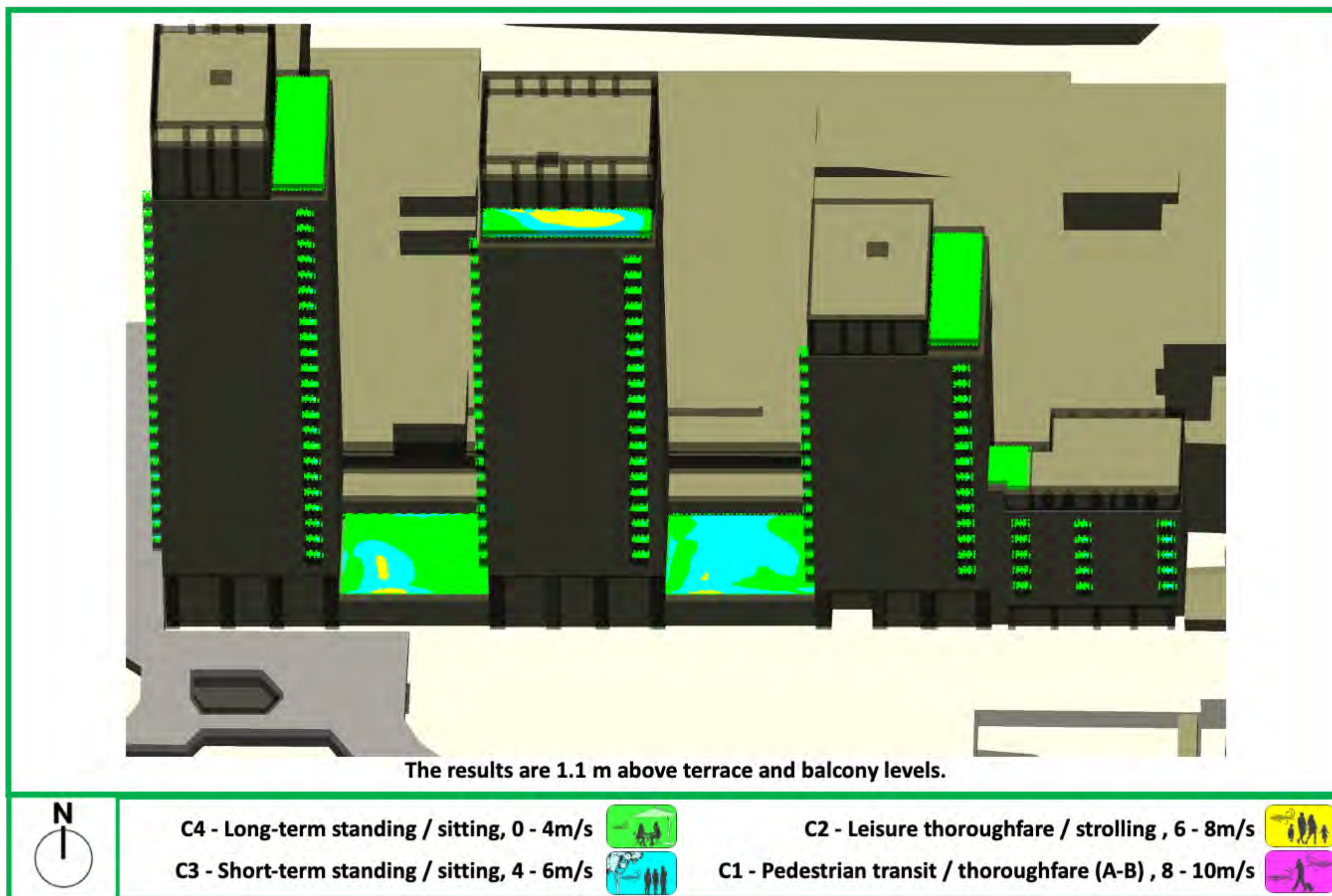


Figure 10.28 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Residential Balconies – Summer

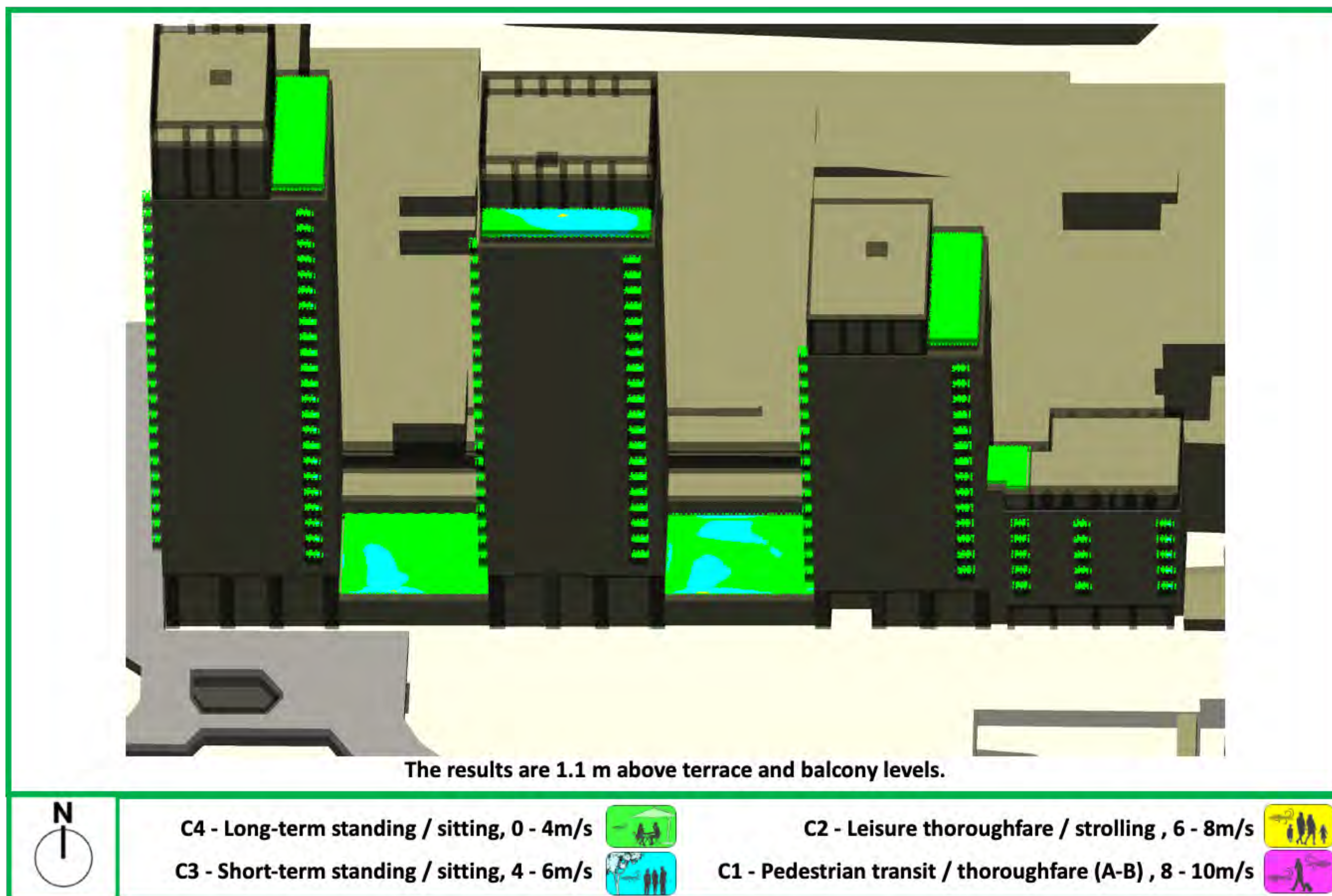
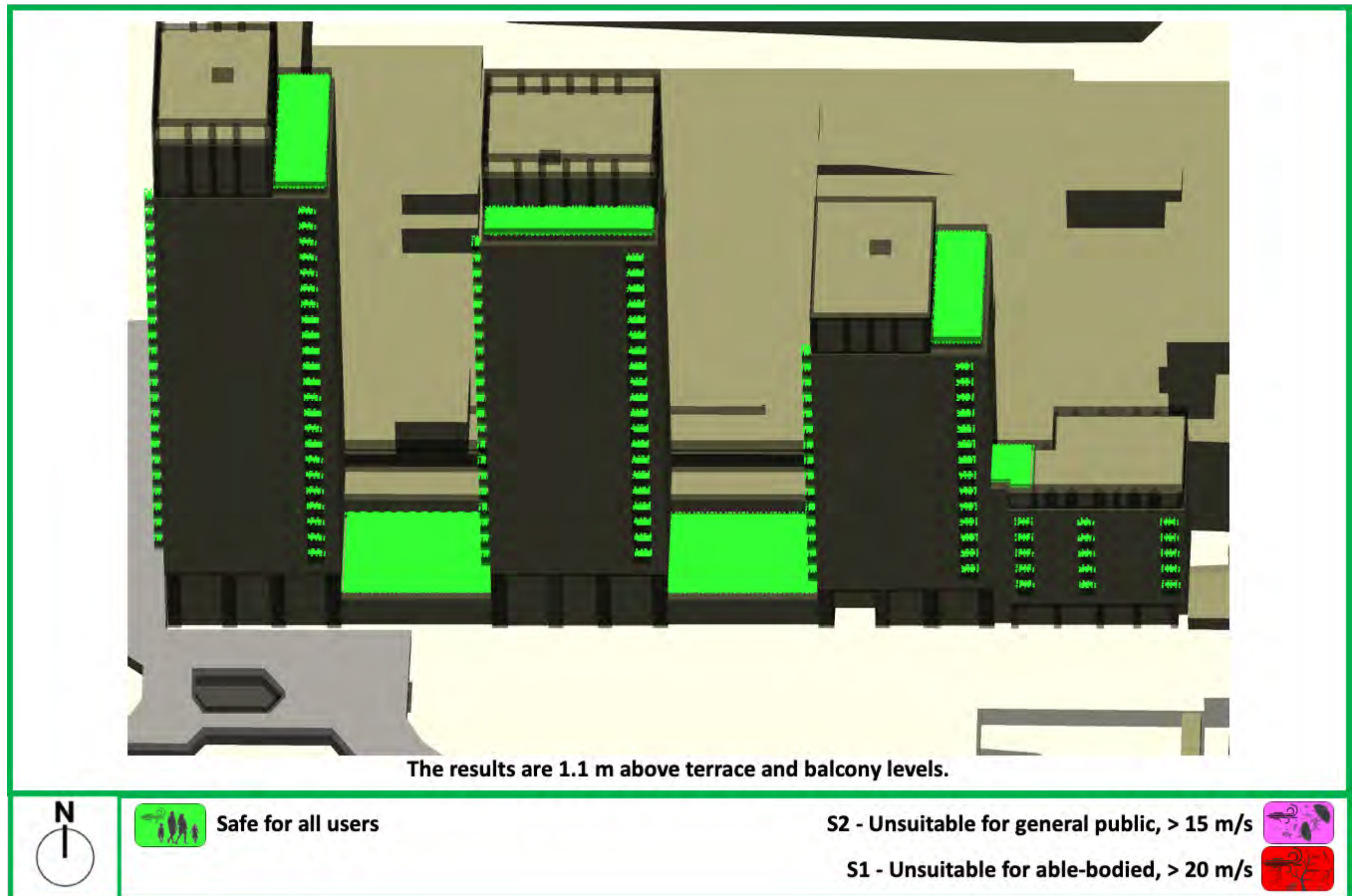


Figure 10.29 Configuration 3: Proposed Development with Cumulative Surrounding Buildings – Residential Balconies – Safety



Chapter 11: Climate Change and Greenhouse Gases

CLIMATE CHANGE AND GREENHOUSE GASES	
AUTHOR	The Climate Consultants
SUPPORTING APPENDIX	ES Volume 3, Appendix: Climate Change and Greenhouse Gases Annex 1: Professional Experience Annex 2: Climate Change Proforma Guide Annex 3: Climate Change Proforma Annex 4: Greenhouse Gas Context Annex 4: Greenhouse Gas Baseline Annex 6: Assessment Approach
KEY CONSIDERATIONS	PART A This Environmental Statement (ES) chapter addresses climate change resilience and adaptation. A future climate scenario has been developed through the use of the future climate projections published by the Met Office (through the UK Climate Projections (UKCP18) website). The results include projections for variables including annual mean temperatures, and annual changes in summer and winter precipitation. To describe the predicted future climate, a medium emissions scenario (RCP8.5) for 2080 has been utilised as the future baseline. RCP8.5 has been used as it represents the most reasonable emissions scenario with regards to climate policy, land use, and technological development. The year 2080 is the timeframe considered most relevant to the Proposed Development. The projected change to the range of climatic conditions will adopt the 50% probability level, which is a central estimate adopted given the level of uncertainty associated with predicting the modelled scenarios. The future climate change scenario has been considered for each of the technical topics presented in this ES ('In-Combination Climate Change Impacts'), and the level of assessment and methodology is proportional to the available evidence base. The aim of the assessment has been to consider whether the effect on receptors (under the current condition, without climate change) are likely to be different under an alternative future climate regime; in particular, to identify whether the potential impacts of the Proposed Development will be worse or improve under the future baseline, and therefore if these changes alter the significance of effects identified for the Proposed Development under the current condition (without climate change). This is the potential for climate change to affect the Proposed Development. This section also includes an overview of the climate change resilience and adaptation measures that have been factored into the design of the Proposed Development. PART B Greenhouse gases (GHGs) cumulatively contribute towards global climate change. The effects of climate change vary on a local, regional, and global scale; consideration has therefore been given to GHG emissions within Reading, South-East England and the UK. GHG emissions will be generated throughout the lifetime of the Proposed Development. Initially, emissions will be released during the extraction, processing and manufacture of raw materials, the transportation of these materials and during the demolition and construction works of the Proposed Development. Emissions will then be generated once complete and operational, and finally during the decommissioning phase. Consideration has thus been given to the following: <i>Demolition and Construction</i> • Embodied carbon from the extraction, manufacture, transportation, assembly, replacement, and deconstruction of materials used to construct the Proposed Development; • Direct emissions from the transportation of demolition and construction materials and earthworks, as well as construction workers accessing the site; and • Direct emissions from non-road mobile machinery. <i>Operation</i> • Direct emissions from road or other traffic generated due to the Proposed Development; • Indirect emissions from imported consumables, including power, fuel usage, and water usage; • Direct emissions from on-site refrigerant accidental leakages; • Embodied carbon from building consumables, such as food, commodities, and waste; • Direct emissions from land use change; and • Embodied carbon from repair, maintenance, and refurbishment of the building during its lifetime.

CLIMATE CHANGE AND GREENHOUSE GASES	
	<i>Decommissioning</i> • Direct emissions from transportation of materials; and • Direct emissions from non-road mobile machinery. The main direct and indirect GHGs of concern for the Proposed Development are carbon dioxide (CO₂) and nitrogen oxides (NOx), dust and fine particulate matter (PM₁₀ and PM_{2.5}).

PART A CLIMATE CHANGE RESILIENCE AND ADAPTATION

Assessment Methodology

- 11.1
- The approach to assessing the potential impact of climate change on the Proposed Development has been undertaken in accordance with the Institute of Environmental Management and Assessment's (IEMA's) guidance 'Climate Change Resilience and Adaption'¹, which presents a framework for the consideration of climate change resilience and adaption in the EIA process. It recognises a need for a proportionate approach to the assessment, due to the uncertainties associated with predicting how the environment will respond to climate change.
- 11.2
- The guidance advises on inter alia, defining the future climate scenario, the integration of climate change adaption into the design, and the process for EIA. The guidance also provides advice on the execution of the impact assessment across the technical topics, including the identification of the climate related parameters which are likely to influence the project in question, and the anticipated changes to those parameters under a future climate scenario.
- 11.3
- Consistent with the guidance, current and future climate scenarios have been developed through the use of the future climate projections published by the Met Office (through the UK Climate Projections (UKCP18) website²). The results include projections for variables including annual mean temperatures and annual changes in summer and winter precipitation. Further details are set out in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 2**.
- 11.4
- To describe the predicted future climate, a high emissions scenario (RCP8.5) for 2080 has been utilised as the future baseline. RCP8.5 has been used as it represents a conservative high emissions scenario. The year 2080 is the timeframe considered most relevant to the Proposed Development, this is relevant as an estimated operational lifetime of 60 years has been assumed, this being a typical assumption in accordance with British Standard EN 15978:2011³. The projected change to the range of climatic conditions has adopted the 50% probability level, which is a central estimate adopted given the level of uncertainty associated with predicting the modelled scenarios, although consideration has been given to the range of predicted conditions. This approach is in accordance with the IEMA Climate Change Resilience and Adaptation guidance, which states that *"Recommended best practice is to use the higher emissions scenario (RCP 8.5 in the latest UKCP18 projections) at the 50th percentile, for the 2080s timelines, unless a substantiated case can be made for not doing this (e.g. anticipated lifespan of the project is shorter than 2080s)"*.
- 11.5
- The future climate change scenario has been considered by each of the technical topics covered within this ES ('In-Combination Climate Change Impacts'), and the level of assessment and methodology is proportional to the available evidence base. The aim of the assessment has been to consider whether the effect on receptors (under the current condition, without climate change) are likely to be different under an alternative future climate regime; in particular, to identify whether the potential impacts of the Proposed Development will be worse or improve under the future baseline, and therefore if these changes alter the significance of effects identified for the Proposed Development under the current condition (without climate change). A key aspect of the assessment (for each of the technical topics considered) has been to identify the likely effect of those receptors considered more vulnerable to changes in climate, having taken into account the resilience and adaptive measures (being either design or management) which are proposed for the scheme in order to mitigate the risk presented by climate change.
- 11.6
- To obtain the relevant information from technical topics a proforma was issued along with a guide, setting out existing and future climate conditions. These are provided in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 2** and **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 3**. The assessment builds upon the information responses from each technical topic and addresses 'In-

¹ IEMA (2020). Climate Change Resilience and Adaption
² <https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/download-data>

³ British Standard BSEN 15978:2011. Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.

Combination Climate Change Impacts' using professional judgement, taking account of the assessment approach.

- 11.7 Due to the level of uncertainty in both the future climate projections and how the future climate conditions may affect sensitive receptors, the assessment is qualitative (determining whether or not there is the risk of significant effects as a result of climate change impacts on/in conjunction with the Proposed Development), based on objective professional judgement.
- 11.8 Where mitigation measures are identified to either eliminate or reduce adverse effects and are incorporated either through the design or will be translated into operational or managerial standards/procedures typically via planning conditions, the 'residual' significance of effects (those effects which remain following the implementation of suitable mitigation measures) are considered.
- 11.9 The final section of Part A of this ES chapter presents the adaption and resilience measures proposed as part of the Proposed Development, in response to the projected future climate change scenario (as described below).

Climate Conditions

- 11.10 Current and future climate conditions are set out in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 2**. A summary of the conditions is set out below.

Current Climate Conditions

- 11.11 The current climate in the local area of the Proposed Development is set out in Table 11.1. The data presented represent normal conditions based on 5-year averages, not anomalies.

Table 11.1 Current Climate Statistics at the Proposed Development

Parameter	Summer			Winter			Annual		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Temperature (°C)	13.0	19.2	26.7	1.8	6.0	10.1	7.2	11.9	16.7
Cloud (%)	38.1	48.3	62.6	67.1	72.6	80.0	55.5	61.3	67.8
Precipitation (mm)	0.6	1.4	2.8	1.5	2.6	3.9	1.4	2.0	2.6
Snow (mm)	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Wind Speed (m/s)	3.0	3.4	3.9	3.5	4.3	5.3	3.3	3.8	4.3
Humidity (%)	56.6	62.1	68.9	84.0	85.7	87.4	72.1	74.2	77.1
Table notes: Due to the year-on-year variations in meteorology, which occur naturally irrespective of climate change, the data presented represent 5-year averages.									

Future Climate Change Scenario

- 11.12 The future climate for 2080 in the local area of the Proposed Development is set out in Table 11.2. The data presented represent normal conditions based on 5-year averages, not anomalies.

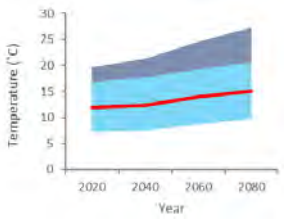
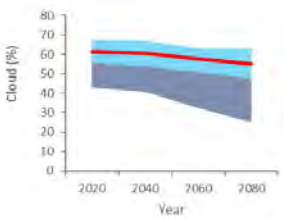
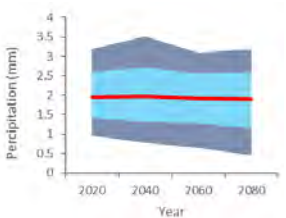
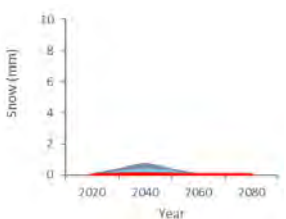
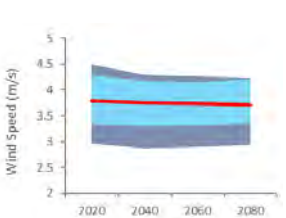
Table 11.2 Future Climate Statistics at the Proposed Development

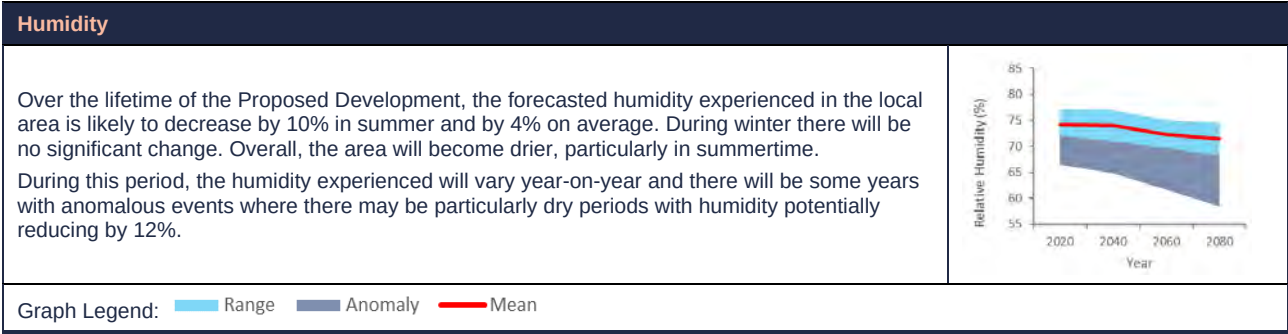
Parameter	Summer			Winter			Annual		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Temperature (°C)	15.7	23.2	31.2	3.7	8.1	11.8	9.6	15.0	20.5
Cloud (%)	25.2	36.3	52.8	62.1	71.0	79.1	47.5	55.3	63.0
Precipitation (mm)	0.2	0.9	2.3	1.6	3.1	4.5	1.2	1.9	2.6
Snow (mm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Speed (m/s)	2.9	3.3	3.8	3.5	4.3	5.4	3.4	3.7	4.2
Humidity (%)	50.0	55.8	63.9	83.0	85.3	87.6	68.2	71.4	74.5

Parameter	Summer			Winter			Annual		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Table notes: Due to the year-on-year variations in meteorology, which occur naturally irrespective of climate change, the data presented represent 5-year averages.									

- 11.13 A summary of how each of the climatic parameters are forecasted to change in the future climate scenario is set out in Table 11.3. When considering the likelihood of potential impacts, it is important to take account of the uncertainty in climate forecasts and the graphs presented illustrate both the variability of annual conditions as well as the changes due to anomalous events.

Table 11.3 Future Changes in Climate at the Proposed Development

Temperature	
Total Cloud	
Precipitation	
Snow	
Wind Speed	



Future Climate Summary

- 11.14 Over the lifetime of the Proposed Development, the climate in the local area of the Proposed Development is likely to become:
- Warmer;
 - Less cloudy; and
 - Less humid (drier).
- 11.15 Precipitation and wind speeds are likely to remain similar to those currently experienced.
- 11.16 Although there is forecasted to be less snow in the future, the location currently experiences little snow and there will therefore be an insignificant change.
- 11.17 It is also worth noting that the anomalous events are likely to become more severe in the future, with potential occurrences of hot, sunny, dry periods; these may result in average summer temperatures being 10°C hotter than normal for the time (14°C hotter than current summers).
- 11.18 While the Met Office's headline results suggest significant changes in precipitation, the changes are largest for Scotland and not significant for most of southern and eastern England, including Reading. However, the UKCP18 UK and regional forecasts suggest more generally that precipitation in summer will involve more intense storms, which gives an increased risk of surface flooding. It does not suggest this for winter though.

Potential Effects

- 11.19 The potential effects of climate change upon the Proposed Development are described below. The assessment builds upon the information responses from each technical topic and addresses 'In-Combination Climate Change Impacts' using professional judgement, taking account of the assessment approach used in the respective technical ES chapters (ES Volume 1, Chapters 6 – 10).

Socio-Economics

- 11.20 During the lifetime of the Proposed Development there are likely to be climate-related events that may contribute to resource scarcity, displacement, and conflicts, leading to political and social instability. Vulnerable populations, often with lower socio-economic status, may be disproportionately affected by climate change impacts, widening economic disparities and social inequalities. Users of the Proposed Development may be affected socially as well as financially, particularly as costs of living may increase. Addressing these socio-economic risks at the Proposed Development is expected to be coordinated by the local authority and the Government, and outside the scope of the Proposed Development design. Therefore, it is not possible to predict how the effects reported in ES Volume 1, Chapter 6: Socio-Economics would change for the future climate scenario.

Traffic and Transport

- 11.21 It is considered that the future climate scenario would not have a direct effect on severance, delay or amenity, fear and intimidation, beyond what is currently experienced under normal climate conditions. However, there will be more intense summer storms, giving an increased risk of surface flooding, which may result in travel disruption. In addition, as the climate in the local area becomes warmer and drier, travel behaviours are likely to change resulting in a switch to more sustainable and active travel modes. The potential effects include:

- Increased surface flooding – causing travel disruption to users of the Proposed Development, increased days working at home and thus higher energy usage;
- Increased surface flooding – causing travel disruption to retail supplies, leading to impacts upon economics;
- Increased and more extreme temperatures – risk to electric vehicle battery and hydrogen vehicle safety; and
- Warmer and drier climate – behaviour change to more active travel modes, such as walking and cycling. This presents an increased risk of UV radiation and exposure to air pollution.

- 11.22 It is considered that the magnitude of impact and resultant nature and scale of the effects of the Proposed Development during the operational phase will not be changed under the future climate conditions. Overall, there is unlikely to be a significant effect upon the Proposed Development.

Air Quality

- 11.23 Air quality is mainly influenced by temperature and wind speed. The forecasted wind speed experienced at the site is unlikely to change significantly from current conditions over the lifetime of the Proposed Development. During this period, there will be a range of wind speeds experienced year-on-year as well as some years with anomalous events. In general, average wind speeds are unlikely to change beyond 4% of typical speeds for the local area. There is therefore unlikely to be any significant potential air quality effects due to wind speed.
- 11.24 The future climate is predicted to be warmer, with potential occurrences of hot, sunny, dry periods (up to 14°C hotter than current summers). There is a risk of potential effects from increased temperatures, these include:
- Surface ozone increasing due to higher temperatures, allowing more NOx to convert NO2 and/or more ozone, which are both harmful to human health and may thus worsen local air quality;
 - Increased temperatures may lead to a greater demand for air conditioning of buildings which would increase electrical demand and thus may result in increased indirect pollutant emissions via the National Grid;
 - During summer periods, warmer temperatures will cause soils to become drier, which may result in increased dust from landscaped areas;
 - Drier and hotter conditions may lead to wildfires in the UK, the pollution from which may result in higher pollutant (particularly PM2.5) concentrations at the Proposed Development. While these may lead to higher concentrations for several days, they are likely to be short-lived and not significantly affect long-term exposure; and
 - The combined effect of increased temperatures and reduced precipitation may encourage a behavioural change in transportation during summer, with potentially more users of the Proposed Development and nearby properties walking and cycling, instead of using private cars. This may in turn lead to improved air quality in the local area, although the inverse is also possible with wetter winters users may use private modes of transport to a greater degree.

- 11.25 It is considered that the magnitude of impact and resultant nature and scale of the effects of the Proposed Development once complete and operational will not be significantly changed under the future climate conditions. Overall, there is unlikely to be a significant effect upon the Proposed Development.

Noise and Vibration

- 11.26 The future climate will be warmer, resulting in the potential for an increased demand on heating and cooling systems, both within the Proposed Development itself and external to the site. Increased temperatures during the warmer months (i.e. summer) also have the potential to result in future residents of the residential component of the Proposed Development having to rely on comfort cooling for longer periods of time. The use of natural ventilation solutions (openable windows) for the control of overheating would expose the occupants to greater internal noise levels. However, traffic noise may decrease due to shifts in transport preferences as the weather gets hotter (i.e. car to bicycle).
- 11.27 Building Regulations Approved Document O (ADO) took effect on 15 June 2022. It aims to protect the health and welfare of occupants of buildings by reducing the occurrence of high indoor temperatures. This reduces

reliance upon opening windows for the control of overheating for new developments. Apartments in the Proposed Development will be required to achieve the overheating requirements set out in the ADO. As part of the requirements of the ADO, apartments that cannot use open windows to mitigate overheating will be mechanically ventilated and cooled. The remaining apartments will be mechanically ventilated and will rely on openable windows to mitigate overheating. Overall, there is unlikely to be a significant effect upon the Proposed Development.

Daylight, Sunlight and Overshadowing

- 11.28** The British Standard “Daylight in buildings” (BS EN 17037) contains advice and guidance on interior daylighting. The guidance contained in the BRE Guidelines⁴ is intended to be used with BS EN 17037 and its UK National Annex. The test is based on target illuminances from daylight to be achieved over specified fractions of the reference plane (a plane at table-top height covering the room) for at least half of the daylight hours in a typical year. This involves using climatic data for the location of the site (via the use of an appropriate, typical or average year, weather file within the software) to calculate the illuminance from daylight at each point on an assessment grid on the reference plane at an at least hourly interval for a typical year. The climate change projections suggest it will be less cloudy at the Proposed Development in the future, and hence the Proposed Development will be exposed to higher illuminance from daylight. However, this would not impact the conclusions within the ES chapter (**ES Volume 1, Chapter 9: Daylight, Sunlight and Overshadowing**) which are based on numeric daylight assessments.

Wind Microclimate

- 11.29** Wind microclimate is highly influenced by wind speeds. The forecasted wind speed experienced at the site is unlikely to change significantly from current conditions over the lifetime of the Proposed Development. During this period, there will be a range of wind speeds experienced year-on-year as well as some years with anomalous events. This may lead to reduced wind comfort at sensitive receptors in the public realm. In general, average wind speeds are unlikely to change beyond 4% of typical speeds for the local area. Overall, there is unlikely to be a significant effect upon the Proposed Development.

Archaeology

- 11.30** The primary impact in relation to climate change on buried heritage assets is rising water levels because of increased rainfall. The climate change projections suggest precipitation is likely to remain similar to that currently experienced. However, there is likely to be more intense storms in summer, giving an increased risk of rainfall and associated rising of water levels. Any such change after the Proposed Development is completed could be beneficial for the preservation for any localised alluvial deposits containing paleoenvironmental remains, or other organic remains such as timber, remaining in situ (due to the sensitivity of paleoenvironmental remains to changes in hydrology which result in desiccation).

Ground Conditions

- 11.31** When assessing the effect of climate change on ground conditions, the key variable is the future effect and change in rainfall levels. The climate change projections suggest precipitation is likely to remain similar to that currently experienced. However, there is likely to be more intense storms in summer, giving an increased risk of rainfall and associated rising of water levels. When considering the potential effects, it is important to note that surface drainage from the site is known to collect into a sump and is discharged along with foul water into the foul water sewer system. In addition, there are no streams or drainage ditches on or adjacent to the site and it has been identified to have very low risk of surface water flooding. Furthermore, the site is located in Flood Zone 1, which carries a low risk of flooding from rivers and the sea (<0.1% probability)⁵. Overall, there is unlikely to be a significant effect upon the Proposed Development.

Heritage, Townscape and Visual

- 11.32** The likely effects of the Proposed Development are defined under the current climate conditions, which may alter under a future climate scenario. The likely projected future conditions for each of temperature,

precipitation, wind speed and cloud cover have been considered. It is considered that the magnitude of impact and resultant nature and scale of the effects of the Proposed Development, once complete and operational, will not be changed under the future climate conditions. Overall, there is unlikely to be a significant effect upon the Proposed Development.

Health and Wellbeing

- 11.33** Health and wellbeing of future users of the Proposed Development has the potential to be affected by changes in climate, particularly due to more extreme storms, increased temperatures, and heatwaves. The potential effects include:
- More extreme storms and heatwaves may result in a higher rate of hospitalisation;
 - Increased temperatures – may lead to more insects leading to increased health risks;
 - Increased temperatures – may affect the wellbeing of users of the Proposed Development; and
 - Changes in climate leading to increased risk of biosecurity, due to climate-related immigration and globalisation.
- 11.34** There may also be other risks, such as antimicrobial resistance, which are likely to be influenced by climate change, but there is unlikely to be a significant effect upon the Proposed Development.

Ecology and Biodiversity

- 11.35** The National Planning Policy Framework (NPPF) requires the establishment of “*coherent ecological networks that are more resilient to current and future pressures*”. Climate change is likely to result in higher mean and maximum temperatures, drier summers, wetter winters, increased unpredictability, and more extreme weather events. The changes are likely to result in gradual colonisation of species in a northerly direction e.g. from the continent. This will be most prevalent in more mobile species groups such as bats, birds and invertebrates, but also relates to other animal groups and plants. Where there is limited connectivity and reduced mobility there is the potential for localised extinctions. Conversely, species at the southern extent of their range are likely to disappear as conditions become too warm, although this is unlikely to affect any species within the Proposed Development, all of which are all relatively common and widespread.
- 11.36** More subtle changes may, however, be expected including possible changes to habitat condition, including through changes in threats or pressures to which the habitats are exposed. This may include increased risk of disease and pest species, as well as changes in stress factors such as scorching and droughting with the potential to reduce productivity and growth, and surface flooding with the potential to damage vegetation.
- 11.37** Predicted climactic changes are anticipated to result in increased heat and drought stress on plants, especially those with specialist habitat requirements which tend have greater sensitivity to change. This is likely to affect plants within the site, posing a risk both to the quantum of vegetation as well as biodiversity. However, the species being planted are relatively common and widespread and could likely be replaced.
- 11.38** The vegetation will be managed by a Landscape Contractor, who will regularly carry out surveys checking the condition of the vegetation, including potential insect or fungal attacks. Where conditions have deteriorated, the Contractor will immediately inform the appointed Management Company. The risks of pests and diseases upon the proposed trees will be surveyed and managed following DEFRA’s Tree Health Management Plan⁶ and Forestry Commission guidelines⁷. Where necessary an Arboricultural Association approved contractor will undertake remedial action.
- 11.39** High temperatures can be exacerbated locally by the Urban Heat Island effect in areas with higher proportions of hard surfaces which absorb radiation. Green infrastructure, i.e. habitats on-site, can therefore contribute to mitigation of the effects of climate change especially heat, and if designed well, sudden high rainfall events by reducing surface water runoff. The landscape strategy for the Proposed Development includes areas of hedge planting, tree planting, amenity planting and turf, and bark mulch surfaces. These areas will reduce both the total and peak surface water discharge, as well as providing benefits to biodiversity and water quality.
- 11.40** Overall, there is unlikely to be a significant effect upon the Proposed Development.

⁴Building Research Establishment (BRE) Report 209: ‘Site Layout Planning for Daylight and Sunlight 2011: A Guide to Good Practice’ (‘the BRE Guidelines’)

⁵Meinhardt (2023). Flood Risk Assessment and Drainage Strategy, Broad Street Reading, Issue P02, Doc. Ref.: 001.

⁶ Defra (2014). Tree Health Management Plan. Available at: <https://www.gov.uk/government/publications/tree-health-management-plan>

⁷ Forestry Commission (2020). Collection, Tree pests and diseases, Identify, report, prevent and minimise the introduction, spread and impacts of tree pests and diseases in the UK. Available at: <https://www.gov.uk/government/collections/tree-pests-and-diseases>

Other

- 11.41 In addition to the potential effects set out above, there are other climate-related risks that may affect the Proposed Development. These include:
- Increased temperatures – more periods of overheating potentially requiring mechanical systems to run for extended periods and/or additional air conditioning installation and use, leading to increased energy consumption;
 - Increased temperatures and worse heatwave events – potential increased risk of fires within the Proposed Development from electric vehicles and hydrogen vehicles within the car parking;
 - Increased temperatures and heatwave events – leading to more food spoiling for residents and retail;
 - Worse heatwave events, causing productivity reductions of workers within the Class E use and residents working at home;
 - More intense storms – increased lightning frequency, leading to higher risk of building being struck, potentially damaging infrastructure;
 - Climate-related regulatory changes – stricter Building Regulations related to climate resilience may require retrofits and redesigns;
 - Increased temperatures – potential risk of water scarcity, may impact cooling systems, fire suppression and general building operations;
 - Climate-related insurance costs and availability – premiums for property insurance may rise; and
 - Climate-related asset depreciation – if the building is not adequately adapted or retrofitted to climate risks then there may be a decrease in property value.

11.42 It is considered that these effects are uncertain and are unlikely to be a significant effect upon the Proposed Development.

Adaptation and Resilience of the Proposed Development to Climate Change

- 11.43 Based on the future climate change scenario projections, the main climatic factors that have influenced the evolution and design of the Proposed Development are temperature, humidity and more intense storms. The design team have worked collaboratively to ensure climate change adaptation measures are incorporated into the design, details of which are set out in reporting for each technical topic and summarised in **ES Volume 1, Chapter 4: The Proposed Development**.
- 11.44 This section focuses on the potential significant effects of climate change upon the Proposed Development identified in the section above. Table 11.4 sets out the potential significant effects, what adaptation measures have been implemented into the design or will be implemented operationally, and a determination as to whether there is a remaining significant risk for the Proposed Development.
- 11.45 Table 11.4 demonstrates that with the proposed adaptation measures in place, the residual effects will all be Not Significant and the Proposed Development will be resilient to the potential effects of climate change.
- 11.46 While the Proposed Development is considered resilient, there remains uncertainty when considering situations in the future and it is expected that the appointed Management Company will seek support and adapt to any climate-related risks not considered in this assessment.

Table 11.4 Adaptation and Resilience of the Proposed Development to Climate Change

Description	Adaptation	Residual Significance
Surface ozone increasing due to higher temperatures, allowing more NOx to convert NO ₂ and/or more ozone, which are both harmful to human health and may thus worsen local air quality	The design includes Mechanical Ventilation and Heat Recovery (MVHR), taking air from a 'clean' location away from local pollution sources (i.e. roads and car parks), helping to minimise the intake of pollution into the building. The Government and local authority both have a statutory duty to maintain pollution levels below regulated thresholds; it is therefore considered unlikely that the Proposed Development would be exposed to concentrations above regulated thresholds	Not Significant
Increased temperatures – may lead to more insects leading to increased health risks	The ingress of insects will be minimised through the use of MVHR. However, should insects become a serious health risk or nuisance, the users of the Proposed Development should inform the appointed Management Company, who will take remedial action to deter and/or neutralise the insects.	Not Significant
Increased temperatures – more periods of overheating potentially requiring mechanical systems to run for extended periods and/or additional air conditioning installation and use, leading to increased energy consumption	An overheating analysis has been undertaken, taking account of climate change, which has fed into the design of the MVHR system. This system has therefore been designed to take account of more extreme temperatures, within the assessed energy consumption. Should further cooling be required for occasional heatwaves, this would be considered to not exceed what could occur during the current climate scenario. It is acknowledged that future temperatures could be significantly higher than present and despite measures built into the design, there remains a risk of increased energy consumption by future users; to help mitigate this risk, the appointed Management Company will seek to adopt energy supplies from sustainable sources	Not Significant
Increased temperatures and heatwave events – leading to more food spoiling for residents and retail	The building will utilise an MVHR system which has been designed to take account of more extreme temperatures. With the MVHR in place, internal temperatures will be maintained within normal conditions, causing food spoiling to be minimised. It is acknowledged that future temperatures could be significantly higher than present and despite measures built into the design, there remains a risk of temporary higher internal temperatures causing food to spoil beyond what would normally occur. During such events, good operational management practices should be adopted by future users and promoted by the appointed Management Company. In addition, through the use of an operational management plan, the appointed Management Company will ensure sufficient waste recycling facilities are provided during such events to minimise odours and bioaerosols.	Not Significant
Climate-related regulatory changes – stricter Building Regulations related to climate resilience may require retrofits and redesigns	Should any regulatory changes occur due to climate change, such that the Proposed Development is required to make changes, the appointed Management Company will put in place all measures, retrofits or redesigns as legally required.	Not Significant

Part A – Likely Significant Effects

- 11.47 In conclusion, under the future 2080 climate scenario, the residual effects of the Proposed Development are not considered likely to alter from the effects identified as described throughout this ES and summarised in **ES Volume 1, Chapter 13: Likely Significant Effects and Conclusions** under the current climate conditions. It is considered by the design team that the adaptation and resilience measures set out above will address the future climate change scenario for the lifetime of the Proposed Development (2080) and no additional or different likely significant climate change adaptation/resilience related effects have been identified.

PART B GREENHOUSE GAS EMISSIONS ASSESSMENT

ASSESSMENT METHODOLOGY

- 11.48 This section of this ES chapter provides a Greenhouse Gas (GHG) assessment for the Proposed Development (as described in **ES Volume 1, Chapter 4: The Proposed Development**).
- 11.49 GHGs are gases which have the potential to alter atmospheric temperatures and contribute to climate change. The Proposed Development will lead to the direct and indirect release of GHGs, both during the demolition and construction works, and throughout its lifetime. This assessment estimates the GHG emissions associated with the Proposed Development taking a lifecycle approach and presents the numerous mitigation measures and specific design measures provided by the scheme to minimise its GHG footprint.

- 11.50** The EIA Directive 2014⁸ sets out the rationale for incorporating climate change into the EIA process. It states: *“Climate change will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change.”*
- 11.51** The requirements of the EIA Directive 2014 have been adopted within UK EIA Regulations 2017⁹ and require that the assessment provides: *“A description of the likely significant effects of the development on the environment resulting from, inter alia... (f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change”.*
- 11.52** This assessment (Part B) covers the impacts of the project on climate through the quantification of GHGs resulting from the Proposed Development. The assessment provides an estimate of GHG emissions in the opening year and over the lifetime of the Proposed Development.
- 11.53** The impact of future climate change on the resilience of the Proposed Development has been addressed within Part A of this ES chapter.
- 11.54** Relevant policy and guidance to this assessment is set out in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 4.**

Defining the Baseline

- 11.55** Considerations of the baseline have been made based on the following, involving the collection and preparation of several emission inventories:
- UK wide GHG emissions between 1990 and 2020 have been obtained from the National Atmospheric Emission Inventory (NAEI)¹⁰. Emissions for 2021 to 2050 have been based on the Balanced Net Zero Pathway trajectory estimated by the Climate Change Committee (CCC)¹¹;
 - Regional GHG emissions between 2005 and 2020 have been obtained from the Department for Business, Energy and Industrial Strategy (BEIS)¹². Emissions for 1990 to 2004 have been calculated based on the ratio of regional emissions for 2005 to country GHG emissions (which have been obtained from the NAEI¹⁰). Emissions between 2021 and 2050 have been based on the ratio of regional emissions for 2020 to country GHG emissions and factored forwards based on CCC’s Balanced Net Zero Pathway trajectory¹¹;
 - Local authority GHG emissions between 2005 and 2020 have been obtained from the BEIS¹². Emissions for 1990 to 2004 have been calculated based on the ratio of local authority emissions for 2005 to country GHG emissions. Emissions between 2021 and 2050 have been based on the ratio of local authority emissions for 2020 to country GHG emissions and factored forwards based on CCC’s Balanced Net Zero Pathway trajectory¹¹;
 - UK wide NOx (nitrogen oxides) and PM (particulate matter) emissions between 1990 and 2020 have been obtained from the Department for Environment, Food and Rural Affairs (Defra)¹³. NOx and PM concentrations between 2019 and 2030 have been obtained from the Department for Environment, Food and Rural Affairs (Defra)¹⁴ and used to estimate emissions between 2021 and 2030, based on the ratio of emissions to concentrations in 2020. Emissions between 2031 and 2050 are not available and have therefore been projected by TCC using Defra data between 2019 and 2030, details of which are given in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 3**; and
 - Regional and local authority NOx and PM concentrations between 2019 and 2030 have been obtained from Defra¹⁴ and used to estimate emissions between 2019 and 2030, based on the ratio of UK wide emissions¹³ to UK wide Defra concentrations in 2020. Emissions between 1990 and 2018 have been estimated based on Defra UK wide emissions, using the ratio of regional and local authority emissions

to UK wide emissions in 2020. Emissions between 2031 and 2050 have been projected by APS using the Defra data between 2019 and 2030, details of which are given in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 3.**

Evolution of the Baseline

- 11.56** The EIA Regulations¹⁵ as amended require that the likely evolution of the baseline is considered in the event that the Proposed Development were not to come forward, i.e. the likely conditions if the cumulative schemes (see paragraph 11.162) and any relevant policy designations were to come forward in the absence of the Proposed Development.
- 11.57** The above sources listed in the ‘Baseline Conditions’ section of this ES chapter have been considered when determining the likely evolved baseline conditions. This will consider a scenario in the absence of the Proposed Development being implemented where the site remains in its current uses.

Geographical Study Areas

- 11.58** Within this assessment the geographical study areas considered are set out in Table 11.5.

Table 11.5 Geographical Definitions

Geographical Level	Definition
Local	Reading
Regional	South East England / Berkshire
UK	UK

Impact Assessment Methodology

Demolition and Construction

Embodied Carbon

- 11.59** Information on the quantities of construction materials required to construct the Proposed Development, have been provided in **ES Volume 1, Chapter 5: Demolition and Construction**. Conservative assumptions have also been applied where quantities were indicated but the precise quantities were not provided.
- 11.60** The embodied carbon in the materials used to construct the Proposed Development (as presented in **ES Volume 1, Chapter 5: Demolition and Construction**) have been calculated using carbon factors for individual materials (including production and transport), based on published information from The Inventory of Carbon and Energy (‘ICE’)¹⁶ produced by the University of Bath and other databases. Where details of the individual materials are not known at the application stage, then embodied carbon has been approximated based conservative estimates derived from a range of published information.

Direct and Indirect Emissions

- 11.61** GHG emissions from construction traffic have been predicted using Defra’s Emissions Factors Toolkit (EFT v12.0)¹⁷ and the BEIS’s GHG conversion factors¹⁸, taking account of traffic volumes, distances travelled and vehicle types (based on the information provided in **ES Volume 1, Chapter 5: Demolition and Construction**).

⁸ Directive 2014/52/EU of the European Parliament and of the Council on the assessment of effects of certain public and private projects on the environment.

⁹ Town and Country Planning (Environmental Impact Assessment) Regulations (2017)

¹⁰ NAEI. (2022). Devolved Administration GHG Inventory 1990-2020. Retrieved from National Atmospheric Emissions Inventory: <https://naei.beis.gov.uk/data/ef-all>

¹¹ CCC. (2022). Committee on Climate Change, The-Sixth-Carbon-Budget-Charts-and-data-in-the-report.xlxb

¹² BEIS. (2022). UK-local-authority-ghg-emissions-2020.xlsx

¹³ Defra Emissions of air pollutants in the UK, 1990 to 2020, by pollutant and by major emissions source.ods

¹⁴ Defra. (2023). Background Mapping data for local authorities. Retrieved from UK AIR Air Information Resource: <https://uk-air.defra.gov.uk/data/laqm-background-home>

¹⁵ His Majesty’s Stationary Office (HMSO) 2017. The Town and Country Planning (Environmental Impact Assessment) (England) Regulations 2017 (as amended in 2018 and 2020).

¹⁶ Circular Ecology (2020), ‘Inventory of Carbon & Energy (ICE), Version 3.0’

¹⁷ Defra (2023). Emission Factor Toolkit. Retrieved from Defra: <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

¹⁸ BEIS. (2022). Greenhouse gas reporting: Conversion factors 2022. Retrieved from GOV.UK:

<https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022>

- 11.62** Consideration has also been given to GHG emissions from non-road mobile machinery ('NRMM'), including the energy and fuel use associated with construction plant and facilities used within the demolition and construction activities. Emissions have been based on the likely engines and their operational usages.

Completed Development

Embodied Carbon

- 11.63** Over the lifetime of the Proposed Development there will be embodied carbon associated with the repair, maintenance, and refurbishment of the building. These emissions are effectively 'unregulated' as there is no policy or standard for establishing compliance nor is there published data on good practice against which developments can be benchmarked. Nonetheless, emissions from repair, maintenance and refurbishment have been considered following the approach set out in paragraph 11.59, taking account of material lifespans (as defined by the Royal Institution of Chartered Surveyors (RICS)¹⁹).

Direct and Indirect Emissions

- 11.64** Direct GHG emissions generated by changes in road traffic associated with the Proposed Development, emissions from any on-site combustion plant, emissions from land use change and indirect GHG emissions from electricity use, water use, and consumables may impact climate change.
- 11.65** To assess the effects of changes in road traffic, GHG emissions from road traffic have been predicted using Defra's EFT v12.0¹⁷ and BEIS's GHG conversion factors¹⁸, taking account of traffic volumes, distances travelled and vehicle types, using information provided by Stantec (the project transport consultants).
- 11.66** Considerations of direct GHG emissions from operational fuel consumption have been based upon information provided by Hoare Lea, the energy consultants for the project. Potential GHG emissions from refrigerants leakage from the Air Source Heat Pumps (ASHPs) has also been given consideration.
- 11.67** Indirect GHG emissions from operational electricity and water consumption have been calculated using BEIS GHG conversion factors¹⁸ and assumed operational usage for the scale and nature of the Proposed Development.
- 11.68** GHG emissions associated with land use change have been calculated based on the approximate net area change in grassland, bushes and trees at the site and emission rates from published research^{20,21}.
- 11.69** Additional consideration has been given to GHG emissions associated with potential consumables throughout the lifetime of the Proposed Development, such as food, material commodities and waste. These emissions, although uncertain, will vary depending on the use of the site, and where possible consideration has been given to that of the existing use of the site to identify the net change. To provide a conservative assessment it has been assumed that the existing uses are vacant. The assessment follows the approach set out in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 6**.

Decommissioning

Embodied Carbon

- 11.70** The embodied carbon associated with the end of life / decommissioning of the buildings are highly uncertain, but the emissions have been estimated following the approach set out in paragraph 11.59.

Direct and Indirect Emissions

- 11.71** GHG emissions from NRMM used during the decommissioning activities (i.e. enabling and demolition works) have been considered. Emissions have been calculated following the approach set out in paragraph 11.61, taking account of the likely number of engines for the Proposed Development.

Assumptions and Limitations

- 11.72** The assessment involves a range of assumptions, uncertainties, and limitations. A brief overview of the key assumptions and limitations are discussed below:

- The embodied carbon values for each construction material involve a considerable amount of uncertainty. The values are based on a range of studies and incorporate a range of material densities. The values will depend on where the materials are sourced and thus rely on the UK market and global trade agreements, which remain highly uncertain due to the UK's exit from the European Union. The assessment does, however, utilise the most detailed database available to help minimise the uncertainties and provide the most realistic values possible;
- Emission factors associated with transport also involve a considerable amount of uncertainty. Future year vehicle emission rates are based on a range of factors, such as expected vehicle fleet release dates, anticipated improvements in emission reduction technologies, expected uptake rates of different vehicles based on government policies, etc. It is therefore possible that the expected future emission rates in the EFT may differ from reality. Historically, evidence had suggested that Defra's EFT exaggerated reductions in NOx emissions as expectations of reductions from diesel vehicles were included which were not seen in practice. However, analyses of recent NOx measurements now provide evidence that vehicle controls are working and as a result Defra's EFT (v9.0 onwards) is reflecting the rate of observed reductions and can be relied upon to give the most likely emissions. In the short-term, consumers may switch from diesel vehicles to petrol vehicles, which will lead to an increase in GHG emissions. In the longer-term, electric and hydrogen vehicles are likely to be adopted, whereby electric vehicles will lead to an increase in energy demand from the national grid and thus lead to a displacement of GHG emissions, and hydrogen vehicles will still release NOx emissions. Although the future vehicle emissions are uncertain, the best available information currently available has been used in the assessment; and
- The emissions associated with Use Class E water consumption involved a considerable amount of uncertainty. No information on water consumption was available for this use within the Proposed Development. In the absence of information, typical water consumption rates for retail use have been assumed.

- 11.73** Although there is uncertainty associated with assessment and sources of data utilised, the predictions made by this assessment have been carried out in a robust manner to minimise uncertainties where possible.

Methodology for Defining Effects

Global Warming Potential

- 11.74** It is important that the assessment is provided in the same context as the relevant treaties, legislation, policies and guidance. These consider direct and indirect GHG emissions in terms of CO₂-eq, where carbon dioxide or any other GHG emission is presented as an equivalent to carbon dioxide by their Global Warming Potential (GWP).
- 11.75** The relevant GWPs are presented in **ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 4**. It is important to note that while direct GHGs (such as CO₂) are regulated, radiative forcing (RF) can also occur due to aerosols, such as black carbon (BC) and organic carbon (OC), and short-lived gases (such as carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and nitrogen oxides (NOx)) which are indirect GHGs. In particular, the key aerosols released from road traffic and combustion plant emissions are BC and changes in clouds due to aerosols (particularly BC) have significant negative RF, reducing global warming²². Although CO₂ is of most importance due to its abundant quantity, it is also important to not just consider CO₂. GHG emissions are therefore considered in terms of CO₂-eq.

¹⁹ RICS. (2017). *Whole life carbon assessment for the built environment*.

²⁰ Chang et al. (2015). *The Greenhouse gas balance of European grasslands*, *Global Change Biology*, Volume 21, Issue 10, 2015. Retrieved from: <https://doi.org/10.1111/gcb.12998>

²¹ IPCC (2000). *Land Use, Land-Use Change and Forestry Special Report*, Cambridge University Press, UK. pp 375.

²² IPCC. (2013). *Climate Change 2013, The Physical Science Basis, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Receptors and Receptor Sensitivity

11.76 Anthropogenic GHG emissions have dramatically increased since pre-industrial levels. This increase is responsible for a change in global mean radiative forcing and it is expected that further emissions will significantly alter our climate in the future²³. It is therefore extremely important to minimise emissions and in the absence of a published definition of sensitivity to GHG emissions, the sensitivity of the receptor (global climate) has been considered to always be ‘high’ in this assessment.

Magnitude of Impact

- 11.77 The magnitude of impact or change from the baseline conditions has been considered on a scale of high, medium, low, or negligible. The assessment of magnitude is carried out taking account of any mitigation measures embedded within the Proposed Development (see paragraph 11.107). In the absence of clearly defined criteria for assessing magnitude in the context of GHG emissions, a hybrid approach utilising qualitative methods, quantitative methods and professional judgement has been used, which rely on standard GHG accounting and reporting principles.
- 11.78 In GHG accounting, it is a widely accepted practice to exclude emission sources that do not have a material contribution to the overall carbon footprint on the basis of the De Minimis rule²⁴. ISO guidance on GHG reporting (ISO 14064-1)²⁵ states that ‘the organisation may exclude from quantification direct or indirect GHG sources or sinks whose contribution to GHG emissions or removals is not material or whose quantification would not be technically feasible or cost effective’. In this context, multiple sources have introduced a ‘materiality threshold’. PAS 2050²⁶, for example, stipulates that in order to be considered ‘material’, the contribution from any one source of GHG emissions should be more than 1% of the anticipated total GHG emissions associated with the product being assessed.
- 11.79 Within the Department for Energy and Climate Change (DECC) guidance²⁷ on emissions from stationary installations, emission sources with a <1% contribution can be excluded from UK emission inventories and the inventory still be considered complete for reporting purposes and comparison with the UK carbon budgets. This would thus suggest that a <1% contribution from the Proposed Development could be considered negligible in its contribution to the UK carbon budgets.
- 11.80 The EU Emissions Trading System (EU ETS)²⁸ provision for small installations states that small installations whose emissions do not exceed a threshold of 25,000 tCO₂-eq in each of the three years 2008 to 2010 and, where they carry out combustion activities, have a rated thermal input below 35 MW, excluding emissions from biomass, can opt out from the scheme. The UK Emissions Trading Scheme (UK ETS) replaced the EU ETS in the UK in 2021. This states that emitters can opt out from the scheme if their emissions do not exceed a threshold of 25,000 tCO₂-eq and have a rated thermal input below 35 MW in any relevant reporting year²⁹.
- 11.81 Additionally, as part of its public reporting under the Task Force on Climate-related Financial Disclosures framework (IFC Performance Standard 3: Resource Efficiency and Pollution Prevention³⁰), the International Finance Corporation (IFC) discloses emissions of projects with estimated annual emissions over 25,000 tCO₂-eq through the Environmental and Social Review Summary for each project.
- 11.82 In line with the above, a 1% materiality threshold has been implemented in this assessment when determining magnitude of the relevant change in GHG emissions. To ensure a robust approach, a second reference point has been included, i.e. 25,000 tCO₂-eq annual emission maximum level. It is, therefore, assumed that any annual carbon emissions quantum <1% of the (proportional value) of the relevant carbon budget(s) and <25,000 tCO₂-eq would not be considered to have a ‘material’ contribution to baseline conditions. These thresholds are based upon UK scales; since baseline conditions are significantly lower at local and regional scales, the criteria for determining the magnitude of impact have been adjusted to ensure an appropriate level of rigour. The criteria for determining the magnitude of impact at each scale are provided in Table 11.6.

Table 11.6 Criteria for Determining the Magnitude of Impact

Annual GHG Emissions	Annual GHG Emission Contribution to Baseline Conditions		
	Lower than 1%	Equal to 1%	Higher than 1%
Local			
Lower than 25,000 tCO2-eq in any year	Negligible	Negligible	Low
Equal to 25,000 tCO2-eq in any year	Negligible	Low	Medium
Higher than 25,000 tCO2-eq in any year	Low	Medium	High
Regional			
Lower than 25,000 tCO2-eq in any year	Negligible	Negligible	Low
Equal to 25,000 tCO2-eq in any year	Low	Medium	High
Higher than 25,000 tCO2-eq in any year	Medium	High	High
UK			
Lower than 25,000 tCO2-eq in any year	Negligible	Low	Medium
Equal to 25,000 tCO2-eq in any year	Low	High	High
Higher than 25,000 tCO2-eq in any year	Medium	High	High

11.83 While the emission thresholds outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by the IEMA guidance⁴⁰ outlined in the ‘Impact Assessment Methodology’ section, which may result in a different overall conclusion than the one suggested by quantitative criteria alone based on a percentage increase / decrease relative to the baseline.

Defining the Effect

11.84 An approach to define negligible magnitudes of impacts has been set out by IEMA, which states “Activities that do not significantly change the result of the assessment can be excluded where expected emissions are less than 1% of total emissions, and where all such exclusions total a maximum of 5% of total emissions; all exclusions should be clearly stated”. This approach was utilised when defining the scope of the assessment.

Nature of Effect

11.85 The nature of effect is considered to be ‘beneficial’ where there is a significant reduction in emissions, ‘adverse’ where there is a significant increase in emissions, and ‘negligible’ when there is an insignificant change in emissions.

Scale of Effect

- 11.86 The level of effect attributed has been assessed based on the anticipated magnitude of impact due to the Proposed Development and the sensitivity of the affected receptor. The level of effect has been based on professional judgement and Table 11.7 has been a tool which has assisted with this process.
- 11.87 The consideration of the level of effect has also been informed by an evaluation of the anticipated environment within which the Proposed Development is expected to exist, driven by the ongoing decarbonisation of the national electricity grid and the UK’s recent legally binding ‘net-zero’ carbon target for 2050, as well as the influence and validity of any assumptions adopted when undertaking the prediction of impacts.

²³ Cogan, A (2012) Atmospheric carbon dioxide retrieved from the Greenhouse gases Observing SATellite (GOSAT): Comparison with ground-based TCCON observations and GEOS-Chem model calculations, Journal of Geophysical Research, Atmospheres, Volume 117, Issue D21.

²⁴ De minimis is a legal principle which allows for matters that are too small to be meaningful or of insufficient importance to be exempted from a rule or requirement. It can be used by the courts as an exclusionary tool to dismiss trivial matters from litigation.

²⁵ International Organization for Standardization, (2018) IS/ISO 14064-1: 2018. Greenhouse Gases - Part 1: Specification with Guidance at the Organization Level for Quantification and Reporting of Green House Gas Emissions and Removals.

²⁶ British Standards Institution, (2011) PAS 2050:2011 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services.

²⁷ DECC (2013) The Department of Energy and Climate Change (DECC) (2013) Guidance on Annual Verification for emissions from Stationary Installations.

²⁸ Ricardo Energy & Environment, (2019) Preparation for the implementation of the EU ETS provisions for small installations - Best Practice Guidance. Report for European Commissions - DG Climate Action.

²⁹ BIES (2023). Guidance Opt out of the UK ETS if your installation is a 'hospital or small emitter'. Retrieved from: <https://www.gov.uk/guidance/opt-out-of-the-uk-ets-if-your-installation-is-a-hospital-or-small-emitter>

³⁰ International Finance Corporation (2012) Performance Standards on Environmental and Social Sustainability. Available at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_pps.

Table 11.7 Scale of Effects

Magnitude of Impact	Receptor Sensitivity	Effect Scale	Definition
Negligible	High	Negligible	The Proposed Development is unlikely to cause a meaningful change to baseline emissions with respect to the carbon budgets and unlikely to alter the authority's ability in reducing their contribution for the achievement of net zero. This effect is not significant.
Low		Minor	The Proposed Development is likely to cause a small change to baseline emissions with respect to the carbon budgets but is unlikely to alter the authority's ability in reducing their contribution for the achievement of net zero, when taking account of potential recoverability within the net zero programme period. This effect is considered less likely to be significant but will be subject to professional judgement.
Medium		Moderate	The Proposed Development is likely to cause a small change to baseline emissions with respect to the carbon budgets and is likely to restrict the authority's ability in reducing their contribution for the achievement of net zero, when taking account of potential recoverability within the net zero programme period. This effect is considered more likely to be significant but will be subject to professional judgement.
High		Major	The Proposed Development is likely to cause a considerable change to baseline emissions with respect to the carbon budgets and is very likely to restrict the authority's ability in reducing their contribution for the achievement of net zero, when taking account of potential recoverability within the net zero programme period. This effect is considered significant.

11.88 In addition, the significance of effects have been considered with respect to the IEMA guidance, which is set out in Table 11.8.

Table 11.8 IEMA Significance of Effects

Effect Scale	Definition
Beneficial	The Proposed Development's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.
Negligible	The Proposed Development's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Minor Adverse	The Proposed Development's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Moderate Adverse	The Proposed Development's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Major Adverse	The Proposed Development's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.

11.89 In categorising whether an effect is significant or not, due consideration has also been given to the nature, duration, and geographical scale of the effect in question (e.g. direct / indirect, temporary / permanent, short / medium-term, etc). Consideration has also been given to whether the effect is 'Beneficial', 'Negligible' or 'Adverse'. The IEMA guidance states that Moderate and Major adverse effects should be considered significant, whilst other effects should be considered not significant. Overall, the significance is based on professional judgement.

Geographic Extent

11.90 For the purposes of this assessment, the geographical scope of the identified likely significant effects has been assumed to be 'international' in all cases due to the global nature of climate change and its transnational ramifications.

Duration of Effect

11.91 Furthermore, in view of the findings of the IPCC Special Report³¹ on the effects of global warming of 1.5°C that some effects from climate change may be long-lasting, the duration of all effects assessed in this ES chapter is assumed to be long-term and permanent.

Direct and Indirect Effects

11.92 Within this assessment, changes in emissions are considered to have a direct effect where the emissions are directly being released from the Proposed Development within the local scale, and considered to have an indirect effect where emissions are produced outside of the local scale and are thus released indirectly from a source that does not form part of the Proposed Development.

Categorising Likely Significant Effects

11.93 In the absence of formal criteria to determine the significance, a range of methodologies and guidance have been utilised, including professional judgement.

11.94 The IEMA guidance⁴⁰ states:
"All GHG emissions from projects will contribute to climate change and may be considered significant".

11.95 The IEMA guidance focuses on the three underlying principles to inform the assessment of significance, as follows:

- "The GHG emissions from all projects will contribute to climate change; the largest interrelated cumulative environmental effect";
- "The consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive"; and
- "GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant".

11.96 In addition, it also considers the following:

- "When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible.
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages.
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered".

11.97 The guidance goes on to state:

- "The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050"; and
- "The specific context for an individual project and the contribution it makes must be established through the professional judgement of an appropriately qualified practitioner, drawing on the available guidance, policy and scientific evidence".

11.98 However, adopting alternative methodologies (see paragraphs 11.83), the effects that are identified as being Major are likely to be classified as significant effects, with Minor and Moderate effects being subject to the impact of magnitude and professional judgement. However, as stated earlier in this ES chapter, a blended

31 IPCC, (2018) Global warming of 1.5 °C. Summary for Policymakers. Available at: <https://www.ipcc.ch/sr15/chapter/spm/>.

quantitative-qualitative approach relying on these alternative methodologies has been applied so the effect categorisation will also be subject to professional judgment, which is common practice.

BASELINE CONDITIONS

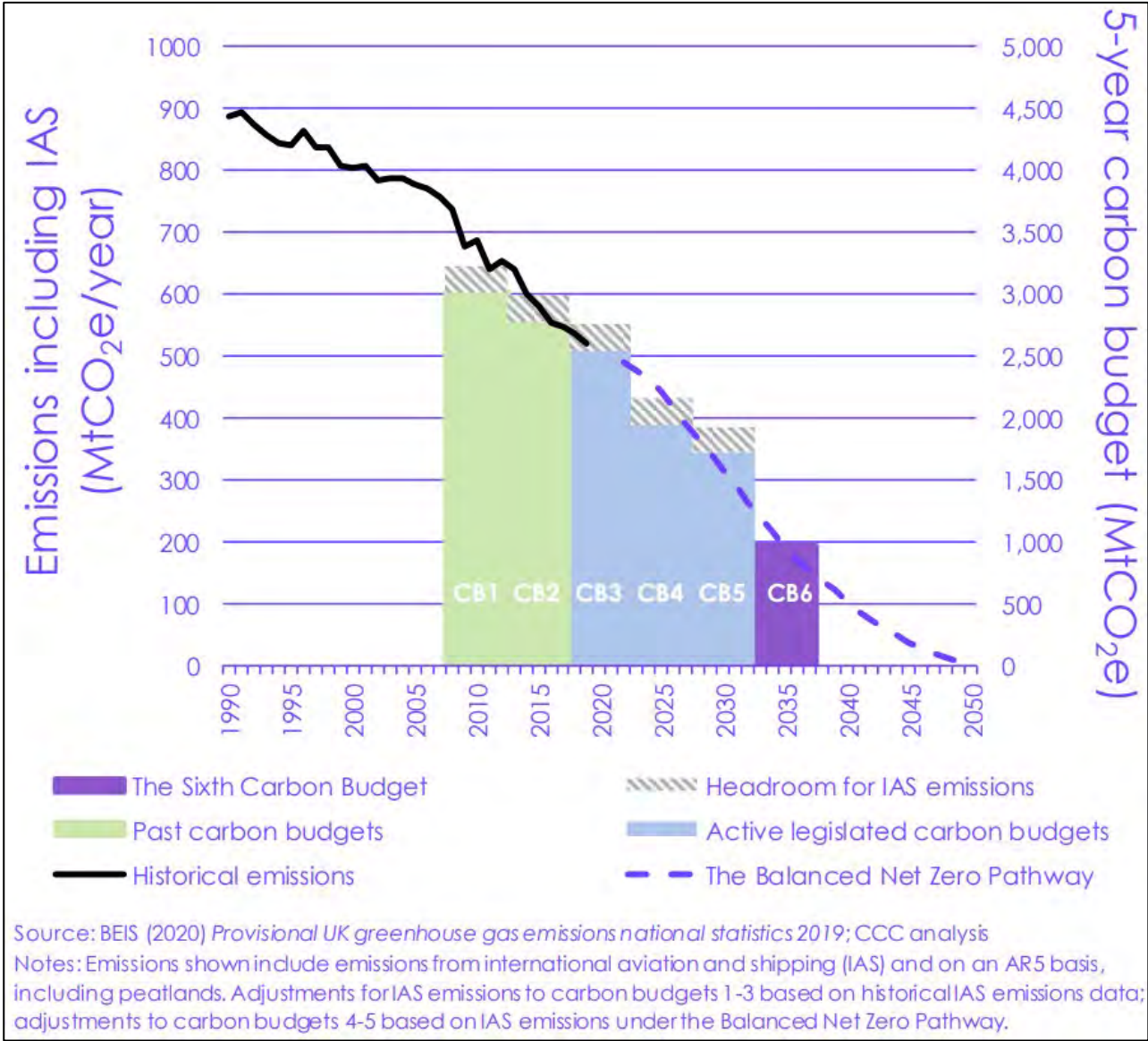
- 11.99 Existing and future conditions have been estimated using the methodology set out in paragraph 11.52 at local, regional and UK wide scales. The baseline conditions have been calculated for each year between 1990 and 2050 and summed over each of the UK 5-year carbon budget periods. Table 11.9 presents the current and future baseline conditions in relation to the UK carbon budgets. This demonstrates how baseline emissions are expected to reduce between 2018 and 2032, with emissions generally following the reduction requirements to meet the UK 2050 target.
- 11.100 Carbon budgets at local and regional scales have been estimated based on their UK emission contributions. The local and regional baseline conditions have been compared to these estimated carbon budgets and are presented in Table 11.9.

Table 11.9 Baseline Conditions in Relation to Carbon Budgets (MtCO₂-eq)

UK Carbon Budget	Fourth		Fifth		Sixth	
5-Year Period	2023 - 2027		2028 – 2032		2033 – 2037	
Scale	Budget	Baseline	Budget	Baseline	Budget	Baseline
Local	2.6	2.5	2.3	1.8	1.3	1.1
Regional	192	186.7	170	134.9	95	82.3
UK	1,950	1,896.2	1,725	1,369.7	965	835.6

- 11.101 To illustrate this further, the UK wide baseline conditions and carbon budgets are shown in Figure 11.1. This shows the projected reduction in annual emissions to follow the carbon budgets, reaching the statutory target in 2050. Note that international aviation and shipping (IAS) was outside the scope for the first to fifth carbon budgets but is included within the scope for the sixth carbon budget.

Figure 11.1 Expected Baseline Conditions and UK Carbon Budget



- 11.102 In addition, the Tyndall Centre for Climate Change Research has quantified the implications for the United Nations Paris Agreement for Reading, setting climate commitments for the local authority³². These only take account of energy-related CO₂ emissions and set a recommended pathway for the local authority. The energy-related CO₂ Tyndall Carbon Budgets for the 4th, 5th, and 6th budget periods are 1.2, 0.6, and 0.3 MtCO₂-eq, respectively.

RECEPTORS AND RECEPTOR SENSITIVITY

Existing

- 11.103 The assessment of GHGs does not typically include identification of sensitive receptors, as GHG emissions do not exclusively affect specific locations or receptors but leads to impacts on the global climate through indirect effects by contributing to climate change.
- 11.104 The assessment considers the effects on the global climate in the context of local, regional and UK wide scales. For the purposes of this assessment, the global climate is considered as a high sensitivity receptor.

³² Tyndall Centre for Climate Change Research (2023). Setting Climate Commitments for Reading, Quantifying the implication of the United Nations Paris Agreement for Reading.

EMBEDDED MITIGATION

- 11.105** The Proposed Development has sought to incorporate measures into the design to avoid and minimise GHG emissions where possible.
- 11.106** The IEMA guidance⁴⁰ is clear that it is important the Proposed Development incorporates good design and best practice measures to ensure any impacts are minimised as far as practicable. The IEMA guidance sets out an approach for mitigating GHG emissions, through the GHG Management Hierarchy. The approach includes five steps to identify potential opportunities for direct GHG mitigation action. These are:
- *“Do not build: evaluate the basic need for the project and explore alternative approaches to achieve the desired outcome/s.*
 - *Build less: realise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required.*
 - *Design clever: apply low carbon solutions (including technologies, materials and products) to minimise resource consumption during the construction, operation, user’s use of the project, and at end-of-life.*
 - *Construct efficiently: use techniques (e.g. during construction and operation) that reduce resource consumption over the life cycle of the project.*
 - *Offset and sequester: as a complimentary strategy to the above, adopt off-site or on-site means to offset and/or sequester GHG emissions to compensate for GHG emissions arising from the project”.*
- 11.107** When incorporating measures into the design of the Proposed Development the approach has been taken to ‘be lean, be clean, be green’. Measures taken for each stage of the GHG Management Hierarchy are set out below.

Do Not Build

- 11.108** The Proposed Development has been designed to maximise the use of the small site by building vertically, rather than a low-level building over a wider area, helping to minimise the land used.
- 11.109** The Proposed Development will be built on an urbanised site with little existing vegetation and will therefore have no adverse impact on land use change.
- 11.110** Consideration was given to refurbishment of the existing building, but it could not be appropriately refurbished to meet the requirements of the design.

Build Less

- 11.111** The Proposed Development is intrinsically sustainable due to its urbanised location with easy access to local amenities and public transport, which encourages healthy behaviours such as walking and cycling.
- 11.112** Reclaimed and recycled materials will be used throughout the design where feasible and appropriate, including reuse of demolished material from the existing building at the site during the construction phase.

Design Clever

- 11.113** Heating and hot water is provided efficiently through air source heat pumps (ASHPs).
- 11.114** All spaces will include highly efficient Light Emitting Diode (LED) lighting.
- 11.115** The design includes the provision of cycle infrastructure, helping to minimise GHG emissions, including the following.
- The Proposed Development will ensure that the site is connected to the surrounding existing cycling / walking infrastructure such as designated cycle routes and footways (for example Dusseldorf Way and Queens Walk), which provide connections to nearby amenities and public transport interchanges.
 - The Proposed Development is close to the local roads of central Reading, enabling easy access to public transport that covers a wider area.

- Overall, the Proposed Development will include cycle parking; a total of 347 for future residents, 17 for the retail units and 30 (15 new) for the public realm.
- Additionally, cycle parking will be implemented with signage clearing defining the long and short stay spaces. This will ensure efficient movement of bicycles in and out of the site.

11.116 Regarding car parking, the design includes a number of measures to help minimise GHG emissions, including:

- As a result of the Proposed Development, there will be a net reduction of 290 parking spaces in the existing MSCP (which currently provides 784 parking spaces), helping to minimise GHG emissions. The total car parking spaces within the MSCP will comprise 494 spaces. Of these 494 spaces, 100 will have the potential to be allocated to future residents of the Proposed Development.

Construct Efficiently

- 11.117** Where feasible, the following measures to reduce GHG emissions from material use and waste will be taken:
- The sustainable reuse of soil and aggregate materials from demolition and excavation;
 - The reuse, where possible of materials and waste generated from construction works;
 - The use of materials with lower embodied carbon where reasonably practicable, such as those with a higher recycled content;
 - Procuring locally sourced materials where reasonably practicable; and
 - Careful consideration of material quantity requirements to avoid over-ordering and generation of waste materials, while also reducing transportation-related emissions.
- 11.118** Best practice measures will be employed to help minimise GHG emissions, including:
- Machinery and vehicles will be switched off when not being actively used to minimise GHG emissions;
 - Water consumption will be minimised where possible;
 - Recycling materials where possible; and
 - Implementing a Travel Plan to minimise GHG emissions from construction traffic.

Offset and Sequester

- 11.119** The Proposed Development will introduce new vegetated landscaping which will help sequester GHG emissions.

POTENTIAL EFFECTS

Demolition and Construction

- 11.120** GHG emissions resulting from the demolition and construction of the Proposed Development have been considered, taking account of emissions embodied within the building materials, emissions released from construction vehicles, and emissions released from NRMM. Details of these are set out in the following subsections of this ES chapter.

Embodied Material Emissions

- 11.121** Embodied carbon values have been estimated for the Proposed Development using the methodology set out in paragraph 11.59. Where available, details of the material compositions of the existing buildings to be demolished and for construction of the Proposed Development are set out in the **ES Volume 1, Chapter 5: Demolition and Construction**. Hardcore materials recovered during demolition will be screened for re-use in the subsequent groundworks for the Proposed Development as sub-grade material in the temporary haul roads and compounds and in the proposed access roads and car parking. The quantities of re-used materials are unknown. Taking a conservative approach, emissions have been calculated only for those materials proposed. These are summarised in Table 11.10, along with the relevant embodied carbon emissions.

Table 11.10 Embodied Carbon Calculation – Proposed Development

Material	Quantity (tonnes) ^a	Most Relevant ICE Material Category	Embodied Carbon Factor (kg CO ₂ -eq/kg)	Embodied Carbon (tonnes CO ₂ -eq)
Arisings & Concrete in Piles	1,142	Concrete, average UK mix	0.10	118
Concrete to foundations and substructures	3,427	Concrete, average UK mix	0.10	354
Concrete in Superstructures	11,900	Concrete, average UK mix	0.10	1,230
Substructure Rebar	600	Steel, Rebar	1.99	1,194
Superstructure rebar	1,100	Steel, Rebar	1.99	2,189
Façade Cladding (incl. Brick) and Glazing	7,200	Ceramics - Tiles and Cladding Panels	0.78	5,990
Roof finishes	585	concrete block, high density solid, average strength, per kg	0.09	54
Blockwork Walls	642	AAC concrete block	0.28	180
Internal Walls	71	Plaster - Plasterboard	0.39	28
Ceilings	35	Plaster - Plasterboard	0.39	14
Wall Finishes	0	Paint - EXAMPLE: Triple Coat	1.31	<1
Floor Finishes	5	General Carpet	9.80	52
Hard and Soft Landscaping	846	precast concrete paving (Blocks, Slabs, Channels and Kerbs)	0.13	111
TOTAL ^b				11,513
Notes: The quantities are those given in ES Volume 1, Chapter 5: Demolition and Construction , with some converted from a volume quantity (m ³) to mass quantity (tonnes). For the purposes of the assessment, the worst-case assumption has been made that none of the waste materials during construction are reused or recycled. Most of these materials will, however, be separated into recyclable waste streams before removal from the site for disposal.				

Construction Transport

11.122 Construction traffic trip generation in annual average daily traffic (AADT) movement is presented in **ES Volume 1, Chapter 5: Demolition and Construction**. Construction traffic outlined in the ES chapter has been considered to be either heavy duty vehicles (HDVs) or light duty vehicles (LDVs) as a conservative approach. Emissions from construction traffic have been derived from Defra’s Emissions Factors Toolkit (EFT v12.0)¹⁷. Calculated emissions are presented in Table 11.11 for each year of the demolition and construction period. The emissions have been presented in terms of direct GHG emissions, in relation to the GHGs identified within treaties (e.g. CO₂) as well as direct and indirect (e.g. including NOx and PM) GHGs combined, to demonstrate the potential total impact on the climate. The focus of the assessment is on regulate (direct) GHGs.

Table 11.11 Construction Traffic GHG Emissions

Year	Vehicle Type	Emission Rate			Trip Distance (km) ^b	Total Emission (tonnes CO ₂ -eq) ^c	
		CO ₂ ^a (kg CO ₂ -eq/km)	NOx ^a (kg NOx/km)	PM ^a (kg PM/km)		Direct GHG	Direct + Indirect GHGs
2024	HDV	365,470.32	-61,744.25	57,203.22	100	365	360.93
2025	HDV	359,256.35	-51,211.59	56,468.07	100	359	364.51
2026	HDV	352,271.89	-42,787.00	55,840.05	100	352	365.32
2027	HDV	344,878.53	-36,106.64	55,325.05	100	345	364.10
2028	HDV	337,372.90	-30,941.80	54,915.81	100	337	361.35
2029	HDV	82,477.26	-6,773.21	13,651.73	100	82	89.36
2024	LDV	14,166.71	-2,880.58	2,884.46	10	14	14.17

³³ Desouza C. D. et al. (2020). Real-world emissions from non-road mobile machinery in London. Atmospheric Environment, 223, 117301. <https://doi.org/10.1016/j.atmosenv.2020.117301>

Year	Vehicle Type	Emission Rate			Trip Distance (km) ^b	Total Emission (tonnes CO ₂ -eq) ^c	
		CO ₂ ^a (kg CO ₂ -eq/km)	NOx ^a (kg NOx/km)	PM ^a (kg PM/km)		Direct GHG	Direct + Indirect GHGs
2025	LDV	13,820.00	-2,576.66	2,853.52	10	14	14.10
2026	LDV	13,447.26	-2,283.24	2,824.27	10	13	13.99
2027	LDV	13,060.74	-2,008.18	2,799.23	10	13	13.85
2028	LDV	12,668.49	-1,748.12	2,776.84	10	13	13.70
2029	LDV	3,069.44	-376.59	689.15	10	3	3.38
TOTAL – Whole Demolition and Construction Phase						1,911.96	1,978.75
Notes: ^a Vehicle speeds have been assumed to travel at an average speed of 48 kph (circa 30 mph). ^b HDVs have been assumed to travel up to 100 km and LDVs have been assumed to travel up to 10 km. ^c CO ₂ is a direct GHG regulated under treaties. NOx and PM and indirect GHGs unregulated by treaties. Both direct and indirect GHGs affect the climate. As explained in ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 6 , NOx has a negative GWP and the combined GHG emissions may in some instances have negative values.							

Non-Road Mobile Machinery

11.123 Consideration has also been given to the potential impacts of emissions from NRMM used during the demolition and construction period. For the purpose of this assessment, a conservative assumption has been made that all NRMM machinery is assumed to meet stage IIIA for the whole demolition and construction period and all machines with constant speed engines to meet stage IIIA emission standards.

11.124 ES Volume 1, Chapter 5: Demolition and Construction sets out the NRMM anticipated to be utilised along with the number of associated weeks and hour within those weeks that they are likely to be operational. NOx and PM emissions for these NRMM have been assumed to follow the stage IIIA emission standards. There is limited information available on CO₂ emissions from NRMM: however, a study³³ was carried out that demonstrated NRMM typically generate approximately 700 gCO₂/kWh. Engine sizes (kWh) of various NRMM have been taken from the Department for Transport (DfT). The DfT publication³⁴ also states that NRMM are likely to be operational for less than 70% of their possible operational hours. The operational hours, emission rates and engine sizes have been combined to derive the GHG emissions for each stage of the demolition and construction works (see Table 11.12).

Table 11.12 NRMM GHG Emissions

Activity	Emissions (tonnes)			Total Emission (tonnes CO ₂ -eq) ^a	
	CO ₂	NOx	PM	Direct GHG	Direct + Indirect GHGs
Mobile Crane	315.32	-286.49	81.08	315.32	109.91
Tower Crane	23.82	-40.59	18.38	23.82	1.62
Platform Hoists	315.32	-286.49	81.08	315.32	109.91
Cutters, drills and small tools	1.40	-2.39	1.08	1.40	0.10
Mini Skid Steer Loader	140.14	-127.33	54.05	140.14	66.87
Forklift truck	78.83	-84.16	40.54	78.83	35.21
HGVs/lorries/vans	998.50	-907.21	256.76	998.50	348.05
Piling rigs	255.76	-232.37	65.77	255.76	89.15
Scaffolding and mobile hydraulic access platforms	23.82	-40.59	18.38	23.82	1.62
Ready-mix concrete lorry	998.50	-907.21	256.76	998.50	348.05
Concrete pump	255.76	-232.37	65.77	255.76	89.15

³⁴ DfT (2004). Non-Road Mobile Machinery Usage, Life and Correction Factors. Report to the Department for Transport. AEAT/ENV/R/1895.

Activity	Emissions (tonnes)			Total Emission (tonnes CO ₂ -eq) ^a	
	CO ₂	NOx	PM	Direct GHG	Direct + Indirect GHGs
Water pump	68.67	-73.31	35.32	68.67	30.68
TOTAL				3,475.82	1,230.30
Notes: ^a CO ₂ is a direct GHG regulated under treaties. NOx and PM are indirect GHGs unregulated by treaties. Both direct and indirect GHGs affect the climate. As explained in ES Volume 3, Appendix: Climate Change – Annex 4 , NOx has a negative GWP and the combined GHG emissions may in some instances have negative values.					

Completed Development

- 11.125** GHG emissions resulting from the operation of the Proposed Development have been considered, taking account of emissions from changes in transport, consumption of utilities, consumables, changes in land use and from the repair and maintenance of the Proposed Development. Details of these are set out in the following subsections of this ES chapter.
- Operational Transport**
- 11.126** The Proposed Development traffic flows have been provided by Stantec, the transport consultants for the Proposed Development.
- 11.127** Transport emissions have been derived from Defra’s EFT (v12.0) and BEIS’s GHG conversion factors¹⁸, taking account of declining emissions due to fleet changes, traffic volumes, distances travelled and vehicle types. These are presented in Table 11.13 for the Proposed Development. These are assumed to occur throughout the lifetime for the Proposed Development (60 years based on RICS guidance¹⁹).
- 11.128** It is also important to acknowledge that the climate will not just be affected by direct GHGs; indirect GHGs, such as NOx and PM, may also have significant impacts which may result in a contributory effect and are largely produced from transportation. Although there are large uncertainties in future vehicle uptakes, PM emissions (including PM₁₀, PM_{2.5} and other sizes of PM) are unlikely to significantly change over the next few decades, whereas NOx emissions are likely to decrease due to cleaner vehicle technologies. The reduction in NOx will likely lead to an increase in CO₂-eq, since NOx has a negative GWP. Total emissions are thus calculated for both direct GHGs (relevant to treaties and carbon budgets) and total GHGs (direct and indirect GHGs combined). The Proposed Development will lead to a net reduction in vehicle movements and as such the resultant GHG emissions are negative in value.

Table 11.13 Proposed Operational Transport Emissions

Vehicle Type	Emission Rate			Annual Distance (km)	Total Emission (tonnes CO ₂ -eq) ^a	
	CO ₂ (kg CO ₂ -eq /km)	NOx (kg NOx /km)	PM (kg PM /km)		Direct GHG	Direct + Indirect GHGs
HGV	1.18	0.00	0.00	10	0.03	0.04
LDV	-11.03	-0.01	-0.00	10	-0.26	-0.33
Annual Total					-0.23	-0.29
Lifetime Total					-13.7380	-17.6673
Notes: ^a CO ₂ is a direct GHG regulated under treaties. NOx and PM are indirect GHGs unregulated by treaties. Both direct and indirect GHGs affect the climate. As explained in ES Volume 1, Appendix: Climate Change – Annex 4 , NOx has a negative GWP and the combined GHG emissions may in some instances have negative values.						

Fuel Consumption

- 11.129** The Proposed Development will provide hot water and heating to the proposed building electrically using air source heat pumps (ASHPs).
- 11.130** However, the Proposed Development will include an emergency life safety system. The plant is likely to operate for less than 50 hours per year to adhere with the Environmental Permitting Regulations. GHG emissions have

thus not been calculated, but given the few hours of operation, the emissions are unlikely to change the conclusions of the assessment and are therefore considered ‘not significant’.

Air Source Heat Pumps

- 11.131** Heating will be provided through the use of ASHPs. It is important to consider the carbon footprint of the ASHPs, both in terms of potential emissions released through refrigerant leakage and during the manufacture and transportation. The majority (70-80%) of the carbon footprint from the ASHPs can be attributed to the electrical power required for operation, which is likely to be comparable or higher than other forms of heating (such as fossil fuelled plant), due to the low efficiency of the heat pumps. It is, however, important to acknowledge that no emissions are directly produced on-site through combustion of fossil fuels and electricity imported to the site may be sourced from renewable sources, thus they can help to minimise GHG emissions.
- 11.132** Leakage of refrigerant gases from the ASHPs is expected to gradually occur over the lifetime of the Proposed Development, particularly where the pumps are not maintained well. There are a range of fluids used as the refrigerant in ASHPs, and most commonly this includes fluorocarbons, ammonia and water. Fluorocarbons are direct GHGs with high GWPs, and while ammonia is not a GHG, the ammonia emissions are likely to quickly react in the atmosphere to form PM (an indirect GHG). While it is not possible to calculate the GHG emissions from leakage for the Proposed Development due to insufficient information, research³⁵ suggests that approximately 20% of the carbon footprint of ASHPs arise from the leakage of refrigerant gases.
- 11.133** The contribution from the production and disposal of heat pump hardware has been considered. Research³⁵ indicates that the contribution is likely to be around 2-3% of the carbon footprint of ASHPs. Based on the electrical power required (see Table 11.14), the production and disposal of ASHP hardware may lead to direct GHG emissions of 257.21 tonnes CO₂-eq over the lifetime of the Proposed Development, and total GHG emissions (direct plus indirect GHG emissions) of 91.33 tonnes CO₂-eq.

Electricity Consumption

- 11.134** Power for the Proposed Development, including the ASHPs, will be obtained from the National Grid, where GHG emissions will be generated away from the Proposed Development. Electricity from the National Grid is produced using a variety of methods in the UK, some of which include the combustion of materials (such as fossil fuels or waste) and involve GHG emissions being emitted into the atmosphere (such as NOx and PM). It is not known what electricity supplier will be used by the Proposed Development in the future or how the electricity will be produced. A conservative approach has therefore been taken assuming that electricity may be sourced from combustion related methods. It is, however, likely that electricity will be increasingly sourced from renewable production sources in the future. The resulting GHG emissions are presented in Table 11.14.

³⁵ Johnson E. P. (2011) Air-source heat pump carbon footprints: HFC impacts and comparison to other heat sources, Energy Policy, Volume 39, Issue 3, Pages 1369-1381.

Table 11.14 GHG Emissions from Electricity Consumption

Energy Consumption	Emission Rate			Annual Usage (kWh)	Total Emission (tonnes CO ₂ -eq)	
	CO ₂ (kg CO ₂ -eq /kWh)	NOx (kg NOx /kWh)	PM (kg PM /kWh)		Direct GHG	Direct + Indirect GHGs
Electricity Use	142,895.20	-120,219.44	28,060.83	738,934.76	142.90	50.74
Annual Total					142.90	50.74
Lifetime Total					8,573.71	3,044.20

Water Consumption

- 11.136** GHG emissions are also released within the water production and transfer processes. Daily water usage of the residential units are set out in the Sustainability Statement³⁶ submitted in support of the planning application, which states that the maximum operation water consumption is 104.65 L/person/day. The residential occupancy totals 1,674 (as set out in **ES Volume 1, Chapter 6: Socio-Economics**), the total annual water consumption for the Proposed Development was calculated to be approximately 69,900,968 L. The annual GHG emissions are presented in Table 11.15.
- 11.137** The exact use of the non-residential part of the development is currently unknown. The water usage has therefore been calculated using an estimate consumption value for a shopping centre (56.27 L/day/m²)³⁷, which was then applied to the GIA floorspace of the Proposed Development. The total annual water consumption for the non-residential development was calculated to be approximately 36,356,554 L.

Table 11.15 GHG Emissions from Proposed Water Consumption

Consumption	Water Usage (litres/annum)	Emission Rate (kg CO ₂ -eq/L)	GHG Total Emission (tonnes CO ₂ -eq)
Annual Water Consumption (residential)	63,942,196.50	0.0004	26.92
Retail	36,356,557.44	0.0004	15.31
Annual Total			42.23
Lifetime Total			2,534

Land Use

- 11.138** GHG emissions can also result from changes in land use, where existing GHG sinks are lost (such as vegetation being removed). The site currently comprises urbanised land, with some existing hedges along the eastern boundary.
- 11.139** The Proposed Development aims to enhance biodiversity on-site through the incorporation of green infrastructure and ecosystem services and includes the plantation of native trees and scrubs and the installation of Green / Brown Roofs. These may act as future GHG sinks if maintained.
- 11.140** Due to the increase in vegetation proposed, there will be a reduction in GHG emissions relating to changes in land use.
- 11.141** The approximate net change in land use has been calculated from the areas of new uses using values from the Sustainability Statement for the Proposed Development and existing land within the site based on Google Satellite mapping and the Proposed Development design (**ES Volume 1, Chapter 4: The Proposed Development**). Based on the net change, the GHG emissions are presented in Table 11.16.

Table 11.16 GHG Emissions from Proposed Land Use Change

Vegetation Type	Net Area (m ²)	Annual Emission Rate (kg CO ₂ -eq/m ²)	GHG Total Emission (tonnes CO ₂ -eq)
Grassland	85,140	-1,277.10	-0.02
Bushes	0.00	0.00	0.00
Trees	69,924	-2,087.71	-0.03
Annual Total			-0.06
Lifetime Total			-3.75

Embodied Building Maintenance and Repair Emissions

- 11.142** During the lifetime of the Proposed Development the building will likely require some maintenance and repairs, as some materials have shorter lifespans than the Proposed Development. The RICS guidance¹⁹ sets out lifespans of typical construction materials of when they will likely need repairing or replacing. The relevant materials and lifespans are set out in Table 11.17 along with their associated embodied carbon emissions. Where the guidance does not consider the material, professional experience and information set out in the **ES Volume 1, Chapter 5: Demolition and Construction** has been used. It should, however, be acknowledged that improvements in material production processes are expected in the future, which will help to minimise emissions.

Table 11.17 Embodied Carbon Calculation – Repair and Maintenance

Material	Quantity (tonnes)	Most Relevant ICE Material Category	Embodied Carbon Factor (kg CO ₂ -eq/kg)	Embodied Carbon (tonnes CO ₂ -eq)
Arisings & Concrete in Piles	0	Concrete, average UK mix	0.10	0
Concrete to foundations and substructures	0	Concrete, average UK mix	0.10	0
Concrete in Superstructures	0	Concrete, average UK mix	0.10	0
Substructure Rebar	0	Steel, Rebar	1.99	0
Superstructure rebar	0	Steel, Rebar	1.99	0
Façade Cladding (incl. Brick) and Glazing	7,137	Clay, Brick	0.21	1,520.28
Roof finishes	0	Plaster - Plasterboard	0.39	0
Blockwork Walls	0	AAC concrete block	0.28	0
Internal Walls	0	Plaster - Plasterboard	0.39	0
Ceilings	0	Plaster - Plasterboard	0.39	0
Wall Finishes	0.0241	Paint - General	2.91	0.07
Floor Finishes	27	General Carpet	9.80	259.70
Hard and Soft Landscaping	0	precast concrete paving (Blocks, Slabs, Channels and Kerbs)	0.13	0
TOTAL				1,780.05

Consumables

- 11.143** In addition, one of the major contributors to the climate are GHG emissions associated with consumables, such as food and material consumption. Food alone accounts for approximately 26% of global GHG emissions³⁸. Consideration has therefore also been given to GHG emissions associated consumables throughout the lifetime of the Proposed Development. There is likely to be embodied carbon within the furniture used throughout the Proposed Development, as well as a wide range of indirect emissions, such as those associated with food consumption, drink preparations, waste disposal, material possessions, etc.

³⁶ Envision (2023). Broad Street Mall, Reading Sustainability Statement (Draft)
³⁷ Action Manufacturing (2023). <https://actionmfg.com/water-usage-rough-estimates/>

³⁸ IPCC (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

- 11.144** To provide some context, it is useful to understand that on average, each person in England generates 1.4 tCO₂-eq from the consumption of food per year³⁹, which would equate to 84 tCO₂-eq per person over the lifetime of the Proposed Development. Given that there will be approximately 1,674 residents within the Proposed Development, the food consumption from the proposed residential use alone, could be at least 2,344 tCO₂-eq per annum.
- 11.145** The exact emissions are, however, too uncertain to fully quantify, as it is not possible to ascertain what the exact consumables used by future users of the Proposed Development will be, particularly since there is a variety of uses proposed. Therefore, GHG emissions from consumables have been assessed qualitatively, using the methodology described in **ES Volume 3, Appendix: Climate Change – Annex 4**.
- 11.146** The likely consumptions of consumables for the uses of the Proposed Development are set out in Table 11.18. Overall, the level of consumables used to result from the operation of the Proposed Development is considered to be high.

Table 11.18 Assessment of Consumables

Proposed Development Use	GIA (m ²)	Likely Consumption				Overall Consumption
		Food	Material Commodities	Manufacture	Waste	
High density residential	53,497.9 ^b	High	High	Low	High	High
Retail – Food	1,770.22	High	Low	Low	Medium	Medium
TOTAL						High ^a
Notes: ^a The overall consumption has been calculated based on consumptions weighted by the GIAs of the proposed uses. ^b The GIA used for the residential calculations includes both residential amenity and servicing areas, as well as general residential floorspace.						

Decommissioning

Transportation

- 11.147** When the Proposed Development is decommissioned, Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs) may access the site to remove the demolished rubble. Details of HGV and LGV movements at this stage are not known, and it may be that a sustainable approach is adopted in the future to reuse the material on-site. Taking a conservative approach, the number of HGVs and LGVs has been assumed to be the same as those anticipated to be used during the demolition period (three years) of the Proposed Development. Emissions from decommissioning traffic have been derived from Defra’s Emissions Factors Toolkit (EFT v12.0)¹⁷. Calculated emissions are presented in Table 11.19. The emissions have been presented in terms of direct GHG emissions, in relation to the GHGs identified within treaties (e.g. CO₂) as well as direct and indirect (e.g. including NO_x and PM) GHGs combined, to demonstrate the potential total impact on the climate. The focus of the assessment is on regulate (direct) GHGs.

Table 11.19 Decommissioning Traffic GHG Emissions

Years	Vehicle Type	Emission Rate			Trip Distance (km) ^b	Total Emission (tonnes CO ₂ -eq) ^c	
		CO ₂ ^a (kg CO ₂ -eq/km)	NO _x ^a (kg NO _x /km)	PM ^a (kg PM/km)		Direct GHG	Direct + Indirect GHGs
2089-2092	HDV	2499.99	1.10	0.60	100	250.00	286.91
2089-2092	LDV	696.62	0.30	0.29	100	69.66	90.80
TOTAL – Decommissioning Phase						319.66	377.71
Notes: ^a Vehicle speeds have been assumed to travel at an average speed of 48 kph (circa 30 mph). ^b Vehicles have been assumed to travel up to 100 km. ^c CO ₂ is a direct GHG regulated under treaties. NO _x and PM and indirect GHGs unregulated by treaties. Both direct and indirect GHGs affect the climate. As explained in ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 6, NO _x has a negative GWP and the combined GHG emissions may in some instances have negative values.							

NRMM

- 11.148** The decommissioning works will likely require NRMM to be used, the emissions from which are unknown. It is highly likely that low-emission alternatives will be available by the time the Proposed Development is decommissioned. However, to provide a conservative assessment, emissions from NRMM have been considered and assumed to be the same as those calculated for the demolition and construction works. The total direct GHG emissions are estimated to be approximately 3,476 tCO₂-eq (1,230 tCO₂-eq when considering both direct and indirect GHG emissions).

Total

- 11.149** The total GHG emissions for the lifetime of the Proposed Development, taking account of demolition and construction works, operation, maintenance and decommissioning, have been calculated and are given in Table 11.20.

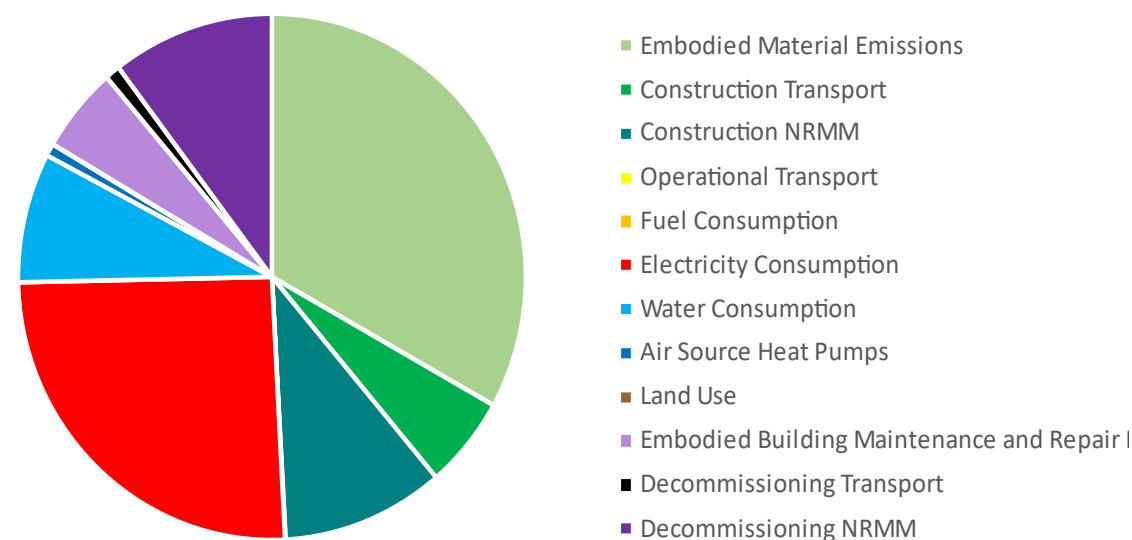
Table 11.20 Total GHG Emissions

Module	Emission Source	GHG Emissions (kt CO ₂ -eq) ^a	
		Direct GHG	Direct + Indirect GHGs
Demolition and Construction	Embodied Material Emissions	11.1	11.1
	Construction Transport	1.9	2.0
	Construction NRMM	3.5	1.2
Operational	Operational Transport	0.0	0.0
	Fuel Consumption	0.0	0.0
	Electricity Consumption	8.6	3.0
	Water Consumption	2.5	2.5
	ASHPs	0.3	0.1
	Land Use	<0.1	<0.1
	Embodied Building Maintenance and Repair Emissions	1.8	1.8
Decommissioning	Decommissioning Transport	0.3	0.4
	Decommissioning NRMM	3.5	1.2
TOTAL		33.4	23.4
Notes: ^a CO ₂ is a direct GHG regulated under treaties. NO _x and PM are indirect GHGs unregulated by treaties. Both direct and indirect GHGs affect the climate. As explained in ES Volume 3, Appendix: Climate Change and Greenhouse Gases – Annex 4, NO _x has a negative GWP and the combined GHG emissions may in some instances have negative values.			

- 11.150** Figure 11.2 illustrates the contribution of each emission source to the total emissions over the lifetime of the Proposed Development. The emissions predominantly (38%) comprise of embodied emissions, i.e., embodied material emissions during construction (33%) and embodied Building Maintenance and Repair Emissions (5%). Other significant contributors include electricity consumption (26%), both construction and decommissioning NRMM (both 10%), operational water use (8%) and construction transport (6%). Contributions from operational transport, fuel consumption, air source heat pumps, land use and decommissioning transport were all calculated to be <5% and can thus been screened out as insignificant based on the criteria set out in the IEMA guidance⁴⁰.

³⁹ WWF-UK and Food Climate Research Network (2009). How low can we go? An assessment of greenhouse gas emissions from the UK food system end and the scope to reduce them by 2050.

Figure 11.2 Total GHG Emissions for the Proposed Development per Emission Source



Significance

11.151 The changes in GHG emissions associated with the Proposed Development have been compared to the UK carbon budgets and estimated regional and local carbon budgets. The comparison is given in Table 11.21.

Table 11.21 Comparison of GHG Emissions over Carbon Budget Periods

Carbon Budget Period	Carbon Budget (Mt CO ₂ -eq)	Baseline (Mt CO ₂ -eq)	With Proposed Development (Mt CO ₂ -eq)	Baseline % of Carbon Budget	Net Change (% of Budget)
Local ^a					
2023 – 2027	2.6 (1.2)	2.5	0.016 (<0.001)	97.2%	0.63% (<0.01%)
2028 – 2032	2.3 (0.6)	1.8	0.007 (0.001)	79.4%	0.29% (0.13%)
2033 – 2037	1.3 (0.3)	1.1	0.002 (0.001)	86.6%	0.15% (0.32%)
Regional					
2023 – 2027	192	187	0.016	97.2%	0.01%
2028 – 2032	170	135	0.007	79.4%	0.00%
2033 – 2037	95	82	0.002	86.6%	0.00%
UK					
2023 – 2027	1950	1,896	0.016	97.2%	0.00%
2028 – 2032	1725	1,370	0.007	79.4%	0.00%
2033 – 2037	965	836	0.002	86.6%	0.00%
Notes:					
^a Energy-related CO ₂ Tyndall Carbon Budgets and associated values provided in brackets.					

11.152 Based on the significance criteria set out in the IEMA guidance⁴⁰ on the assessment of GHGs for EIA, the Proposed Development's GHG impacts would be considered not significant, on the basis that the Proposed Development:

- Would be consistent with applicable existing and emerging policy requirements (such as the Reading Borough Council (RBC) Local Plan⁴¹ and the Reading Climate Emergency Strategy⁴²).

- Would be consistent with good practice design standards for projects of this type (see adopted sustainable design measures in paragraph 11.105).
- Will lead to residual emissions when the UK is attempting to achieve net zero but is doing enough to align with and contribute to keeping the UK on track towards achieving net zero by 2050.

11.153 When considering alternative methodologies, Table 11.20 demonstrates that the Proposed Development will lead to <1% of local, regional and UK carbon budgets for all years, and will lead to a net change of less than 25,000 tonnes CO₂-eq for all years assessed. Comparing these against the criteria set out in Table 11.6, the magnitude of impact for the Proposed Development will be Negligible at local, regional and UK scales.

11.154 Combining these magnitudes of impacts with Table 11.7, when considering the high sensitivity of the climate receptor, the likely effect may be considered Negligible (not significant) for all carbon budget periods at local, regional and UK scales.

11.155 Taking account of the Tyndall Carbon Budgets, the Proposed Development will lead to a <1% change to the energy-related local budgets. Comparing these against the criteria set out in Table 11.6, the magnitude of impact for the Proposed Development will be Negligible at local scale, resulting in a likely effect that may be considered Negligible (not significant) at local scale.

11.156 In determining whether the effects are significant or not, due consideration has also been given to the nature, duration, and geographical scale of the effect in question (e.g. direct / indirect, temporary / permanent, short / medium-term, etc). Overall, the significance is based on professional judgement.

11.157 Taking into account the likely effects, the overall significance of the Proposed Development is considered to be not significant. This judgement is based on:

- Effects being Negligible at local, regional and UK scales;
- Effects being Negligible at local scale when compared to the Tyndall Carbon Budgets;
- The net change in emissions will be less than 25,000 tonnes CO₂-eq in all years;
- In view of global warming, the duration of all effects assessed are assumed to be long-term and permanent;
- The Proposed Development has adopted good sustainable design measures to reduce GHG emissions as far as possible, as set out in paragraph 11.105;
- The emissions predominantly (38%) comprise embodied material emissions, which are highly uncertain;
- As the effects are in essence driven by embodied emissions, the effects will be indirect; and
- The embodied emissions represent emissions to extract, refine, process, transport and fabricate the materials. These emissions occur indirectly offsite, most of which are unlikely to occur within the local scale.

11.158 Notwithstanding the significance, the focus of the assessment has been to incorporate measures into the design of the Proposed Development to avoid and minimise GHG emissions. In particular, the significance does not take account of unregulated emissions such as those associated with consumables. It is thus important that measures are adopted to help minimise unregulated emissions. These measures are set out in paragraph 11.105.

MITIGATION, MONITORING AND RESIDUAL EFFECTS

11.159 Changes in GHG emissions associated with the Proposed Development have been assessed. There will be a net increase in GHG emissions as a result of the Proposed Development and, when considering several other methodologies and taking account of professional judgement, the overall likely effects will be not significant. No mitigation measures or monitoring are therefore proposed. The residual effects will be not significant.

⁴⁰ IEMA. (2022). Environmental Impacts Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance.
⁴¹ Reading Borough Council (2019). Reading Borough Local Plan.

⁴² Reading Borough Council (2020). Reading Climate Emergency Strategy.

Residual Effects

11.160 All of the residual effects resulting from the Proposed Development, are presented in Table 11.22, identifying whether the effect is significant or not.

Table 11.22 Residual Effects

Receptor	Description of the Residual Effect	Scale and Nature	Significant / Not Significant	Geo	D I	P T	St Mt Lt
Global Climate	GHG emissions from the Proposed Development	Negligible	Not Significant	I	D & I	T & P	Mt & Lt
Notes: Residual Effect - Scale = Negligible / Minor / Moderate / Major - Nature = Beneficial or Adverse Geo (Geographic Extent) = Local (L), Borough (B), Regional (R), National (N) D = Direct / I = Indirect P = Permanent / T = Temporary St = Short Term / Mt = Medium Term / Lt = Long Term N/A = not applicable / not assessed							

GHG emissions associated with this is not deemed to be feasible due to the absence of sufficient information. Nevertheless, it is expected that it will include measures to avoid, prevent, reduce and / or offset GHG emissions, conforming to the climate change requirements set out in the RBC Local Plan⁴¹. Any GHG emissions generated by the development will contribute to the baseline emissions at local, regional and UK scales. Overall, the cumulative emissions from this development will not alter the conclusion that the likely significant effects of the Proposed Development will be Negligible (not significant).

PART B – LIKELY SIGNIFICANT EFFECTS

11.166 There are no likely significant effects associated with the Proposed Development in relation to Climate Change and Greenhouse Gases.

ASSESSMENT OF THE FUTURE ENVIRONMENT

Evolution of the Baseline Scenario

- 11.161 If the Proposed Development did not come forward, it is expected that the site would remain in its current state. Sufficient details of the building materials, quantities, maintenance and repair, as well as electricity, water and fossil fuel usage are not available to allow GHG emissions to be appropriately calculated and compared to the Proposed Development. However, the existing site is in use as part of the Broad Street Mall shopping centre; thus should the site continue to remain in its current state it is expected that GHG emissions from the site would likely be similar to those of the Class E use of the Proposed Development and thus the net change would be less than estimated. Nevertheless, the effects of the Proposed Development would remain not significant.
- 11.162 The UK Government has adopted a long-term strategy to aim for net zero emissions by 2050, as such, the trend for reducing GHG emissions from all sectors will continue in the future.
- 11.163 Whilst any cumulative schemes in the local area will lead to an incremental increase in baseline GHG emissions in the shorter term, they are expected to adhere to the climate change requirements set out in the RBC Local Plan⁴¹ and will be subsequently managed effectively during operation to ensure required targets are achieved. Taking into account wider trends of decarbonisation, the GHG emissions at local, regional and UK scales set out above are anticipated to decrease in the medium to long-term.

Cumulative Effects Assessment

11.164 Relevant cumulative schemes have been identified and outlined in **ES Volume 1, Chapter 2: EIA Methodology**. A quantitative analysis of the GHG emissions associated with the cumulative schemes is not deemed to be feasible due to the absence of sufficient, robust data on the technical specifications of these projects, notably their building servicing strategy, materials specification and transport provision. Nevertheless, it is expected that all cumulative schemes will include measures to avoid, prevent, reduce and / or offset GHG emissions, conforming to the climate change requirements set out in the RBC Local Plan⁴¹. Any GHG emissions generated by the cumulative schemes will contribute to the baseline emissions at local, regional and UK scales. Overall, these cumulative emissions will not alter the conclusion that the likely significant effects of the Proposed Development will be Negligible (not significant).

Minster Quarter Development Framework

11.165 Directly to the south of the Proposed Development is the Minster Quarter Area, which is outlined for major mixed-use development under the Minster Quarter Development Framework. A quantitative analysis of the

Chapter 12: Effect Interactions

INTRODUCTION

- 12.1 This chapter of the Environmental Statement (ES) summarises the likelihood for effect interactions. Effect interactions occur because of interactions between multiple individual effects as a result of the Proposed Development, impacting a single assessed receptor i.e. the combination of individual effects, for example effects interactions in relation to noise, airborne dust and traffic on a single receptor.
- 12.2 Note that effects arising from the Proposed Development in combination with other developments, or 'cumulative schemes', have been discussed separately throughout this ES (in **ES Volume 1, Chapters 6 – 11** and **ES Volume 2**) as appropriate, and have not been re-iterated within this ES chapter to avoid repetition.
- 12.3 There is no established Environmental Impact Assessment (EIA) methodology for assessing the nature and scale of effect interactions on a receptor. However, the European Commission (EC) has produced guidelines to assist EIA practitioners in developing an approach which is appropriate to a project. These guidelines have been used to develop an approach which uses the defined residual effects of the Proposed Development (as presented throughout this ES (in **ES Volume 1, Chapters 6 – 11** and **ES Volume 2**) to determine the potential for effect interactions. These residual effects are reliant on mitigation measures (as identified throughout this ES and presented within **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring Schedule**), and the mitigation measures have been assumed to be secured / implemented through the discharge of relevant planning conditions and / or appropriate legal agreement.
- 12.4 The approach to defining effect interactions involves tabulating the residual effects of the Proposed Development against receptors or, where more appropriate, receptor groups to identify the potential effect interactions. For the purposes of this assessment, residual effects that have been identified in **ES Volume 1, Chapters 6 – 11** and **ES Volume 2** that **do not affect a common sensitive receptor have not been presented in this ES chapter, as no effect interactions are anticipated**. Only residual effects that are likely to give rise to effect interactions have been considered and discussed as relevant.
- 12.5 Residual effects that are beneficial, or adverse in nature and that are minor, moderate or major in scale have been considered. Based on the definitions of what negligible effects comprise for each of the technical assessments, these do not warrant further consideration therefore have not been considered in the assessment of effect interactions within this ES chapter.
- 12.6 The residual effects highlighted in **green** within the tables presented in this ES chapter reflect beneficial effects (minor, moderate or major) and those in **orange** reflect adverse effects (minor, moderate or major). This approach has been followed unless otherwise justified for each respective technical chapter.
- 12.7 A qualitative approach has been undertaken to the assessment of effect interactions and professional judgement has been used to determine whether the combination of multiple individual effects results in an effect interaction on the receptor or receptor group in question. Where a receptor is likely to experience both adverse and beneficial effects, consideration is given as to whether these would counteract each other through their interaction, depending on the nature of each effect. A quantitative approach has not been undertaken to the assessment of effect interactions, as there is no established methodology.
- 12.8 The scale of an effect interaction has not been assigned as part of this assessment; however, whether the effect interaction is considered to be a significant effect or not has been identified. For example, when one or more residual significant effects (i.e. effects that are typically moderate or major in scale) from different EIA topics (e.g. air quality and odour, noise and vibration, traffic and transport) coincide on a receptor, the effect interaction has been considered as being **'significant'**. If none of the individual effects are significant, consideration has been given as to whether or not the combination of many not significant effects could result in a combined significant effect, based on professional opinion.
- 12.9 This ES chapter has subsequently been divided into two parts:
- Demolition and Construction – which addresses the potential for effect interactions to relevant receptors/receptor groups arising from the enabling works and construction; and
 - Completed Development – which addresses the potential for effect interactions to relevant receptors/receptor groups arising from the completed and operational Proposed Development.
- 12.10 Effect interactions arising from the demolition and construction works (see Table 12.1) and the completed and operational/occupied Proposed Development (see Table 12.2) are discussed in the following sections of this ES chapter.

DEMOLITION AND CONSTRUCTION

- 12.11 Table 12.1 presents the in-combination effects assessment and identifies the potential for effect interactions throughout the demolition and construction works.
- 12.12 Where the potential for an effect interaction is identified, this is discussed in more detail below.

Table 12.1 Potential for Effects Interactions – Demolition and Construction

Receptor	Technical Topic Area & Residual Effect	Scale and Nature of Residual Effect	Significance of Individual Effect
Other existing residential dwellings	Noise: Construction activity noise	Minor Adverse Local	Not Significant
	Vibration: Construction activity vibration	Minor Adverse Local	Not Significant

- 12.13 Table 12.1 shows that there is the potential for an in-combination effect / effect interaction on other existing residential dwellings, in particular, to residential amenity relating to:
- Demolition and construction works noise; and
 - Demolition and construction works vibration.
- 12.14 It is not uncommon for construction works to be undertaken in close proximity to residential uses and the potential for temporary or short-term adverse effects on local residences and residential amenity is expected. This is an inevitable consequence of living within an urban environment, particularly within an area undergoing regeneration in accordance with a local development plan.
- 12.15 The planning process provides a mechanism through the stipulation of planning conditions to control the potential for adverse residential amenity or 'nuisance' effects during demolition and construction works particularly associated with noise and vibration. Planning conditions typically require detailed construction plans and procedures to be agreed with the local authority prior to the start of works on a site relating to for example, the control of noise, dust / air quality, road traffic and vibration. In addition, specific requirements tend to be set regarding public relations and community engagement for large construction projects and mechanisms for receiving, handling and responding to any complaints. As a result, impacts and resultant nuisance effects, including to residential amenity, tend to be managed as far as is reasonably practicable through planning conditions and obligations on contractors, however it is recognised that adverse nuisance effects could still arise.
- 12.16 A number of measures to mitigate noise and vibration from the demolition and construction shall be implemented. The measures shall constitute 'Best Practicable Means'; the specific measures shall be defined throughout the detailed demolition and construction works programming and will all be incorporated into a Construction Management Plan (CMP). The measures include but are not limited to:
- Fully encapsulating the existing building with a sheeted scaffold;
 - All machines in intermittent use shall be shut down in the intervening periods between works if possible, or throttled down to a minimum;
 - Stationary noise sources will be situated as far as possible from noise-sensitive receptors; and
 - The use of Continuous Flight Auger piling over more noisily piling methods.
- 12.17 Based on the scale of the noise and vibration effects defined (all Minor Adverse and not significant), significant in-combination effects on residential amenity are not anticipated.

COMPLETED DEVELOPMENT

- 12.18 Table 12.2 presents the in-combination effects assessment and identifies the potential for effect interactions on completion and occupation of the Proposed Development.
- 12.19 Where the potential for an effect interaction is identified, this is discussed in more detail below.

Table 12.2 Potential for Effect Interactions – Completed Development

Receptor	Residual Effect	Scale and Nature Geographic Extent	Significance of Individual Effect
15 Queens Walk (Queens Court)	Daylight: Change in daylight amenity	Minor to Moderate Adverse Local	Significant
	Sunlight: Change in sunlight amenity	Minor Adverse Local	Significant
	Townscape: Change to Townscape Character Area 4: Civic Centre	Moderate Beneficial Local	Significant
16 Castle Street (The Sun Inn)	Daylight: Change in daylight amenity	Minor Adverse Local	Significant
	Heritage: Change in historic setting	Moderate Adverse Local	Significant
	Townscape: Change to Townscape Character Area 3: Historic Core	Moderate Adverse Local	Significant
Church of St Mary	Daylight: Change in daylight amenity	Minor Adverse Local	Significant
	Heritage: Change in historic setting	Moderate Adverse Local	Significant
	Townscape: Change to Townscape Character Area 3: Historic Core	Minor Adverse Local	Not Significant

15 Queens Walk (Queens Court)

12.20 Table 12.2 shows that there is potential for interactions between the effects relating to daylight and sunlight on 15 Queens Walk. These effects could combine / interact to adversely affect residential amenity. As both daylight and sunlight effects are significant in isolation, the in-combination effect / effect interaction between daylight and sunlight is assessed to be significant. These adverse effects are largely inevitable with the redevelopment of the site in an area where redevelopment is supported by Reading's aspirations for the area.

12.21 In addition to the potential effect interaction between daylight and sunlight effects on receptors at 15 Queens Walk (Queens Court), there is also the potential for a further effect interaction between the reduction in daylight and sunlight amenity and the townscape character within Townscape Character Area 4: Civic Centre. Due to the attractive architecture and massing of the Proposed Development, the receptors at 15 Queens Walk (Queens Court) would experience a significant beneficial effect which could interact with the adverse effects on daylight and sunlight amenity.

12.22 Each of the effects on 15 Queens Walk are significant in isolation. As such, there are considered to be **significant** effect interactions on 15 Queens Walk between daylight, sunlight and townscape.

16 Castle Street (The Sun Inn)

12.23 16 Castle Street (The Sun Inn) has the potential to be affected by interactions between effects relating to daylight and heritage. These effects could combine/interact to adversely affect the receptor. The Proposed Development will introduce a greater scale of development to the setting of the receptor. This increased scale will contrast against the domestic scale of the receptor and reduce daylight amenity at the receptor. As, in isolation, both these effects are significant, the adverse in-combination effect between daylight and heritage is assessed to be **significant**. These adverse effects are largely inevitable with the redevelopment of the site in an area where redevelopment is supported by Reading's aspirations for the area.

12.24 In addition to the potential effect interaction between daylight and heritage effects on receptors at 16 Castle Street (the Sun Inn), there is also the potential for an effect interaction between the reduction in daylight amenity, change in historic setting and the townscape character within Townscape Character Area 3: Historic Core. Due to the Proposed Development's modern architecture forming a contrasting backdrop to the historic core of Reading, the receptors at 16 Castle Street (the Sun Inn) would experience a not significant adverse effect which could interact with the adverse effects on daylight amenity and change in historic setting.

12.25 The daylight and sunlight effects on 16 Castle Street (the Sun Inn) are significant in isolation. As such, there are considered to be **significant** effect interactions on 16 Castle Street (the Sun Inn) between daylight, sunlight and townscape.

Church of St Mary

12.26 The Proposed Development has been assessed to potentially result in a loss of daylight amenity at the Church of St Mary, and a change in the receptors historic setting. These effects could combine / interact to adversely affect the receptor. The modern materiality and architectural style of the Proposed Development differs from that of the receptor and emphasises its separation from the receptor, while the height of the Proposed Development could result in a loss of daylight amenity. As in isolation, both these effects are significant, the adverse in-combination effect between daylight and heritage is assessed to be significant. These adverse effects are largely inevitable with the redevelopment of the site in an area where redevelopment is supported by Reading's aspirations for the area.

12.27 In addition to the potential effect interaction between daylight and heritage effects on receptors at the Church of St Mary, there is also the potential for an additional effect interaction between the reduction in daylight amenity, change in historic setting and the townscape character within Townscape Character Area 3: Historic Core. Due to the Proposed Development's modern architecture forming a contrasting backdrop to the historic core of Reading, the receptors at the Church of St Mary would experience a not significant adverse effect which could interact with the adverse effects on daylight amenity and change in historic setting.

12.28 The daylight and sunlight effects on the Church of St Mary are significant in isolation. As such, there are considered to be **significant** effect interactions on the Church of St Mary between daylight, sunlight and townscape.

SUMMARY AND CONCLUSION

12.29 The assessment has demonstrated that there is the potential for effect interactions to take place during the demolition and construction of the Proposed Development to Other Existing Residential Dwellings within proximity to the site. The in-combination effects relate to noise and vibration. However, based on the scale of the noise and vibration effects defined, significant in-combination effects on residential amenity are not anticipated.

12.30 On completion and occupation of the Proposed Development, there is the potential for significant effect interactions to 15 Queen's Walk (Queens Court), 16 Castle Street (The Sun Inn) and Church of St Mary, as a result of in-combination effects associated with changes in daylight and sunlight amenity and heritage setting. Based on the significant daylight and sunlight and heritage effects, the effect interactions are assessed as being significant at all three receptors.

Chapter 13: Likely Significant Effects and Conclusions

INTRODUCTION

- 13.1** This chapter of the ES presents a summary of the likely significant environmental and socio-economic effects of the Proposed Development during the demolition and construction works, and once completed and occupied. This ES chapter also provides the conclusions of the EIA.
- 13.2** Likely significant effects are generally effects that are moderate or major in scale (although it is noted that professional judgement and published assessment guidance are also used in concluding whether an effect is significant. For example, daylight, sunlight and overshadowing effects that are minor in scale are classed as significant effects (refer to **ES Volume 1, Chapter 9: Daylight, Sunlight and Overshadowing** for further information).
- 13.3** For a detailed description of all environmental and socio-economic effects, reference should be made to individual technical chapters (**ES Volume 1, Chapters 6 – 11**) of this Volume of the ES and **ES Volume 2: Heritage, Townscape, and Visual Impact Assessment**.

LIKELY SIGNIFICANT EFFECTS

- 13.4** For details of the methodology used to define the scale (and so significance), nature, geographic extent and duration of effects and whether effects are direct or indirect, reference should be made to **ES Volume 1, Chapter 2: EIA Methodology** and the individual technical chapters of ES Volume 1 (**Chapters 6 – 11**) and **ES Volume 2: Heritage, Townscape, and Visual Impact Assessment**.

Demolition and Construction

- 13.5** Table 13.1 outlines the likely significant effects resulting from the Proposed Development during demolition and construction. For ease of identification, significant adverse effects are shaded in 'orange' and significant beneficial effects are shaded in 'green'.

Table 13.1 Demolition and Construction – Likely Significant Effects

EIA Topic Area	Receptor(s)	Description of Residual Effect	Classification of Residual Effect			
			Scale and Nature (Geographic Extent)	D I	P T	St Mt Lt
Noise and Vibration	Existing Queens Court student residential (R8)	Construction activity noise	Major Adverse (Local)	D	T	St
	Existing theatre (R11)			D	T	St
	Building C of the Proposed Development (R14)	Construction activity noise – whilst Buildings A and B are being completed	Moderate Adverse (Local)	D	T	St
Notes: Nature = Beneficial / Adverse / Neutral Scale = Negligible / Minor / Moderate / Major Geographic Extent = Site or Local / City-Wide / Sub-Regional or Regional / National / International D = Direct / I = Indirect P = Permanent / T = Temporary St = Short Term / Mt = Medium Term / Lt = Long Term						

Completed Development

- 13.6** Table 13.2 outlines the likely significant effects resulting from the Proposed Development once it is complete and occupied. For ease of identification, significant adverse effects are shaded in 'orange' and significant beneficial effects are shaded in 'green'.

Table 13.2 Completed Development - Likely Significant Effects

EIA Topic Area	Receptor(s)	Description of Residual Effect	Classification of Residual Effect			
			Scale and Nature (Geographic Extent)	D I	P T	St Mt Lt
Socio-Economics	Availability of housing	Provision of 644 new dwellings, a percentage of which will be affordable	Moderate Beneficial (Borough)	D	P	Lt
	Capacity of primary healthcare	Addition of 1,674 new residents	Moderate Adverse (Local)	D	P	Lt
	Capacity of primary schools	Addition of 78 new primary school pupils	Moderate Adverse (Local)	D	P	Lt
Daylight	McIlroys Building	Change in daylight amenity	Minor Adverse (Local)	D	P	Lt
	59-60 St Mary's Butts		Minor Adverse (Local)	D	P	Lt
	2-6 Castle Street		Minor Adverse (Local)	D	P	Lt
	Church of St Mary		Minor Adverse (Local)	D	P	Lt
	16 Castle Street		Minor Adverse (Local)	D	P	Lt
	15 Queens Walk (Queens Court)		Minor to Moderate Adverse (Local)	D	P	Lt
Sunlight	15 Queens Walk (Queens Court)	Change in sunlight amenity	Minor Adverse (Local)	D	P	Lt
Overshadowing	21 March – Amenity Area 6	Transient overshadowing	Minor Adverse (Local)	D	P	Lt
	21 June – Amenity Area 6		Minor Adverse (Local)	D	P	Lt

EIA Topic Area	Receptor(s)	Description of Residual Effect	Classification of Residual Effect			
			Scale and Nature (Geographic Extent)	D I	P T	St Mt Lt
	21 December – Amenity Area 6		Minor Adverse (Local)	D	P	Lt
	Amenity Area 6	Overshadowing – sun hours on ground	Minor Adverse (Local)	D	P	Lt
Wind Microclimate	Podium and Roof Amenity Levels (Summer) – Measurement location T158	Change in wind conditions	Moderate Adverse (Local)	D	P	Lt
Heritage	Church of St Mary	Change in historic setting	Moderate Adverse (Local)	I	P	Lt
	The Sun Inn		Moderate Adverse (Local)	I	P	Lt
	35, 36 and 37 St Mary's Butts and the Horn Inn		Moderate Adverse (Local)	I	P	Lt
	St Mary's Butts Conservation Area (CA)		Moderate Adverse (Local)	I	P	Lt
Townscape	Reading Town Centre Townscape Character Area (TCA)	Change in townscape character	Moderate Beneficial (Local)	D	P	Lt
	Civic Centre TCA		Moderate Beneficial (Local)	D	P	Lt
	Historic Core		Moderate Adverse (Local)	D	P	Lt
Visual	Pedestrians within Reading town centre	Change in visual amenity	Moderate Beneficial (Local)	D	P	Lt
	Leisure / amenity users of Reading town centre		Major Beneficial (Local)	D	P	Lt
Notes: Nature = Beneficial / Adverse / Neutral Scale = Negligible / Minor / Moderate / Major Geographic Extent = Site or Local / City-Wide / Sub-Regional or Regional / National / International D = Direct / I = Indirect P = Permanent / T = Temporary						

¹ RBC (2019). Reading Borough Local Plan.

EIA Topic Area	Receptor(s)	Description of Residual Effect	Classification of Residual Effect			
			Scale and Nature (Geographic Extent)	D I	P T	St Mt Lt
St = Short Term / Mt = Medium Term / Lt = Long Term						

SUMMARY AND CONCLUSIONS

Demolition and Construction

Noise and Vibration

13.7 The EIA has identified that during the demolition and construction works, Major Adverse (**significant**) effects have the potential to occur in relation to noise at the existing Queens Court student residences and the existing theatre. Additionally, Moderate Adverse (**significant**) effects have the potential to occur in relation to noise at Building C of the Proposed Development, once it is completed and operational, during the construction of Buildings A and B of the Proposed Development.

13.8 It should be noted that any disruption at these receptors due to construction would be localised and temporary.

13.9 The effects likely to be experienced are primarily due to the proximity of these receptors in relation to the Proposed Development and the type of construction work required. However, the impact of the construction works would be managed as far as reasonably possible through measures (Best Practicable Means) detailed within the Construction Management Plan (CMP) and other site-specific management plans as discussed throughout this ES and set out in **ES Volume 1, Chapter 14: Environmental Management, Mitigation and Monitoring Schedule**. Further mitigation measures to reduce the impact on the cumulative schemes, should they be occupied during construction, include the use of temporary/localised barriers around particularly noisy construction works and use of alternative ground compaction equipment if location of works to occupied residential receptors cannot be avoided.

13.10 It is not uncommon for construction works to be undertaken near sensitive uses with the potential for temporary or short-term adverse effects on local residences. This is an inevitable consequence of living within an urban environment, particularly within an area undergoing rapid regeneration in accordance with the local plan.

Completed and Operational

Socio-Economics

13.11 The Proposed Development, once complete and operational, will provide Moderate Beneficial (**significant**) effects for the local housing supply at borough level. The Proposed Development will provide 644 residential units, which is approximately 4.1% of the overall target for new homes outlined in the Reading Borough Council's (RBC's) Local Plan¹. and the Applicant will endeavour to deliver the maximum reasonable amount of affordable housing as part of the proposed scheme (subject to viability testing).

13.12 The Proposed Development has the potential to result in Moderate Adverse (**significant**) effects on the capacity of primary healthcare and capacity of primary schools. The Proposed Development will potentially result in the addition of 1,674 new residents and 78 new primary school pupils. It should be noted that this represents a worst-case scenario as it is considered that several of the residents accommodated within the Proposed Development will already be registered with a GP or primary school in the local area or beyond and will therefore not be relocated. They may also use private health care or attend private schools, which is not considered within this assessment.

Daylight, Sunlight and Overshadowing

Daylight

- 13.13** The likely changes in daylight levels for existing residential properties surrounding the site is a consideration for those residing within dense urban areas. The prediction where the change experienced is likely to be significant is limited to a relative low proportion of habitable rooms, where the greater majority is not considered significant. The daylight analysis indicates that the majority of neighbouring residential receptors would not experience significant effects to the levels of daylight they receive with the Proposed Development site in place. Whilst alterations are predominantly negligible, there are instances of Minor and Minor to Moderate (**significant**) alterations seen to windows or rooms at several properties. Given the scale of the massing proposed and the urban context of the site, these effects are likely to be unavoidable in relation to new development.

Sunlight

- 13.14** In terms of change in the levels of sunlight, the technical analysis has shown the effect on fifteen of the sixteen properties technically assessed will be negligible. There is one instances of Minor Adverse (**significant**) alterations to the remaining property, 15 Queens Walk (Queens Court). As above, given the scale of the massing proposed and the urban context of the site, these effects are likely to be unavoidable in relation to new development.

Overshadowing

- 13.15** The Proposed Development will also result in Minor Adverse (**significant**) effects for transient overshadowing (21 March, 21 June, and 21 December) and sun hours on ground on Amenity Area 6. However, it is important to note that in the existing condition only 44% of the area achieves two hours of sunlight. As such, the part affected by the Proposed Development is relatively small in relation to the overall size of the amenity area.

Wind Microclimate

- 13.16** The Proposed Development has the potential to result in Moderate Adverse (**significant**) effects for the wind conditions at podium and roof level amenity spaces of Building B. Measurement location T158 would have 'strolling' use wind conditions in the summer season. Wind mitigation would be required at podium level to provide shelter at these locations.

Heritage, Townscape and Visual Impact

Heritage

- 13.17** Four heritage receptors are assessed to potentially experience Moderate Adverse (**significant**) effects as a result of the Proposed Development, including the Church of St Mary, the Sun Inn, 35, 36 and 37 St Mary's Butts and the Horn Inn, and St Mary's Butts CA, due to a change in the historic setting of these receptors. These adverse effects are largely inevitable with the redevelopment of the site in an area where redevelopment is supported by Reading's aspirations for the area.

Townscape

- 13.18** The Proposed Development, once complete and operational, will result in a Moderate Adverse (**significant**) effect to the Historic Core TCA. The Proposed Development will also result in a Moderate Beneficial (**significant**) effects to the Reading Town Centre TCA and Civic Centre TCA. The Proposed Development has been carefully conceived to ensure the development of the site positively and appropriately contributes to the regeneration of Reading Town Centre and the surrounding area. The Proposed Development has taken particular care to be sympathetically designed for the nearby heritage assets and preserves the setting of nearby listed buildings.

Visual

- 13.19** Pedestrians within Reading town centre and leisure / amenity users of Reading town centre are likely to experience Moderate and Major Beneficial (**significant**) effects respectively. The active frontages and introduced public realm of the Proposed Development will increase the visual amenity of the local area.

LIKELY SIGNIFICANT CUMULATIVE EFFECTS

- 13.20** The EIA process has identified likely significant cumulative effects additional to the main assessment of the Proposed Development, as already summarised in Table 13.1 and Table 13.2 above. Any changes to significant effects already identified as a result of the Proposed Development coming forward, in conjunction with surrounding cumulative schemes have been detailed in the following sections as significant cumulative effects.

Completed and Operational

Socio-Economics

- 13.21** The Proposed Development, in combination with the cumulative schemes that are being developed within a 1km radius of the site, results in significant socio-economic effects related to the provision of housing. In combination, the cumulative schemes and the Proposed Development contribute approximately 21% towards the Borough's housing target of 15,847 homes by 2026. This has been assessed to be a Major Beneficial (**significant**) effect at the Borough level.
- 13.22** The Proposed Development, in combination with the cumulative schemes, has been assessed to result in a Major Adverse (**significant**) effect at Borough level on the availability of primary healthcare. It has been calculated that the additional residents generated by the cumulative schemes, in addition the Proposed Development, would require an additional 5 GPs, resulting in a high magnitude of impact on the capacity of existing GP surgeries in Reading.
- 13.23** The cumulative schemes, in combination with the Proposed Development, have been assessed to result in significant effects in relation to the capacity of secondary schools within the Borough. The introduction of new secondary school pupils as a result of the cumulative schemes and the Proposed Development is expected to have a medium magnitude of impact on secondary school capacity resulting in a Moderate Adverse (**significant**) effect.

Chapter 14: Environmental Management, Mitigation and Monitoring Schedule

INTRODUCTION

- 14.1
- Table 14.1 below provides a summary of all the mitigation measures and monitoring commitments detailed within this **ES (Volumes 1-3)**.
- 14.2
- The ways in which the identified mitigation measures and monitoring commitments could be secured is for Reading Borough Council (RBC) to determine. This is stipulated in Section 70(1)(a) of the Town and Country Planning Act 1990 which enables the Local Planning Authority in granting planning permission to impose conditions on the planning permission “as they think fit”. It is recognised that it is good practice for planning conditions to be discussed and agreed between a Local Planning Authority and an Applicant, before they are imposed.

Table 14.1 Mitigation and Monitoring Schedule

Summary of Mitigation Measures / Monitoring Commitments
ES Volume 1, Chapter 4: Proposed Development
Water
Thames Water Utilities Limited (TWUL) will be consulted on the planning application (once submitted to RBC) and may need to carry out flow and pressure tests for daily demand estimations. This will allow TWUL to assess as part of their statutory duty, the available capacity in the local supply network and determine whether any additional mains laying is necessary to support the Proposed Development. Should upgrades be required, TWUL will discuss these with the Applicant and ascertain the costs for the upgrade works and the scheduling of the works to align with the Proposed Development's build programme.
TWUL will be consulted on the planning application (once submitted to RBC) regarding connection to the sewer network. It is likely that TWUL will need to undertake an assessment to determine the capacity of the local network and the point of connection and will identify any requirement to upgrade the local network. Should upgrades be required, TWUL will discuss these with the Applicant and ascertain the costs for the upgrade works and the scheduling of the works to align with the Proposed Development's build programme.
Lighting
The lighting for the primary circulation routes and pedestrian and cycle paths will be designed to direct light inwards towards the site and downwards to avoid unnecessary light spill. Warmer light colour and temperature shall be considered for these areas to reduce the impact on natural surroundings.
The areas for cycle parking will be designed to create a well and uniformly lit environment for the safe parking, storage and retrieval of bikes.
ES Volume 1, Chapter 5: Demolition and Construction
Site Health and Safety
The Main Contractor will carry out their duties in accordance with the Construction Design Management Regulations (CDM). They will ensure that all site personnel have the correct training and qualifications, every site visitor will have a site induction. There will be a programme of toolbox talks for site operatives and the construction works will be tidy and be well maintained with all safety measures in place. Appropriate Personal Protective Equipment (PPE) will be worn by all operatives always when on the construction site.
Enabling Works
The enabling works and site set-up will involve utility diversions and the removal of any asbestos from the existing adjacent occupied buildings. The following pre-commencement surveys and investigations are envisaged:
Condition survey of any adjoining party walls and boundary walls; Structural surveys of existing buildings; Asbestos survey of existing buildings; Topographical survey to confirm existing site levels; Utility surveys to determine the position of any assets; CCTV survey of the surface water and foul water drainage to confirm size and condition; Utility Diversions / Removals; and Consultation with Thames Water Utilities Limited (TWUL) over the need for flow and pressure tests for daily water demand estimations. This will allow TWUL to assess as part of their statutory duty the available capacity in the local supply network and determine whether any additional mains laying is necessary to support the Proposed Development. TWUL will also be contacted regarding connection to the sewer network .Should upgrades or new connections be required, TWUL will discuss these with the Applicant and ascertain the costs for the works and the scheduling of the works to align with the Proposed Development's build programme.
In addition, to the surveys and investigations identified above, various consents and licenses will be required taking into to the consideration the necessary consents and licences required to commence an on-site activity will be applied for giving appropriate notice periods. These may include:
Connections to existing statutory services and main sewer (see above); License for discharge of water from the site into the public sewer if required.
Any required diversions will be implemented in advance of the construction works, in compliance with all statutory notifications and required provisions.
The boundary of the site will be established both at basement level, ground level and at each car park/shopping centre level and 2400mm high hoarding will be constructed around the works. The hoarding will stay fixed in position until handover and the progressive occupation of Buildings A, B and C and D in sequence.
The individual site areas will be hoarded and secured with acoustic Noise Reduction Hoarding panels.
Where scaffolding is erected Mona flex sheeting will be erected around the perimeter of the area, providing screening and protection to site users.
Safe site access and walking routes will be established and maintained for the duration of the works to segregate vehicles and pedestrians. This will be achieved by the installation of a separate fixed barrier. Designated pedestrian routes for construction personnel will also be established within the construction access routes on Hosier Street and Dusseldorf Way.
Demolition Works
The works required will be regularly reviewed with the retail mall owners and management company to ensure that all works are clearly identified with procedures agreed to ensure that the health and safety of all personnel (i.e. visitors, retail workers etc.) using the existing mall is maintained.
Excavation and Substructure Works

Broad Street Mall Chapter 14: Environmental Management, Mitigation and Monitoring Schedule

Piling will be the undertaken via the Continuous Flight Auger (CFA) piling method, which is the quietest form of piling and is a cast in-situ process.
Where groundwater is encountered during any piling operations within the basement to construct the foundations for the tower cores and tower crane bases, dewatering will be undertaken, pumping will be carried out using silently operated pumps. Groundwater sediment/settlement tanks will be utilised with all necessary environmental controls implemented.
Construction Works
Where practical, prefabricated elements (i.e. such as stairs) will be delivered to site, to minimise on-site labour required to erect the cladding, ease logistics, and to optimise/reduce the programme period.
The temporary use of tower cranes for the demolition and construction works would not exceed a height of 60m above ordnance datum (AOD) and would not infringe any safeguarding obstacle limitation surface. Fixed red aeronautical obstacle lighting to the jibs of the tower cranes will be provided. Crane arcs for the tower cranes will be controlled to prevent oversail of the public realm, highways and neighbouring properties.
The building facades will constitute cladding panels. It is envisaged that off-site manufacture of these panels will be utilised as far as reasonably practical with feasibility studies undertaken to test the benefits to programme of lifting in complete floor height units as the frame progresses. The use of off-site manufacture reduces the construction period for the erection of the external envelope and in turn reduced the period of crane time required to erect the structural envelope.
Demolition and Construction – Construction Method Statement
Sitting within the Construction Management Plan (CMP), the Construction Method Statement (CMS) will outline further detail for each of the different activities and procedures to be undertaken to complete the various construction works. The CMS will include the following elements: - Shorter term programmes of the construction works, highlighting the various stages and their context within the project, including a full schedule of materials and manpower resources, as well as plant and equipment schedules; - Details (including plans) of enabling works, including provision of temporary services, utility diversions, and re-alignment/replacement of hoarding; - Details of the transport routes for HGVs; - Detailed site layout and access arrangements, including plans for storage, site office set-up, vehicular movements, site access and egress; - Prohibited or restricted operations (i.e. locations, site working hours, etc.); - Details of operations that are likely to result in disturbance, with an indication of the expected duration of each phase with key dates, including a procedure for prior notification of the RBC and relevant statutory and non-statutory consultees (including neighbours) so that local arrangements can be agreed in advance; - Procedures to ensure communication is maintained with RBC and the local community to provide information on any operations likely to cause disturbance (e.g. through meetings and newsletters); and - Provision for affected parties to register complaints and the procedures for responding to complaints and Considerate Constructors Scheme and the RBC Management Measures.
Construction Waste Generation
100% recycling of inert waste from demolition and construction is targeted. Excavation spoil/material will be 100% reused off site unless contamination is identified, in which case the preferred course of action will be treatment and re-use. Deep landfill or incineration will be utilised as a last resort if necessary. The disposal of waste or other materials removed from the site will be in accordance with the requirements of all relevant legislation, including: - The Environmental Permitting (England and Wales) Regulations 2016; - The Waste (England and Wales) Regulations 2011 (as amended); - Clean Neighbourhoods and Environment Act 2005; and - Contractors would be encouraged to adopt the principals of the Site Waste Management Plans Regulations 2008 (repealed) as good working practice. The detailed CMP prepared by the Main Contractor prior to the commencement of works will describe the measures required to contain the measures and to manage and disposal of the waste. The CMP, in terms of waste management, will contain: - Classification of all wastes; - Performance measures and target setting against estimated waste forecasts; - Measures to minimise waste generation; - Opportunities for reuse and recycling; - Provision for the segregation of waste streams on-site that are clearly labelled; - Recording of proposed carriers and licenses for disposal sites; - An audit trail encompassing waste disposal activities and waste consignment notes; - Measures to avoid fly tipping by others on land being used for construction; - Measures to provide adequate training and awareness through toolbox talks; and - Consider alternative means of removing waste other than by road.
Water Usage
Processes during the construction phases that require large volumes of water supply include mixing (especially relating to concrete), water for washing down and potable water for sanitary facilities for the construction workforce. It is expected that the water supply to the construction site during the demolition and construction works will be provided from the existing Thames Water sources via an application to use an existing water supply for building purposes. The CMP will outline the appropriate strategy for the sustainable management of water use across the site. The CMP will require relevant contractors during the period of works to investigate opportunities to sustainably manage the use of water.
Energy Usage
All relevant contractors will be required to investigate opportunities to minimise and reduce the use of energy to avoid any likely significant adverse effects associated with excessive energy consumption and resulting greenhouse gas emissions.
Hours of Operation

Broad Street Mall Chapter 14: Environmental Management, Mitigation and Monitoring Schedule

The core site working hours for demolition and construction works will be as follows: 08.00 to 18.00 weekdays; 08.00 to 13.00 Saturday; - No working on Sunday or Bank Holidays.
Monitoring, Inspection and Auditing The CMP will define responsibilities and procedures for the management of the potential impacts on the environment arising during the demolition, enabling and construction. A monitoring programme of the environmental effects of demolition and construction will be implemented to agreed RBC requirements. This programme will: - Evaluate the effectiveness of environmental mitigation, and identify environmental problems and appropriate responses at an early stage; - Ensure that the works are carried out in accordance with the provisions of the CMP; and - Identify and implement any environmental improvements that would contribute to the overall environmental performance of the Proposed Development. To ensure that the contractors are adhering to the CMP, the Applicant will require that site inspections and more formal audits would be undertaken, and a checklist pro-forma would be used, which would cover the environmental issues addressed in the CMP. Where a problem is identified, corrective action will be identified and implemented in conjunction with the Site Manager and Main Contractor. It is envisaged that there will be a requirement for regular reporting of monitoring and auditing to RBC, and RBC would be asked to review implementation of the protective measures as necessary during demolition and construction and would have direct access to the monitoring representative to ensure that any non-compliances with the requirements of the CMP are speedily rectified.
Emergency Response and Environmental Incidences Protocols to be implemented on-site in instances of emergencies and environmental incidences will be set out within the CMP for approval by RBC. Before construction works commence on-site, emergency procedures and fire exit routes from the site would be identified within the fire safety plan. Throughout the course of the construction works, these would be regularly inspected and maintained. The fire safety plan would be updated regularly as construction works progress, particularly as areas are progressively completed, and as the means of escape from the evolving buildings change. Fire alarm points and extinguishers would be situated at each floor of the buildings at the stair cores and within main corridors. Site management, operatives and any visitors to the site would undergo an induction to ensure they are briefed on what actions to take in case of an emergency and in case of an environmental incident. There will be several specific health, safety and environmental aspects identified that will need assessing as the design develops. These are especially poignant given the nature of the Existing Mall and the need to keep construction impact away from the shops and shoppers.
Transport The preferred transport routes to and from the site during the construction period for deliveries of materials to the site and for the removal of wastes will be agreed with the RBC prior to commencement of construction works As the site is located adjacent to the A329, it is considered that this would be the preferred route to be used by construction lorries travelling to and from the site. The A329 allows access to strategic arterial roads, such as the M4, and therefore avoid local residential roads. All construction vehicles will access the site via the A329 then into Castle Street. Egress from the site will be from Queens Walk, along Broad Street Mall and connecting to the A329, heading south. This provides access to strategic arterial roads such as the M4. This will allow vehicles to avoid local residential roads. In the event that this egress route from the site is closed, vehicles would egress from the site via Castle Street but would require signals and/or a Marshall. RBC will be consulted prior to the commencement of construction works regarding the provision of direction signage on the surrounding road network to avoid vehicles using inappropriate routes to reach the site.
Neighbour and Public Relations Prior to the start of any construction works, all Retail Tenants will be consulted to ensure that there is no disruption to their stores' deliveries; and no interruption to the public access of their retail units. There will also be regular monthly stakeholder review meetings at which the tenants will be requested to raise any concerns they have during the construction works. Modifications to internal areas within the Existing Mall will be required during the construction works and these will be explained to the retail tenants and the Mall Centre Manager prior to implementation. These modifications will be identified as part of the internal Construction Logistics sequencing. The contractor will endeavour to communicate with adjoining neighbours within the vicinity of the site and the public who may be affected by the works, and wherever possible give notice of forthcoming activities on-site, particularly those that may have an impact on the aforementioned stakeholders. Engagement with the community could be achieved by: - Facilitating regular community group meetings; - Providing specific notices, emails and warning letters regarding ad hoc construction activities, for example, wide loads to be delivered out of hours; - Providing quarterly newsletters on progress and forthcoming activities; and - Engaging with local schools or youth groups to promote joint activities for education on Health and Safety and also site-based learning activities and/or career advice. To ensure that any comments or feedback from the public and neighbours are captured and effectively responded to, a complaints register will be implemented. The register will be held at the site office. All complaints will be recorded for action in the register. Complaints will be responded to in writing within prescribed timescales outlined in the CMP (unless alternatively agreed in writing) and following the appropriate action to mitigate against the causes of the complaint.
General Site Management A 'clean site' policy will be maintained to keep the site clean and tidy internally, and contractors and their subcontractors will be expected to maintain this policy. For example, materials will be stored with care, spills will be cleaned up immediately and various dust mitigation measures will be put in place and managed through the CMP. Staff facilities would be kept clean and maintained in good working order. Waste would be collected regularly, with food waste removed from site daily. Smoking areas would be provided as necessary. They will be located away from sensitive boundaries and neighbouring residences and businesses. Any damage incurred to the public realm and highway will be repaired in conjunction with RBC and Highways Agency requirements. A street sweeper will also be employed as and when required during the demolition, piling and excavation periods to ensure the surrounding streets remain clean during the works.
ES Volume 1, Chapter 6: Socio-Economics
Completed Development

Broad Street Mall Chapter 14: Environmental Management, Mitigation and Monitoring Schedule

The Proposed Development will result in Community Infrastructure Levy payments which could be used by RBC to support and manage the impacts of development by funding infrastructure such as new schools and health infrastructure. Should RBC allocate the CIL payment in this way, this will ensure that local facilities have sufficient capacity to service its expanding population.

ES Volume 1, Chapter 7: Air Quality

Demolition and Construction

- Communications:
 - Develop and implement a stakeholder communications plan that includes community engagement before and during work on-site;
 - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager; and
 - Display the head or regional office contact information.
- Dust Management Plan:
 - Develop and implement a Dust Management Plan (DMP) approved by RBC which documents the mitigation measures to be applied, and the procedures for their implementation and management.
- Site Management:
 - Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
 - Make the complaints log available to RBC when asked;
 - Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book; and
 - Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
- Monitoring:
 - Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary;
 - Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked; and
 - Increase the frequency of site inspections by the person accountable for air quality and dust issues on-site when activities with a high potential to produce dust area being carried out and during prolonged dry or windy conditions.
- Preparing and Maintaining the Site:
 - Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
 - Erect solid screens or barriers around dusty activities or the site boundary that are as at least as high as any stockpiles on-site;
 - Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
 - Avoid site runoff of water or mud;
 - Keep site fencing, barriers and scaffolding clean using wet methods;
 - Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on-site. If they are being re-used on-site cover as described below; and
 - Cover, seed, or fence stockpiles to prevent wind whipping.
- Operating Vehicle/Machinery and Sustainable Travel:
 - Ensure all vehicles switch off their engines when stationary – no idling vehicles;
 - Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable;
 - Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- Operations:
 - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
 - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
 - Use enclosed chutes, conveyors and covered skips;
 - Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
 - Ensure equipment is readily available on-site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Waste Management:
 - No bonfires and burning of waste materials.
- Measures Specific to Demolition:
 - It is desirable to soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
 - Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground;
 - Avoid explosive blasting, using appropriate manual or mechanical alternatives; and
 - Bag and remove any biological debris or damp down such material before demolition.
- Measures Specific to Construction:
 - Avoid scabbling (roughening of concrete surfaces), if possible;
 - Ensure sand and other aggregates are stored in banded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
 - Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
 - It is desirable for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
- Measures Specific to Trackout:
 - Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
 - Avoid dry sweeping of large areas;

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- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable; - Record all inspections of haul routes and any subsequent action in a site log book; - Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems or mobile water bowsters, and regularly cleaned; - Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable); - Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; and - Access gates should be located at least 10 m from receptors, where possible.
ES Volume 1, Chapter 8: Noise and Vibration
Demolition and Construction
Best Practicable Means (BPM) will be used by the principal contractor to minimise nuisance from noise and vibration.
The noise and vibration control measures to be implemented on-site should be captured within a construction management plan (CMP).
General noise and vibration control measures are listed, with reference to British Standard (BS) 5228 'Code of practice for noise and vibration control on construction and open sites', Part 1: Noise (+A1:2014), and Part 2: Vibration (+A1:2014). This will include the following measures: • Construction will be confined to the permitted hours as set out in the CMP; • Loading/unloading activities will be located away from residential properties and shielded from those properties, where practicable; • Materials will be handled in a manner that minimises noise and drop heights of materials will be minimised; • Careful selection of plant and construction methods. Only plant conforming to relevant national, EU or international standards, directives and recommendations on noise and vibration emissions will be used. The Principal Contractor will ensure that each item of plant used on the project complies with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701 (as amended). The Principal Contractor's Environmental Manager will maintain a register of plant and equipment and statutory certification; • Design and use of acoustic screening measures where practicable and necessary, at the earliest opportunity to meet the noise limits within the CMP. Acoustic screening measures include site hoardings, acoustic barriers, acoustic enclosures, acoustic housing for plant and temporary stockpiles. Such measures can be particularly appropriate for stationary or near-stationary plant such as pneumatic breakers, piling rigs and compressors. Barriers will be located as close to the plant as possible and, in order to provide adequate attenuation, and must have a mass per unit area of at least 7 kg/m2; • All vehicles and mechanical plant used for the purpose of the work will be fitted with effective exhaust silencers and shall be maintained in good and efficient working order and operated to minimise noise emissions; • All compressors and generators will be "sound reduced" models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers; • All machines in intermittent use will be shut down in the intervening periods between works or throttled down to a minimum. Lorry engines will be switched off when vehicles are stationary. Noise emitting equipment which is required to run continuously will be housed in a suitable acoustic enclosure; • Plant and equipment liable to create noise and/or vibration whilst in operation will, as far as reasonably practicable, be located away from sensitive receptors and away from walls which could reflect noise towards sensitive receptors; • Where reasonably practicable, fixed items of construction plant will be electrically powered in preference to diesel or petrol driven; • Vehicles will not wait or queue on the public highway with engines idling; construction traffic movements will be undertaken in accordance with the Construction Traffic Management Plan ("CTMP"); • All appropriate contractor personnel will be instructed on BPM measures to reduce noise and vibration as part of their induction training, and followed up by 'tool box' talks; • Noisy activities will be staggered in time and space where feasible; • Only designated access routes (on-site) will be used; • Reversing alarms incorporating one of more of the features listed below or any other comparable system will be used where reasonably practicable: - Highly directional sounders; - Use of broad band signals; - Self-adjusting output sounders; - Flashing warning lights; and - Reversing alarms will be set to the minimum output noise level required for health and safety compliance. • All site personnel will receive training appropriate to the nature of their roles and responsibility; the training will include specific information in relation to noise and vibration management. If their work activities are assessed as being particularly noise/vibration emission prone all staff will receive induction training that will incorporate environmental awareness training, plus specific training in relation to noise and vibration. • For piling activities, where practicable, piles should be installed by continuous flight auger or vibratory piling. Where necessary, mitigation to reduce vibration levels (in particular, that associated with piling) at receptors near construction works should include consideration of: - Use of alternative methods; - Removal of obstructions; - Provision of cut-off trenches; - Reduction of energy input per blow; - Reduction of resistance to penetration, including mudding in for rotary bored piles; and adding water to the bore hole for impact bored piles; - Excavation under support fluid; - Removal of the plug when using casing vibrators; - Bottom-driving; and - Use of variable moment vibrators. • Where noisy activities are to take place in close proximity to the exiting mall, the following is recommended to reduce occupants' exposure to high noise levels: - Internal shuttering/screening to the facade to reduce the internal noise levels; - Zoning to prevent occupants accessing areas where noise levels are high for a specific activity.
Completed Development
In locations where the Building Regulations Approved Document O (ADO) criteria are exceeded, during periods of overheating, mechanical means of overheating mitigation shall be provided. A suitable overheating mitigation strategy will be developed and agreed with RBC through discharge of relevant planning condition/s relating to this aspect of the detailed design.
Noise mitigation measures may be required to building services plant to meet the plant noise emission limits. The required measures will be developed and agreed with RBC through discharge of relevant planning condition/s relating to this aspect of the detailed design..
To control the noise level on the terraces to meet the BS 8233:2014 upper limit, solid balustrades would be required around the perimeter of the terraces. The required mitigation measures will be developed and agreed with RBC through discharge of relevant planning condition/s relating to this aspect of the detailed design.

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ES Volume 1, Chapter 10: Wind Microclimate
During construction works, the areas under construction will be hoarded off until the point where the building becomes occupied. For the design of the Proposed Development, additional trees and hedges were proposed on the podiums between Building A and B and Building B and C, and on the roof terrace of Building B. These have been captured on the landscape plans submitted with the Planning Application.
ES Volume 3
Appendix: Ground Conditions – Annex 1
The site requires further evaluation by carrying out a geotechnical ground investigation in order to assess the risk of instability due to soluble rock and from ground gas. The following recommendations are made to address the risks and remaining uncertainties: • Shallow boreholes – to determine shallow ground conditions and allow assessment (through sampling and testing) of near surface soils and enable the installation of gas monitoring wells. • Deep boreholes – to determine deeper ground conditions and geotechnical properties of the underlying bedrock for piled foundation design, in particular relating to potential instability associated with underlying chalk. • Ground gas assessment – to determine the ground gas regime beneath the site and assign a characteristic situation.
Appendix: Ecology – Annex 1
Where the proposed works require the removal of ledges within the basement or works to the facades of the buildings with potential to support nesting feral pigeons, this must be preceded by a nesting bird check completed by a suitably qualified ecologist within 48 hours of the works, to confirm the absence of nesting feral pigeons. Should they be present, the nest and a suitable buffer of habitat around it must be retained until the young have left the nest. A licenced pest control contractor specialised in the removal of pigeons may be contacted to provide further advice, as they may be able to facilitate the removal of feral pigeons prior to works under a licence.
In the unlikely event that any protected species are found during construction, works must stop immediately and advice sought from a suitably qualified ecologist on how to proceed
In accordance with British Standard BS 5837:2012 care should be taken to avoid impacts on mature tree adjacent to the site
Ongoing monitoring may be required to ensure that the invasive non-native species – butterfly bush, does not recolonise the site.
Appendix: Archaeology – Annex 1
Although the precise details would need to be agreed with the local authority's archaeological advisor, it is suggested that the most appropriate investigation strategy would be targeted archaeological evaluation if necessary to confirm the presence, nature and significance of archaeological remains. This would in turn enable an informed decision to be made in respect of an appropriate mitigation strategy for any significant archaeological assets, such as targeted excavation, and / or a watching brief during ground works for remains of lesser significance. This would ensure that significant archaeological assets are not removed without record.
Any archaeological work would need to be undertaken in accordance with a Written Scheme of Investigation (WSI) and could be carried out under the terms of a standard archaeological planning condition set out with the granting of planning consent.
Appendix: EIA Methodology – Annex 1 (EIA Scoping Document)
Sediment in Runoff
The following mitigation measures for sediment in runoff will be embedded within the CMP and implemented during the site works: • Site access points will be regularly cleaned to prevent build-up of dust and mud. • Earth movement will be controlled to reduce the risk of construction silt combining with the site surface water runoff. • Properly contained wheel wash facilities will be used where required, to isolate sediment rich runoff. • Drainage of surface runoff and de-watering effluents to settling tanks to remove suspended solids prior to discharge to sewer or removal by a suitably licensed waste operator.
Leaks and Spillages of Contaminants
The following measures will be implemented, where possible: • Implementing control procedures during delivery or movement of service materials. • The drainage system will have cut-off measures that will allow a spill to be contained within the site, so that it can be effectively controlled and managed without leading to off-site effects. • An Emergency Response Plan will be put in place. • Education / information on waste treatment / emergency events/spills etc. can be provided to the building servicing staff and building occupants as appropriate • Oil interceptors would be used in association with the drainage network in high-risk areas to reduce the potential risk for contamination. • The appropriate utility company would be consulted on the potential requirement for an oil interceptor at the point where site surface water runoff enters the combined sewer.
The following mitigation measures will be embedded within the CMP and implemented during the site works: • Spillages and leakages will be immediately contained in line with an emergency response plan and managed through the use of geotextile bunding of adequate capacity (110%) to isolate and minimise the ingress of surface water runoff to non-decommissioned boreholes or exposed surface water drainage pipes. Valves and trigger guns will be protected from vandalism and kept locked when not in use. • An emergency spillage action plan will be produced, which site staff will have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material. • Wherever possible, plant and machinery will be kept away from the drainage system and will have drip trays beneath oil tanks/engines/gearboxes/hydraulics which will be checked and emptied regularly via a licensed waste disposal operator. • Following the discharge of surface runoff and de-watering effluents to settling tanks the drainage would be routed to oil interceptors prior to discharge to sewer. • The majority of concrete used will be pre-mixed and delivered from an off-site source, thereby negating the need to mix concrete on-site and reducing the creation of alkaline wastewater. Any mixing and handling of wet concrete on-site will be undertaken in designated impermeable areas, away from any drainage channels or surface water. • A designated impermeable area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and wastewater will be discharged to the foul drainage system (with approval from TWUL) or contained and removed by tanker to a suitable discharge location by a suitably licenced waste operator.

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The proposed drainage/service runs will be surrounded by appropriate granular bedding materials and located above the static level of any shallow groundwater. The drainage network installed as part of the Proposed Development will be constructed to meet with Building Regulations 2000, Part H.
All liquids and solids of a potentially hazardous nature (e.g. diesel fuel, oils and solvents) are to be stored in designated locations with specific measures to prevent leakage and release of their contents, include the siting of storage area away from surface water drains, on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain 110% of the contents, in accordance with the EA's requirements. Any tanks storing more than 200 litres of oil on-site, would have secondary bunding. All storage will be protected from vandalism and kept locked up when not in use. Wherever possible, plant and machinery will have drip trays beneath oil tanks/engines/gearboxes/hydraulics, which will be checked and emptied regularly via a licensed waste disposal operator. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material in accordance with an Emergency Response Plan (ERP).
Refuelling and delivery areas will be located away from the local sewer network drains.
Disturbance of Existing Drainage Systems and Water Supply Network
The following mitigation measures will be embedded within the CMP and implemented during the site works: - All existing utilities will be identified and marked prior to works commencing. - Signs will be used to warn of the presence of utility infrastructure. - Any damage to the drainage network will be immediately repaired.
Groundwater Flow and Quality
The preparation of a Piling Method Statement which will detail the depth and type of piling to be undertaken and the methodology by which such piling will be carried out, including measures to prevent and minimise the potential for damage to subsurface sewerage and water infrastructure and to demonstrate appropriate design and piling methods to avoid linking shallow and deep groundwater.
The following mitigation measures will be embedded within the CMP and implemented during the site works: - Pile casing will be used during piling and the area around the piling will be isolated from surface water until piling is complete. - Any existing boreholes found on-site would be decommissioned. - If perched groundwater is encountered during establishment of basement and core foundations dewatering may be required. The most appropriate methods to dewater excavations will be selected, for example, prior to dewatering the perimeter of the excavation could be enclosed with either sheet-pile or a diaphragm wall. Piezometers (standpipes) could then be placed outside the sheet pile wall to monitor groundwater levels. - In the event that ground contamination is discovered, work will stop immediately and measures will be taken to prevent disturbance and mobilisation of contaminants, until the contamination has been treated in-situ or removed for off-site disposal or treatment. - If contaminated soils are encountered at the position where piling is due to be undertaken, then these materials should be removed prior to piling in order to prevent the dragging of contaminated soils with the piles to depth. - Contaminated soil requiring disposal will be excavated and kept separate from other soil and waste materials in protected temporary stockpiles prior to disposal. - Water arising from excavations will be disposed of to the local sewer network (subject to agreement with the appropriate authority) if uncontaminated and following the removal of silt via settlement ponds or alternative measures. All existing utilities will be identified and marked prior to works commencing. - Damp-proof membranes will be incorporated into the construction. These membranes will prevent the ingress of groundwater and reduce the risk of contaminants from reaching underground strata or groundwater. The watertight basement will therefore prevent any interior leaks or spillages from freely percolating into the shallow groundwater.
Appropriate methods to dewater excavations are to be selected to ensure that groundwater does not drop below the critical level. Groundwater level monitoring will be undertaken as necessary to assess deformation and stability of surrounding structures, including neighbouring property.
Seepage analysis and groundwater level monitoring will be carried out as appropriate to assess deformation and stability of surrounding structures, including neighbouring property, as considered necessary.
Temporary Settlement and Surface Water Drainage
Temporary drainage facilities will be provided during the construction phase, where necessary, to ensure controlled discharge of surface water runoff.
It will be a requirement to ensure that runoff from the site does not cause pollution or flooding. Measures that will be considered for implementation for temporary drainage through the construction design and/ or CMP include: Site access points will be regularly cleaned to prevent build-up of dust and mud: - Oil interceptors to be installed (notably the outflow from the settlement pond/ tank) to reduce the potential risk for contamination of groundwater and surface water. - All potentially polluted waters (including washdown areas, stockpiles and other areas of risk for water pollution) to have separate drainage and to be tankered away from the site.
If monitoring demonstrates unsatisfactory levels of solids or other pollutants, measures will be implemented to control suspended solids or other polluted discharge to watercourses (e.g. changes to site drainage and settlement facilities and/or use of flocculants).
Foul Drainage
A connection to the foul sewer will be needed for sanitary connection from offices/admin/welfare facilities. It is possible this connection may also be licensed for discharge of process effluent in abnormal circumstances if required.
Flood Risk
The CMP will incorporate measures to prevent an increase in flood risk or pollution during the construction works, in addition to the provision of temporary settlement and drainage measures (where required).
Water Demand
The following measures will be implemented: - Selection and specification of equipment to reduce the amount of water required. - Implementation of staff-based initiatives such as turning off taps, plant and equipment when not in use both on-site and within site offices. - Use of recycling water systems such as wheel washes, site toilets hand wash.

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• Use of a rainwater harvesting system for use in equipment and vehicle washing.
The water consumption throughout the construction works will be monitored, either through sub-metering or reading of utility bills, to allow comparison against best practice benchmarks and improvements to be made.
Wastewater Generation
The installation of water efficient fixtures and fittings can help further reduce the volume of foul water generated on-site.
Any waste effluent will be tested and any water that may have come into contact with contaminated materials or be identified as being contaminated, will be disposed of appropriately and, to the satisfaction of the EA and/or TWUL; and where necessary, disposed of at the correctly licensed facility by a licensed specialist contractor/s.