



Connected Living London

ARMOURER'S COURT

EIA Scoping Report



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Connected **Living London**

ARMOURER'S COURT

EIA Scoping Report

WSP

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APPENDICES

APPENDIX A

PROPOSED STRUCTURE OF THE ENVIRONMENTAL STATEMENT

APPENDIX B

ARCHAEOLOGY PLANS

APPENDIX C

PRELIMINARY ECOLOGICAL APPRAISAL

1. INTRODUCTION

1.1. OVERVIEW

- 1.1.1. Connected Living London (the 'Applicant') is in the process of preparing a full planning application to the Royal Borough of Greenwich (RBG) proposing the construction of a residential-led development off Arsenal Way, Woolwich (the 'Site'). The Site is associated with Crossrail, being designed as an Over-Site Development (OSD) for the Proposed Crossrail Woolwich Station central box. Design evolution is ongoing in consultation with key stakeholders and consultees. The development of the Site is expected to provide up to approximately 515 residential units and non-residential floor space (up to approximately 1,000 sq m) in the form of a series of buildings surrounding a central landscaped podium (the 'Proposed Development').

The anticipated approximate application boundary of the Site is shown in Figure 1-1. The Site is situated within proximity to Woolwich Arsenal Docklands Light Rail (DLR) and National Rail Station and is located approximately 400m south of the River Thames. The Site is bound by Plumstead Road (A206) to the south, Arsenal Way to the west, Cornwallis Road to the east and Gunnery Terrace industrial facility to the north. Buildings from the IO Centre industrial estate are located to the north, east and west. The Site Location plan, showing how the Proposed Development is sited within the wider environment is shown in Figure 1-2. Further details and a description of the Proposed Development and existing Site can be found in Section 2 of this Scoping Report.

- 1.1.2. It is understood that the advice that is provided within the Scoping Opinion that is due to be issued by the Royal Borough of Greenwich will be valid for any forthcoming planning scheme that remains materially the same as the Proposed Development described in this report.

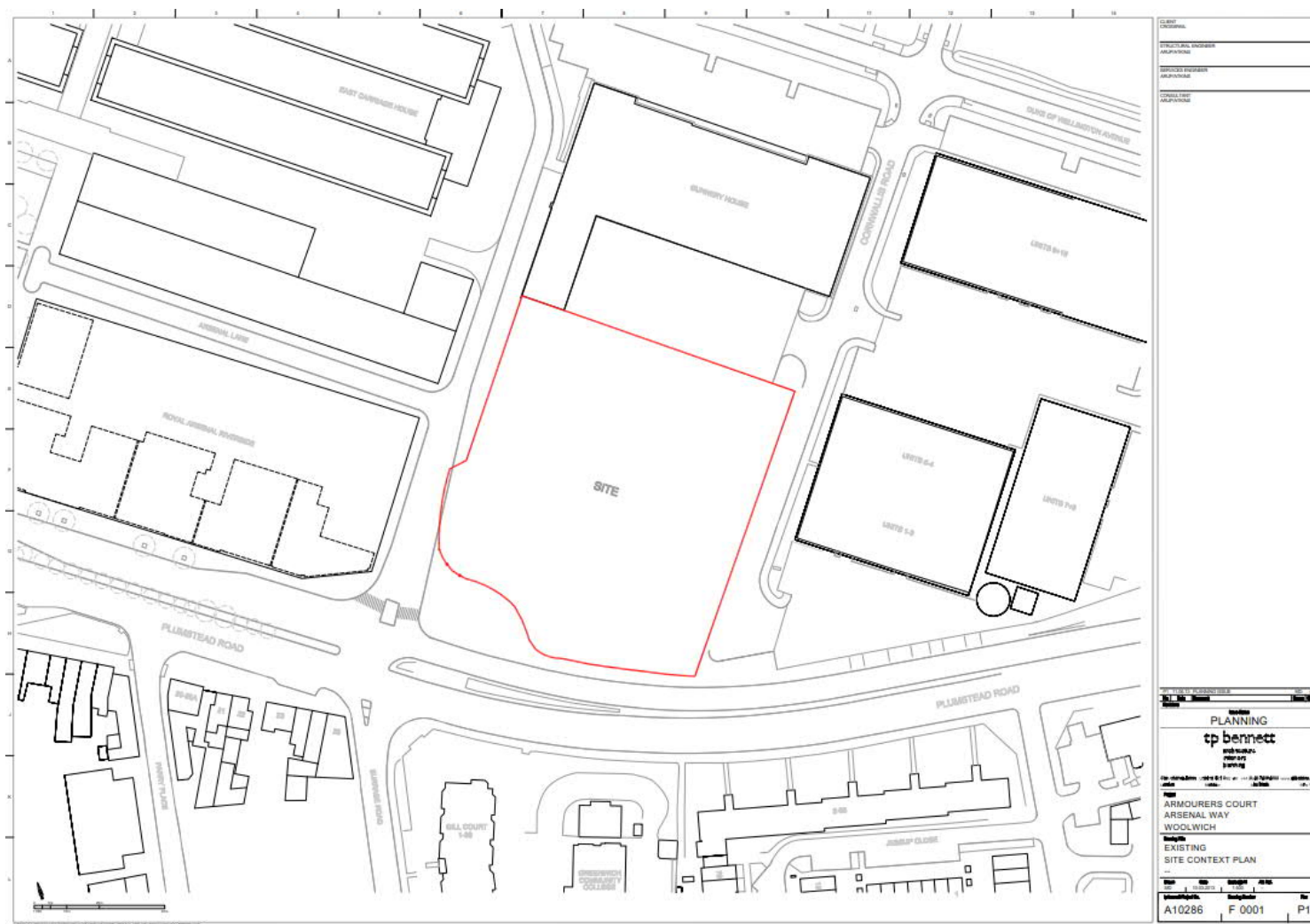


Figure 1-1 - Site Red Line Boundary

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- 1.1.3. The Applicant is committed to delivering a development of the highest quality which aligns with the aims of their vision and development strategy. These comprise:
- Maximising overall housing delivery in highly accessible and sustainable locations;
 - Maximising affordable housing delivery;
 - Providing tenure and unit size mix which is genuinely affordable and contributes to local housing need;
 - Delivering new homes fast; and
 - Creating long-term sustainable income for TfL to reinvest in the transport network.
- 1.1.4. It is also expected that the Proposed Development will demonstrate consideration of RBG policy such as:
- Respond to, and build upon, the development of the urban context that the Royal Arsenal proposes;
 - Adopt the urban design principles to which the RBG aspires for new developments; and
 - Improve the quality of streetscape, commercial, retail and residential opportunities to enhance the gateway from Royal Arsenal Station to the wider area or Woolwich.
- 1.1.5. To achieve these aims and objectives the Applicant have employed a full Project Team. WSP have been commissioned to undertake the role of Lead Environmental Impact Assessment (EIA) consultant. In addition to this WSP are providing the following environmental technical services:
- Air quality;
 - Ecology;
 - Ground conditions;
 - Noise and vibration;
 - Water Resources and Flood Risk;
 - Socio-Economics;
 - Telecommunications;
 - Aviation;
 - Archaeology;
 - Arboriculture;
 - Climate;
 - Health;
 - Major Accidents and Natural Disasters; and
 - Wind (microclimate).
- 1.1.6. The full project team has been listed below:
- Project Managers - Arcadis;
 - Cost Consultant – Stace LLP;
 - Planning Consultant – DP9;
 - Architect - TP Bennett;
 - MEP/Utilities/Energy Sustainability – Hoare Lee;
 - Public Spaces/Townscapes, Built Heritage. Townscape and Visual Impact Assessment Consultant – Arc;
 - Verified Views – Hayes Davidson;
 - Communications – Lowick;
 - Fire Engineer – Hoare Lee;

- Structures – Buro Happold;
- Viability Consultant – Savills;
- Daylight, Sunlight and Overshadowing – GIA;
- Neighbourly Matters – GIA;
- Landscape Consultant – Fabrik;
- Traffic and Transport Consultant – Aecom; and
- Sustainability Strategy – Mott McDonald.

1.1.7. The Full Planning Application will be supported by a suite of application reports including an Environmental Statement (ES) that will report the assessment of likely significant environmental effects of the Proposed Development in line with the scope contained herein and subject to consultation with RBG and relevant stakeholders.

1.1.8. At the time of issue, the design of the Proposed Development is still evolving, however the key components are as follows:

- A development comprising a series of buildings with a maximum height of 26 storeys plus plant (80m).
- Residential provision of up to approximately 515 residential units.
- Approximately 1,000sq m non-residential floor space (likely use Classes A1-A4, B1, D1 and D2).
- Parking facilities comprising 20 blue badge spaces and two standard spaces for the station maintenance team, which is an agreed provision with Crossrail.
- There is ongoing investigation into alternatives to high efficiency gas boilers, including connection to the district heating system and Air Source Heat Pump systems.
- There will be no accommodation below ground, with below ground structures likely limited to lift pots, drainage and service trenches.

1.2. PLANNING HISTORY

1.2.1. The Site was previously subject to planning permission, approved in 2015 (Ref 13/3307/F) for the construction of a similar development, providing a mix of private mark-for-sale housing and affordable housing. This extant permission is still live at the time of issue of this Scoping Report. The development is given the following description in the 2013 ES:

“an Over Site Development above and around the east ventilation and services building at Woolwich Crossrail station, comprising five buildings varying in height from 10 to 25 storeys around a central landscaped podium, to provide 394 residential units, 734 square meters of commercial flood space (Use Classes A1-A4, B1, D1 and D2), all with associated car parking, access, servicing and landscaping”.

1.2.2. The Proposed Development is a design evolution of this previous development. While the site area remains the same, the quantum of the development has been modified with unit numbers increasing from 394 to approximately 515.

1.2.3. The Site is associated with Crossrail, being designed as an Over-Site Development (OSD) for the Proposed Crossrail Woolwich Station.

1.2.4. The Site is within an area which was previously occupied by a car park and the Gunnery Terrace building which has listed status. These buildings were previously demolished as part of the Crossrail development of the Crossrail Woolwich Station central box.

- 1.2.5. The Royal Arsenal Riverside Waterfront Masterplan is a major phased mixed-use residential development currently under construction in close proximity to the Site. The masterplan area extends from the River Thames to within 200m west of the Site. Construction of plot A (the northern component) of the development is underway after receiving planning permission in 2016. The completed development will provide a green corridor with pedestrian access from Woolwich Arsenal to the River Thames.

1.3. DEFINITION OF AN EIA

- 1.3.1. The term 'EIA' describes a procedure that must be followed for certain types of project before they can be given 'development consent'. The procedure is a means of drawing together, in a systematic way, and assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects and the scope for reducing them are properly understood by the public and the relevant local planning authority before it makes its decision. The aim of EIA is to:

*"to protect the environment by ensuring that a local planning authority when deciding whether to grant planning permission for a project, which is likely to have significant effects on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision-making process"*¹.

1.4. REQUIREMENT FOR EIA

- 1.4.1. The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') require that, before consent is granted for certain types of development, an EIA must be undertaken to identify any likely significant effects of the development and mitigation, where appropriate. The EIA Regulations set out the types of development which must be subject to an EIA (referred to as Schedule 1 development) and other developments, which may require assessments if they give rise to significant environmental effects (referred to as Schedule 2 development).
- 1.4.2. The Proposed Development does not fall under any of the types of development set out in Schedule 1 of the EIA Regulations. However, it may be considered to constitute 'Schedule 2' development, if judged to qualify as an 'Urban Development Project' in accordance with Section 10(b) of the EIA Regulations. A development is considered to fall within Schedule 2 if:
- Any part of the development is to be carried out in as sensitive area; or
 - Any applicable threshold or criterion in the corresponding part column 2 of the table in Schedule 2 is exceeded or met in relation to the development. These comprise:
 - The development includes more than 1 hectare (ha) of urban development which is not a dwellinghouse development; or
 - The development includes more than 150 dwellings; or
 - The overall area of the development exceeds 5ha.

¹ Planning Practice Guidance (PPG) Online Tool, Paragraph 032. Reference ID: 4-032-20170728 [online] Available at: <https://www.gov.uk/guidance/environmental-impact-assessment#Sensitive-areas> Accessed: October 2019

- 1.4.3. The total site area is approximately 0.84ha, and is not in a sensitive location, but constitutes more than 150 dwellings and therefore exceeds this threshold in Schedule 2 10(b). As such, the Applicant has elected to submit an ES to accompany the Full Planning Application, in which the likely significant environmental effects of the Proposed Development will be reported.
- 1.4.4. A full description of the Proposed Development, including demolition/site clearance and construction elements will be set out in the ES, to enable the likely significant effects of the temporary construction, and permanent operations effects to be assessed.
- 1.4.5. The emerging Proposed Development is described in Section 2.1.

1.5. REQUEST FOR AN EIA SCOPING OPINION

- 1.5.1. WSP have been commissioned by the Applicant, to coordinate and undertake the EIA to accompany the proposed full planning application to be reported in the ES in accordance with the EIA Regulations.
- 1.5.2. This document sets out the proposed scope and methodologies of the technical assessments of the EIA, and requests an EIA Scoping Opinion from RBG under Regulation 15 of the EIA Regulations to seek agreement to the approach and scope of the EIA to be reported in the ES. This EIA Scoping Report therefore reviews all the environmental disciplines identified in Part 1 of Schedule 4 of the EIA Regulations as is reasonably required to assess the likely significant environmental effects of the application based on the description of the Proposed Development and informed by the planning history.
- 1.5.3. WSP request that RBG provide a Scoping Opinion within five weeks of receipt of this request following discussion with the appropriate consultation bodies. There is a requirement under Regulation 15(4) of the EIA Regulations for RBG to consult with key statutory bodies identified in the regulations. This enables all parties to agree the key issues and proposed methodologies to be included in the ES as part of the formal Scoping process. The EIA Scoping Opinion will then be adopted by the Applicant for the preparation of the ES to accompany the planning application.

1.6. PURPOSE OF THIS SCOPING REPORT

- 1.6.1. In preparing this Scoping Report, the National Planning Practice Guidance (NPPG) 'Environmental Impact Assessment'² (2019) has been considered which states that *"if required, they [an EIA] should limit the scope of assessment to those aspects of the environment that are likely to be significantly affected"*. In addition, the NPPG promotes proportional EIA in so far as the ES should be proportionate and not be any longer that is necessary to assess properly those effects. The NPPG also states that *"Impacts which have little or no significance for the particular development in question will need only very brief treatment to indicate that their possible relevance has been considered."*

² Ministry of Housing, Communities and Local Government (2019). Environmental Impact Assessment Guidance. Available at: <https://www.gov.uk/guidance/environmental-impact-assessment> Accessed: October 2019

1.6.2. Table 1-1 below confirms the details provided in this Scoping Report informed by EIA Regulation 15.

Table 1-1 – Information Provided as part of the Scoping Report

Information	Location in this Scoping Report
A plan to sufficiently identify the land	Figure 1.1
A brief description of the nature and purpose of the development, including its location and technical capacity.	Section 2
An explanation of the likely significant effects of the development on the environment.	Sections 5-17

1.6.3. In addition to the above, Regulation 15 of the EIA Regulations also requires ‘*such other information or representations as the person making the request may wish to provide or make*’. Such other information provided in this Scoping Report is outlined below in Table 1-2.

Table 1-2 – Additional Information provided within this Scoping Report

Information	Location in this Scoping Report
An overview of the conditions present on Site and in the surrounding area, together with a brief overview of the relevant planning history and policy context.	Section 2
Scope of the proposed application reports to be submitted.	Section 3.11
The proposed approach to the EIA and an appraisal of the key environmental issues to be covered in the EIA (‘scoped in’) and the issues not requiring further consideration (‘scoped out’) in the context of the key legislative and policy documents and Part 1 of Schedule 4 of the EIA Regulations 2017 as is reasonably required to assess the likely significant effects of the development.	Sections 3 and 4
Outlines the scope and assessment methodology (including the significance criteria to be adopted) for assessing the likely significant environmental effects to be employed for each respective discipline to be reported in the ES.	Section 3 and Sections 5-16
List of known committed developments for purposes of cumulative assessment.	Section 17
The proposed structure and format of the ES which will comprise three Volumes (1 – Environmental Statement Text and Figures; Volume 2 – Technical Appendices; Volume 3 – Townscape and Visual Impact Assessment and Volume 4 – Non-Technical Summary).	Appendix A
Previous Archaeological Assessment of the Site	Appendix B

1.7. STRUCTURE OF THE EIA SCOPING REPORT

1.7.1. The EIA Scoping Report has been structured as follows:

- Section 2 – Provides a description of the Proposed Development, the Site and the surrounding environment, which represent the baseline conditions;
- Section 3 – Provides an overview of the proposed approach to the EIA;
- Section 4 – Outlines the environmental topics which are considered not significant at this stage and will not form part of the EIA;
- Section 5-17 – These are the environmental topics which are considered potentially significant at this stage;
- Section 18 – Outlines the proposed methodology for the assessment of cumulative effects, comprising both effect interactions and in-combination effects;
- Appendix A – Proposed Structure of the Environmental Statement; and
- Appendix B – Record of Consultation Log.

2. BACKGROUND AND CONTEXT

2.1. DESCRIPTION OF THE PROPOSED DEVELOPMENT

- 2.1.1. The design of the Proposed Development is still evolving; however, key components of the design as they currently stand are described within this section.
- 2.1.2. The Proposed Development is expected to provide approximately 515 residential units and additional non-residential floor space (approximately 1,000sq m) in a series of buildings surrounding a central landscaped podium. The Proposed Development is centred around the station box of Crossrail's Proposed Woolwich Station which creates a divide in the middle of the Site.
- 2.1.3. The Proposed Development surrounds a single storey (6.5 m high at the southern extent, rising to 7.5m high to the north as the ground falls away south to north) station building and OSD podium containing station plant and tunnel ventilation equipment (the top of the vents is a further 6.5m above the building). This block, which occupies the centre of the site for almost the entire site width between Arsenal Way and Cornwallis Road, is topped by a proposed private garden that will serve as the main amenity space for the over site residential development.
- 2.1.4. The residential buildings will be arranged around this centralised amenity space. There will be vents and shafts within the amenity space to enable the operation of the railway below. The proposed amenity space will be linked to ground level by a series of stepped, planted, ramps which separate the buildings and provide a visual and, in some secure locations a physical connection, between ground level and the raised garden.
- 2.1.5. Locations of each of the proposed buildings are yet to be finalised, however, it is expected that they will be arranged with up to three in the northern part of the Site, and up to two in the southern part of the Site. It is expected that the main point of access to the Proposed Development would be from the west, off Arsenal Way. However, access plans are still being finalised.
- 2.1.6. Current car parking provision allows for 20 blue badge spaces with two standard spaces which will be allocated for the Crossrail station maintenance team. The provision of these two standard spaces has been previously agreed with Crossrail.
- 2.1.7. The Site covers an area of approximately 0.84 ha. Building heights are not expected to exceed 25 storeys plus plant, which is no higher than the previous application for the Site, which was granted planning permission. The five residential towers will be the tallest structures of the Proposed Development.

2.2. THE SITE AND SURROUNDINGS

THE SITE

The Site is located north of Plumstead Road (A206), the boundary between Woolwich and the Royal Arsenal Riverside site (Figure 1-2). The Site is bound by the A206 to the south, Arsenal Way to the west, Cornwallis Road to the east and Gunnery Terrace industrial facility to the north. Positioned in an industrial estate, industrial buildings surround the site to the north, east and west. The Site is approximately 400m south of the River Thames and 250m north-east of Woolwich Arsenal railway station. The Site is currently part of the construction site for the Crossrail Woolwich station.

- 2.2.1. Plumstead Road (A206) is the major infrastructure connection to the Site. The road links Woolwich to Greenwich (and Blackwell Tunnel) to the west and Dartford Crossing to the east. Arsenal Way is one of the primary vehicular entrances into the Royal Arsenal site. Both of these roads see significant congestion during peak times. Cornwallis Road is a service road to industrial units to the east of the Site, being used primarily by commercial vehicles.
- 2.2.2. The existing Site is currently a construction compound, which has been used to construct the Woolwich Crossrail station. Structures which were historically on the Site have been demolished and the site cleared to facilitate the station development, with the central part of the Site sitting on the Crossrail station box.
- 2.2.3. The Site is located within the Royal Arsenal Conservation Area. The conservation area includes multiple listed buildings, located mostly to the west and north of the Site. The urban character of the surrounding area of the Royal Arsenal is a mixture of industrial units and varying types of residential properties (modern and traditional). South of the A206/Plumstead Road the character is significantly different, comprising of traditional housing units, commercial services, a primary school and the railway. These two areas are significantly separated from one another by the A206 and junctions.
- 2.2.4. The Site is entirely located within the Greenwich AQMA, designed by RBG for the exceedance of nitrogen dioxide (NO₂) and particulate matter (PM₁₀).
- 2.2.5. The Site itself is in Flood Zone 1, and considered at a very low risk of surface water flooding. However, it is within 1km of the River Thames and borders a Flood Zone 3 area.

THE SURROUNDING AREA

- 2.2.6. There are no statutory listed buildings within the Site, however there are a number within the vicinity of the Site. The closest statutory listed building to the Site, the Royal Arsenal Middle Gate and its attached boundary wall (to the west), are both Grade II listed, and lie close to the site, in front of Plumstead road. There is a group of 16 listed buildings to the west of the Site. In the western part of the Royal Arsenal, focused around No.1 Street. This group includes 3 highly graded buildings: the Brass Foundry (listed Grade I), which dates from 1716.17, and was potentially designed by Sir John Vanbrugh; as well as the Dial Square Entrance Range, and the Board Room (both listed Grade II*). To the north of the Site, north of Cadogan Road, there is another Grade II* listed building, the Grand Store. There are no registered parks and gardens within the Site within 1km of the Site.
- 2.2.7. The site is within the Royal Arsenal Conservation Area, designated in 1981. The Royal Arsenal was Britain's largest and most important centre for manufacturing military equipment and munitions from 1671 until 1994, when the last military personnel left. Many of the buildings in the Royal Arsenal are listed, details of which are provided within this report. The area has undergone significant regeneration and now includes Firepower (the Royal Artillery Museum) and the Greenwich Heritage Centre, as well as new housing by Berkeley Homes in large new buildings as well as converted historic buildings. There are three other conservation areas within a 1km radius of the centre of the Site. These include the recently designated (May 2019) Woolwich Conservation Area, which lies some 210m to the west of the Site, as well as the Plumstead Common and Woolwich Common Conservation Areas.
- 2.2.8. London City Airport (LCA) lies approximately 1km to the north-west of the Site, on the north bank of the River Thames. The proximity of the Site to LCA forms a constraint to the maximum height of the Proposed Development due to the requirement to protect airspace for planes using the airport. This

will limit the maximum height of the towers that form the main element of the Proposed Development. The height restrictions also apply to temporary structures, such as construction cranes. The design of the Proposed Development and construction methodology will allow for this constraint.

- 2.2.9. The closest statutory designated of European or International importance is Epping Forest Special Area of Conservation located 10km to the north of the Site. The closest statutory designated site of national and local importance is Maryon Wilson Park and Gilbert's Pit Local Nature Reserve (LMR) which is located 2km south-west from the Site.
- 2.2.10. The Site has good transport links with the A206, with good quality walking links in the vicinity of the Site and a variety of cycle facilities within the surrounding area. This includes National Cycle Route 1 which is approximately 500m north of the Site.
- 2.2.11. There are three Noise Important Areas (NIA) within 1km of the Site. These are all associated with the A206 Plumstead Road. The closest of these is 30m south of the Site.

3. APPROACH TO EIA

3.1. INTRODUCTION

3.1.1. This section confirms the proposed approach to the EIA and provides an appraisal of the key environmental issues to be covered in the EIA (i.e. 'scoped in') and the issues not requiring further consideration (i.e. 'scoped out') in the context of the key legislative and policy documents. It outlines the approach to the EIA process, including:

- Identifying the approach to the assessment of environmental effects;
- The significance criteria which will be used within the EIA;
- The level of information required for the EIA and proposed structure of the ES; and
- Proposed consultation.

LEGISLATIVE COMPLIANCE

3.1.2. The EIA will be undertaken in the context of relevant legal requirements and current best practice guidance, including the NPPG document 'Environmental Impact Assessment' (2019) and the following:

- Ministry of Housing, Communities & Local Government (2019) – Environmental Impact Assessment Guidance³;
- Institute of Environmental Management and Assessment (IEMA) (2017) – Delivering Proportionate EIA: A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice⁴; and
- IEMA (2016) – Environmental Impact Assessment Guide to: Delivery Quality Improvement⁵.

3.1.3. Legislation, policy or guidance which relates to a specific technical discipline will be considered as appropriate within the ES and discussed within the relevant technical chapters of the ES.

3.1.4. The ES will report the likely significant environmental effects as a result of the Proposed Development. Where possible, mitigation measures and enhancement opportunities will be identified to prevent, reduce or remedy any effects and to optimise any benefits and positive aspects of the Proposed Development.

3.1.5. The ES will review and provide all the relevant environmental information outlined in Regulation 18(3) and Schedule 4 of the EIA Regulations as is reasonably required to assess the likely environmental effects of the development, specifically:

³ Ministry of Housing, Communities & Local Government (2019). Environmental Impact Assessment Guidance Available at: <https://www.gov.uk/guidance/environmental-impact-assessment> Accessed: October 2019

⁴ Institute of Environmental Management and Assessment (IEMA) (2017). Delivering Proportionate EIA: A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice Available at: <https://www.iema.net/policy/ia/proportionate-eia-guidance-2017.pdf> Accessed: October 2019

⁵ IEMA (2016). Environmental Impact Assessment Guide to: Delivering Quality Development <https://www.iema.net/assets/newbuild/documents/Delivering%20Quality%20Development.pdf> Accessed: October 2019

- A description of the Proposed Development – including a description of the location of the Proposed Development, physical characteristics and the full land use requirements of the Site during construction and operational phases;
- Expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the construction and operation of the Proposed Development;
- An assessment of reasonable alternatives studied and clear reasoning as to why the preferred option has been chosen, including a high level comparison of the environmental effects of each alternative;
- A description of the aspects of the environment likely to be significantly affected by the Proposed Development (i.e. sensitive receptors), including: population, soil, water, air, climatic factors, material assets including the architectural heritage, landscape, risks to human health, 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, and the interrelationship between the above factors. This is effectively the baseline position in which the Site and surrounds are considered in their current state;
- A description of the likely significant effects of the Proposed Development on the environment - this will cover direct effects and also any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects. Effects considered will relate to the existence of the Proposed Development, the use of natural resources and the emissions from pollutants. This will also include a description of the forecasting methods to predict the likely effects on the environment;
- A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment, and where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis), explaining the extent to which significant adverse effects on the environment are avoided, prevented, reduced or offset, covering both the construction and operational phases;
- A non-technical summary of the information; and
- An indication of any limitations (technical deficiencies or lack of know-how) encountered by the Applicant in compiling the required information.

3.1.6. A detailed description of the Proposed Development as per the Application Plans will be provided within the ES with sufficient information about the Site, design, size and scale of the Proposed Development such that RBG can reasonably be satisfied that it has sufficient information for determination in full knowledge of the proposal's likely significant effects on the environment.

PLANNING POLICY CONTEXT

3.1.7. The EIA Regulations do not require an assessment of planning policy or guidance; however, the ES will confirm the policy context. The Planning Statement to accompany the planning application will examine the merits of the Proposed Development against the relevant national, regional and local planning policy documentation including:

- National Planning Policy Framework (NPPF) published in March 2012, updated in June 2019⁶;
- Planning Practice Guidance published November 2016, updated in October 2019⁷;
- The London Plan 2016⁸ and the draft New London Plan 2019⁹;
- Royal Greenwich Local Plan: Site Allocations Documents, February 2019¹⁰;
- Royal Greenwich Local Plan: Core Strategy with Detailed Policies ('Greenwich Core Strategy') (2014)¹¹; and
- Woolwich Town Centre Masterplan SPD (2012)¹².

3.1.8. Woolwich is designated in the London Plan 2016 and the draft New London Plan 2019 as an 'Opportunity Area' (Local Plan 2016 Policy 2.13, Map 2.4). These areas, which hold London's major reservoir of brownfield sites, will have growth proactively encouraged. Development proposals in Opportunity Areas should optimise residential and non-residential output densities and provide necessary social and other infrastructure to sustain growth and provide mixed-use developments where appropriate.

3.1.9. Under the London Plan 2016, the Woolwich Opportunity Area has been identified for:

"Building on existing and proposed transport infrastructure including Crossrail, and realisation of the boroughs substantial residential capacity, Woolwich could evolve to perform a higher role in the town centre network, which subject to implementation of the OAPF, could merit Metropolitan status. Implementation of proposals for the Royal Arsenal is also raising the profile of Woolwich and encouraging the wider regeneration of the town centre. Attractive links have been completed between the Arsenal and the town centre and should be complemented by further high-quality design and environmental improvement across the town and the A206 corridor, including General Gordon and Beresford Squares. There is potential to improve links with South East London Green Chain and neighbourhoods to the south."

⁶ Ministry of Housing, Communities & Local Government (2019). National Planning Policy Framework (NPPF). Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2> Accessed: October 2019

⁷ Ministry of Housing, Communities & Local Government (2019). Planning Practice Guidance. Available at: <https://www.gov.uk/government/collections/planning-practice-guidance> Accessed: October 2019

⁸ Mayor of London (2016). The London Plan. Available at: https://www.london.gov.uk/sites/default/files/the_london_plan_malp_final_for_web_0606_0.pdf Accessed: October 2019

⁹ Mayor of London (2019). The Draft Local Plan. Available at: https://www.london.gov.uk/sites/default/files/draft_london_plan_-_consolidated_changes_version_-_clean_july_2019.pdf Accessed: October 2019

¹⁰ Royal Borough of Greenwich (2019). Royal Greenwich Local Plan. Site Allocations Documents. Available at https://www.royalgreenwich.gov.uk/downloads/download/747/site_allocations_documents Accessed: October 2019

¹¹ Royal Borough of Greenwich (2014). Royal Greenwich Local Plan: Core Strategy with Detailed Policies. Available at: https://www.royalgreenwich.gov.uk/downloads/download/718/core_strategy_with_detailed_policies Accessed: October 2019.

¹² Royal Borough of Greenwich (2012). Woolwich Town Centre Masterplan SPD. Available at: https://www.royalgreenwich.gov.uk/downloads/download/432/woolwich_riverside_masterplan Accessed: October 2019.

- 3.1.10. Policy 2.13 also specifically mentions Crossrail related developments, under planning decisions. It is stated that development proposals within opportunity areas and intensification areas should consider a number of things, including:
- *“seek to optimise residential and non-residential output and densities, provide necessary social and or infrastructure to sustain growth, and where appropriate, contain a mix of uses”*
 - *“realise scope for intensification associated with existing or proposed improvements in public transport accessibility, such as Crossrail, making better use of existing infrastructure and promote inclusive access including walking and cycling”.*
- 3.1.11. The Greenwich Core Strategy 2014's Spatial Strategy states a key objective to regenerate Woolwich with development, including housing development. The Site falls within the Strategic Development Location 'Woolwich Town Centre'. Policy TC2 covers Woolwich Town Centre, and states:
- 3.1.12. *“Woolwich Town Centre will re-assert itself as a Major Centre in South East London, improving the quality and quantity of it retain offer and clawing back trade that has previously been lost to other centres. The Royal Borough will be supportive of development that contributes to the eventual reclassification of Woolwich as a Metropolitan Centre. Woolwich will accommodate the majority of additional town centre development in Royal Greenwich over the plan period, including:*
- *Additional and improved comparison retail floorspace;*
 - *Office development;*
 - *Leisure, cultural and tourism uses that contribute towards the evening vitality of the Centre and increase economic benefits; and*
 - *Improved links and enhanced connectivity between the Town Centre, Woolwich Common, the Royal Arsenal and the River Thames, thereby making better use of Woolwich's historic and cultural assets and helping to attract more visitors to the Centre.”*
- 3.1.13. The principle of the Proposed Development should be acceptable given that it will involve the reuse of brownfield land to provide new homes alongside non-residential facilities. In addition to this, planning permission for a previously submitted development similar to the Proposed Development has already been granted, and therefore the principal of the Proposed Development has previously been accepted. The principles of the Proposed Development are supported by the policy context in meeting the housing targets in the Greenwich Core Strategy 2014 and the increased targets proposed in the London Plan 2016 and New Draft London Plan 2019.
- 3.1.14. The Site is identified in the Woolwich Town Centre Masterplan, adopted by RBG in April 2012 as an opportunity area for mixed-use development over the station. The Crossrail site (and the associated developments) are included in phase 2 of the implementation of the Masterplan and are highlighted as the main driver of other developments in this phase.

3.2. ESTABLISHING BASELINE CONDITIONS

- 3.2.1. Each technical discipline has applied specific study areas, these are defined and justified in each relevant topic chapters (see sections 5-16).
- 3.2.2. For the purposed of the EIA and all technical assessments, the baseline scenario (the scenario against which any likely significant effects will be assessed) will be taken to be the Site as it currently is.

3.2.3. The Proposed Development is, as an OSD, is classified as part of the overall Crossrail project, the *Guidance on the carrying out of Environmental Assessment in relation to Planning Applications for Crossrail Works (including Over Site Development)*¹³ will be referred to when preparing the ES. The guidance states that:

“Given that the Crossrail works are ‘committed development’ which may have commenced by the time of the OSD assessment, it may be necessary to consider more than one baseline scenario within the OSD ES. Possible baseline scenarios therefore include:

- *The site pre-Crossrail;*
- *The site during the construction of Crossrail; and*
- *The site following completion of the Crossrail works but prior to the OSD.”*

3.2.4. The Crossrail Act states that it may be necessary to consider more than one baseline scenario within the OSD ES. It is proposed that for the purpose of the EIA and all technical assessments, that the baseline scenario (the scenario against which any likely significant effects will be assessed) that will need to be considered will be that of the Site as it currently is. This is in line with the ‘site following completion of the Crossrail works but prior to the OSD’ option listed above.

3.2.5. The baseline scenario would be within the years 2019 and 2020, depending on survey and assessment time constraints associated with each specific technical assessment. The Site is currently a construction site/compound for the Crossrail Elizabeth line, and has been previously completely cleared to facilitate the works associated with the Crossrail development. This will therefore be considered as the baseline conditions of the purpose of the ES. No other baseline scenarios will be considered.

3.2.6. It is expected that effects arriving at the time of construction of the Crossrail project would for the most part be temporary. An exception to this could be changes to ground contamination, with lasting changes from the beneficial effects of remediation of any contamination. However, for this to be considered sufficient documentation, procured with reliance (CLL would be required to purchase these reports with associated insurance from the party who has ownership of them) would be required.

3.2.7. Where additional baseline scenarios are proposed to be considered, such as the site pre-Crossrail and the site during the construction of Crossrail, this will be detailed in the technical discipline chapters.

3.3. ESTABLISHING FUTURE BASELINE CONDITIONS

3.3.1. As per the EIA Regulations Schedule 4(3), the ‘future baseline’ is the description of the likely evolution of the baseline scenario without the implementation of the Proposed Development, as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of available environmental information and scientific knowledge.

¹³ Crossrail (2009). Guidance on carrying out of Environmental Assessment in relation to Planning Applications for Crossrail Work (including Over Site Development). Document number CRL1-XRL-T1_GUI-C101_OD018-5001 Rev 2.0.

- 3.3.2. The description of the future baseline conditions in the context of each technical topic will be presented in the respective technical chapters in the ES.

3.4. APPROACH TO MITIGATION MEASURES

- 3.4.1. Schedule 4(7) of the EIA Regulations states that an ES should include:

“a description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis. That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.”

- 3.4.2. IEMA's EIA Guide to Delivering Quality Development outlines three types of EIA mitigation:

- *Primary (inherent) – Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken;*
- *Secondary (foreseeable) – Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the ES; and*
- *Tertiary (inexorable) – Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.*

- 3.4.3. The primary and tertiary mitigation will be presented as part of the description of the of the Proposed Development which will be documented in the ES. In addition, each technical chapter of the ES will outline relevant elements of the Proposed Development that are considered to be pre-mitigation scenario i.e. inherent to the Proposed Development. Following the conclusion of the effects of the Proposed Development, any further mitigation (i.e. secondary mitigation) will be outlined separately for each technical chapter. These mitigation measures will further reduce a negative effect or enhance a positive one.

- 3.4.4. Environmental effects which cannot be avoided or mitigation through design will be assessed to determine their significance and where required additional mitigation will be recommended for the relevant phase (construction and/or operation) of the Proposed Development within the relevant technical chapter.

- 3.4.5. The mitigation measures/enhancement measures reported within the ES chapters will be identified and may be secured through planning conditions and/or included within other secured documents such as an Environmental Management Plan (EMP) or CEMP.

3.5. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

- 3.5.1. The assessment will be undertaken in the context of and considering the above details, and relevant planning policy at national (National Planning Policy Framework (NPPF)), regional and local levels. Legislation, policy or guidance which relates to a specific technical discipline will be considered as appropriate within the ES and discussed within the relevant technical chapter.

- 3.5.2. The assessment will consider the sensitive receptors and potential effects of the construction and operational stages of the Proposed Development. The definitions of which are presented below:

- Construction: The construction stage includes all works associated with the construction of the Proposed Development (including works to prepare the Site for construction) such as earthworks, plant operation and movement, remediation and excavations; and
- Operation: Effects once the Proposed Development has been constructed and is inhabited and/or ready for habitation (from an anticipated opening year of 2025).

3.5.3. The assessment of the likely significant effects for each discipline will consider both the construction and operational phases of the Proposed Development. Several criteria will be used to determine if the potential effects of the Proposed Development are 'Significant'. The effects will be assessed quantitatively wherever possible. In general, the significance rating will take account of the following criteria with technical assessment specifics outlined in each technical chapter:

- Adherence of the proposals to legislation, planning policy and international, national and local standards;
- Likelihood of occurrence;
- Spatial extent;
- Sensitivity of the receiving environment or other receptor;
- Value of the affected resource;
- Whether the effect is temporary or permanent;
- Whether the effect is short, medium or long-term in duration; and
- Whether the effect is reversible or irreversible.

3.5.4. An effect is the interaction of an impact on the environment with an identified sensitive receptor, or to the quality of an environmental resource. An adverse effect is defined as one that is unfavourable to a receptor while a beneficial effect is defined as one that is favourable to a receptor.

3.5.5. The effects that are considered to be significant, prior to mitigation, will be identified in the ES. The classification of effects reflects professional judgements as to the importance or sensitivity of the affected receptor(s) and the nature and magnitude of the predicted changes. For example, a high magnitude of change to a feature or site of low importance/sensitivity will result in a lower classification of effect than is the same impact were to occur on a feature/site of high importance/sensitivity.

3.5.6. An impact is a physical or measurable change in the environment, such as the change in land use or noise levels. The descriptions of the magnitude of these impacts are provided in the discipline chapters. A receptor is an entity which may be affected by changes in environmental conditions.

3.5.7. Table 3-1 shows the terms to be used in the ES, unless otherwise stated within individual chapters, to classify effects.

Table 3-1 – Descriptors of the Significance of Effect Categories

Significance Category	Typical Descriptors of Effect
Major Positive/Negative	Where the Proposed Development would cause a large improvement or deterioration to the existing environment.
Moderate Positive/Negative	Where the Proposed Development causes a noticeable improvement or deterioration to the existing environment.

Significance Category	Typical Descriptors of Effect
Minor Positive/Negative	Where the Proposed Development would cause a small improvement or deterioration to the existing environment.
Negligible	No discernible improvement or deterioration to the existing environment as a result of the Proposed Development.

- 3.5.8. Unless otherwise stated in the technical chapters, generally effects which are deemed to be significant for the purpose of the assessment are those which are described as moderate or higher (positive/negative). Those classified as minor or lower (positive/negative) are deemed to be not significant. The classification of these effects will be detailed within each technical chapter of the ES as appropriate.
- 3.5.9. Summary tables that outline the potential effects associated with a technical chapter, potential mitigation measures are included at the end of each technical chapter and within the ES summary chapter.
- 3.5.10. The matrix presented in Table 3-2 will be used as the basis in the ES to determine the significance of a given effect, unless otherwise stated within individual chapters:

Table 3-2 – Matrix for Classifying Significance of Effects

Magnitude of Change	Sensitivity Value of Receptor				
		High	Medium	Low	Negligible
	High	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor to Moderate	Negligible
	Low	Moderate	Minor to Moderate	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

POTENTIAL ENVIRONMENTAL EFFECTS

- 3.5.11. The Applicant is committed to ensuring that likely significant adverse environmental effects potentially arising from the Proposed Development are addressed through the design process before the Application Plans for submission are fixed. Technical specialists are involved in working with the design team to offset or avoid likely significant negative effects.
- 3.5.12. The potential sensitive environmental receptors likely to be affected by the Proposed Development have been identified in this report (see Sections 5-17). A summary of Potential Sensitive Environmental Receptors is shown in Table 3-3 below.
- 3.5.13. In relation to demolition and construction, the objective is to achieve best practice in management and execution of demolition and construction, with specific attention given to ensuring that the environmental effects of demolition and construction operations on neighbours and the public are minimised at all times.

Table 3-3 – Potential Existing Sensitive Environmental Receptors

Technical Topic	Receptors
Air Quality	<p>Construction</p> <p>Human receptors within:</p> <ul style="list-style-type: none"> 50m of the routes used by construction vehicles 350m of site boundary 500m of site entrance <p>Operation</p> <ul style="list-style-type: none"> Future occupants within the Application Site Existing residential properties, schools and hospitals
Ground Conditions	<ul style="list-style-type: none"> Future Site users; Construction workers; Third-party neighbours; Secondary Undifferentiated Aquifer; Secondary A Aquifer; Principal Aquifer; River Thames
Noise and Vibration	<ul style="list-style-type: none"> Residential properties fronting the A206; Future residential properties on Station Way; Royal Arsenal Medical Centre on Arsenal Way; Residential properties on Arsenal Way; Residential properties on Burrage Road; Heronsgate Primary School on Burrage Grove; Residential properties on Jessop Close; and Future occupants of the proposed development itself
Water Resources and Flood Risk	<ul style="list-style-type: none"> Human receptors affected by flood risk Watercourses and surface water drainage patterns Public surface and foul water drainage networks Groundwater Public Water Supply Network
Socio-economics	<ul style="list-style-type: none"> Construction phase employees working at the site. Population affected by the development which includes future residents and employees at the Proposed Development; other residents and employees in the local area who utilise existing social infrastructure; new facilities and amenities which could be delivered by the Proposed Development.
Telecommunications	Buildings in regions around the Proposed Development that fall into the radio shadow of the building
Daylight, Sunlight and Overshadowing	<p>Residential and educational receptors:</p> <ul style="list-style-type: none"> 16 to 68 Jessup Close; 4 to 35 Gill Court; 24A Plumstead Road;

Technical Topic	Receptors
	<ul style="list-style-type: none"> Duncombe House; Bentham House; Berkeley House; 1 to 4 Foundry House; and 1 to 28 Cornwallis Road. Heronsgate Primary School Royal Arsenal.
Environmental Wind	<ul style="list-style-type: none"> Areas intended for siting and standing; Areas intended for leisure walking; Areas intended for business walking; Roof tops for maintenance only.
Townscape and Visual Impact Assessment	<p>Townscape receptors</p> <ul style="list-style-type: none"> TCA1: Royal Arsenal TCA2: Woolwich Town Centre TCA3: Northwest Plumstead TCA4: West Thamesmead <p>Visual Assessment</p> <ul style="list-style-type: none"> RV1: Beresford Street RV2: Burrage Road, close to its junction with Vincent Road RV3: Duke of Wellington Avenue (near Arsenal Way) RV4: Shrewsbury Park (Policy DH(g) local view no 2) RV5: Public Open Space near to Villas Road RV6: Grand Depot Road RV7: General Gordon Square RV8: Plumstead Road, close to Plumstead College RV9: Thames Path, close to Gallions Point RV10: Thames Path, close to Royal Victoria Gardens RV11: Thames Path, Barking Creek Park RV12: Dial Arch Square RV13: Major Draper Street RV14: Wellington Park RV15: Duke of Wellington Avenue (near Cornwallis Road) RV16: Plumstead Road, close to its junction with Parry Place RV17: Burrage Road, close to its junction with Congleton Road
Built Heritage	<ul style="list-style-type: none"> Conservation areas Listed buildings Non-statutory locally listed buildings
Traffic and Transport	<ul style="list-style-type: none"> Vehicle occupants and operators Interchange users Vulnerable road users Parking and loading facilities Waterway users
Climate Change	<ul style="list-style-type: none"> London Borough of Greenwich Wider UK GHG emissions

OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 3.5.14. Where relevant, technical chapters will identify opportunities for enhancing the environment and will seek to include such enhancements in mitigation measures.

3.6. CONSIDERATION OF ALTERNATIVES

- 3.6.1. Schedule 4 of the EIA Regulations states '*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*'.
- 3.6.2. The ES will include a separate chapter with a description of the reasonable alternatives studied by the Applicant (for example, in terms of development design, technology, location, size and scale), which are relevant to the Proposed Scheme and its specific characteristics. The chapter will also include an indication of the main reasons for selection of the chosen option, including a comparison of the environmental effects.
- 3.6.3. In accordance with the EIA Regulations, and where appropriate, the following types of alternatives assessment will be considered and described in the ES:
- Do-Nothing Scenario: The consequences of no development taking place;
 - Continue with the scheme previously consented under the extant planning permission within the Site affords, considering effects reported in the ES submitted for the extant scheme; and
 - Alternative Layouts: Consideration of the evolution of the current design from conception to its current form.

3.7. PROPOSED STRUCTURE OF THE ENVIRONMENTAL STATEMENT

- 3.7.1. Appendix A of this Scoping Report details the proposed structure of the ES for the Proposed Development. A summarised version of which is shown in Table 3-4 below.
- 3.7.2. The Proposed Development may lead to significant environmental effects on the following aspects, although some effects may be limited in their temporal geographical scope. The following technical topics are scoped into the ES:
- Air Quality;
 - Ground Conditions;
 - Noise and Vibration;
 - Water Resources and Flood Risk;
 - Socio-Economics;
 - Telecommunications;
 - Daylight, sunlight and overshadowing;
 - Environmental wind;
 - Townscape, built heritage and visual impact assessment;
 - Transport and access; and
 - Climate change.

Table 3-4 – Proposed Structure of the Environmental Statement

Volume	Chapters/Documents
Volume 1 – Environmental Statement	<ul style="list-style-type: none"> Chapter 1: Introduction Chapter 2: The Proposed Development Chapter 3: Consideration of Alternatives Chapter 4: Approach to the EIA Chapter 5-16: Technical Chapters Chapter 18: Cumulative Effects Chapter 19: Summary
Volume 2 – Technical Appendices	This will be specific to each technical appendices.
Volume 3 – Townscape and Visual Impact Assessment	The Townscape and Visual Impact Assessment will be separated from the Volume 1 ES and be presented in its own Volume.
Volume 4 – Non-Technical Summary	A concise summary of the Environmental Statement that provides a description of the EIA process and its findings in a manner that is easily understood by the general public.

3.8. SCOPE OF THE APPLICATION DOCUMENTS

The planning submission will be supported by a suite of Application Report and Plans. Table 3-5 contains a list of documents expected to be submitted with the Planning Application, and a brief description of the purpose of each document.

Table 3-5 – Documents to be Submitted for Approval

Document	Purpose	Author
Planning application form, certificates and notices	To provide the Site and planning application details including site ownership and any notices served to respective site owners.	DP9
Community Infrastructure Levy (CIL) Form	To provide details of any floorspace that will be CIL chargeable and any floorspace that will qualify for relief.	DP9
Planning statement including planning obligations, draft Heads of Terms and any economic / employment considerations	Sets out the Site context and need for the development and includes an assessment of how the Proposed Development accords with relevant national, regional and local planning policies.	DP9
Financial Viability and Housing Statement	To define financial viability of the Proposed Development and affordable housing provision.	Quod / Savills
Red Line Planning Application Boundary	To confirm the location and extent of the planning application boundary.	TP Bennett
Detailed Application Drawings and Accommodation Schedule	To define the design, layout and elevations of the Proposed Development and proposed works both above and below ground.	TP Bennett

Document	Purpose	Author
Open Space and Landscape Plans	To define the landscaping and open spaces within the Proposed Development.	Fabrik
Design and Access Statement including Accessibility Statement, landscaping details and details of external/internal lighting.	Sets out the design rationale and principles behind the Proposed Development including the content, layout, access and circulation proposed. Includes a description of the design evolution, strategy and principles.	TP Bennett
Environmental Statement (in 3 volumes) including Non-Technical Summary	To report the assessment of the likely significant effects of the Proposed Development.	WSP
Preliminary Ecological Appraisal	To map habitats which may be present on site, and report on the protected or otherwise notable species of fauna and flora which may be present on site, or impacted by the Proposed Development.	WSP
Preliminary Risk Assessment	The principal aim of this is to highlight environmental considerations with respect to ground, ground gas, and groundwater conditions.	WSP
Waste Management Strategy Report	Calculates expected waste generation from the development during construction and operational phases. Identifies a plan in relation to separating, collection, treatment and disposal of waste.	AECOM
Transport Assessment and Travel Plan	Considers the major modes of transport and provides a review of the existing situation, analysis of the likely conditions after development and recommends necessary mitigation measures. The Transport Assessment will be standalone and not be appended to the ES.	AECOM
Flood Risk Assessment and Drainage Strategy	To consider Flood Risk Assessment and site specific Drainage Strategy requirements (where required)	WSP
Sustainability and Utilities	<p>Outlines the strategy for reducing carbon dioxide emissions and the proposed energy and sustainability strategy.</p> <p>Identifies capacity requirements for the Proposed Development in terms of water resources, gas, electricity, telecoms.</p>	Hoare Lea
Statement of Community Involvement	Summarises the outcome of public consultations in relation to the proposals.	Lowick/DP9

4. TOPICS SCOPED OUT OF THE EIA

4.1. INTRODUCTION

- 4.1.1. As part of the EIA process and based on the information available to date, there are a number of topics for which it is considered an assessment as part of the EIA is not required and it is proposed that these environmental issues are scoped out of the EIA.

4.2. ARTIFICIAL LIGHTING

- 4.2.1. The Department for Communities and Local Government's Planning Practice Guidance (6th March 2014) includes guidance relating to 'Light Pollution' and provides an overview of the key issues relating to artificial lighting in the planning process and specifically aims to answer the following:
- 'Does a new development proposal, or major change to existing one, materially alter light levels outside the development and / or have the potential to adversely affect the use or enjoyment of nearby buildings or open spaces?'*
- 4.2.2. The current lighting environmental zone surrounding the Site are expected to be E3 (Medium District Brightness – Suburban) and E4 (High District Brightness – Urban) environmental zones. Therefore, the potential effect of the Proposed Development on light spill and glare (associated with lighting installations during construction and permanent installations during the operational phase) will not materially alter the current lighting levels.
- 4.2.3. The lighting design will be developed in accordance with current best practice and guidance, taking into account the surrounding sensitivities including existing neighbouring residential properties and will be based on the use of low light pollution installations. External lighting will be designed to meet statutory requirements.
- 4.2.4. As a result, the effect of artificial lighting on road users, pedestrians and cyclists is considered to be insignificant and is proposed to be scoped out of the ES.

4.3. ARCHAEOLOGY

- 4.3.1. The Site of the Proposed Development is in an area that has been subject to extensive ground and below ground disturbance due to the construction of the Crossrail Woolwich Station. The Proposed Development will not introduce any new disturbance in comparison with works already undertaken as part of the Crossrail station.
- 4.3.2. As part of the previous planning application submission for the Site, it was requested by Historic England that that mapping was submitted to demonstrate that the area of the Proposed Development has been subject to the significant ground disturbance associated with the Crossrail works and that no additional areas remain that need to be considered further. The site plans shown within Appendix B were provided for the previous Planning Application, defining the area of disturbance. These were considered by Historic England and were determined to satisfy the

requirement to demonstrate the application area had been appropriately considered, and that no discernible on-going archaeological interest was within the Site¹⁴.

- 4.3.3. Based on this history of recent disturbance, and the Archaeological Investigations *Archaeological Investigations at The Royal Arsenal, Woolwich. Crossrail Station Box – Interim Statement* undertaken to inform the previous ES on the Site, Archaeology has been scoped out of the ES. This Interim Statement is provided in Appendix B.

4.4. AVIATION

- 4.4.1. The Site is located approximately 1km south of LCA. As such, LCA has been consulted to determine potential constraints to development to ensure that airport operations remain unaffected by the Proposed Development.
- 4.4.2. The previous development iteration (Ref 13/3307/F) received height constraint information for the Site from LCA. The limitation was calculated to be between 32 and 35 storeys across the Site. The Proposed Development will be 25 storeys plus plant, well below this limitation, and no higher than the previous proposed development for the Site, which was granted planning permission and LCA did not object to.
- 4.4.3. Correspondence with LCY was received via email on 11 November 2019 which confirmed that:
“The Obstacle Limitation Surface of the airport allows to have an obstacle up to 85m in the proposed area.....Another factor to consider is the proposed height of cranes which will be used during the construction period. If the new proposed building is shadowed by a taller one, it also impacts decision making.”
- 4.4.4. It should be noted that consultation with LCA has been undertaken to ensure that the height restrictions for this area have not been reduced since the previous application was submitted. It is not expected that the result of this would require aviation to be scope in to the ES, as and changes in height restriction which may impact on the Proposed Development will be addressed through the design.
- 4.4.5. It should also be noted that the protected zones defined by LCA include heights for construction cranes. The design will therefore allow for this constraint.
- 4.4.6. Based on these constraints, and the nature of the Proposed Development, it is proposed that the topic of aviation be scoped out of the ES.

4.5. ECOLOGY

- 4.5.1. The ecology assessment was informed by data collected from a desk study and a field survey undertaken in October 2019.

¹⁴ RBG (2014). Former Car Park Nos. 12, 14, 15 and 16 Gunnery Terrace, Cornwallis Road, Woolwich, SE18 (Ref 13/3307/F). Available at <https://committees.royalgreenwich.gov.uk/documents/s36248/005%20-%20Fmr%20Car%20Pk%20-%202012.14.15.16%20Gunnery%20Trce%20-%20Crossrail.pdf> Accessed 22 October 2019

- 4.5.2. The desk study covered the Site boundary and a study area around the Site comprising:
- 10km for Natura 2000 Sites, namely, Ramsar Sites, Special Protection Areas (SPAs) and Special Areas of Conservation (SACs); and
 - 2km for Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Habitats of Principal Importance and ancient woodland.
- 4.5.3. The desk study areas followed best practice guidance, and publicly accessible data was used where available^{15 16}. A field survey was conducted on land within the Site boundary and adjacent habitats.
- 4.5.4. The results of the desk study and field survey are summarised in Table 4-1. The habitats within the Proposed Development were considered to potentially be classified as 'open mosaic habitat on previously developed land' Habitat of Principal Importance (HPI). However, this was discounted as habitats are of insufficient size and lack vegetation (Riding et al 2010)¹⁷.

Table 4-1 – Summary of Ecological Features within Survey Area

Ecological Feature	Description
Designated Sites	
Epping Forest SAC	Epping Forest is 10km north, north west from the Site it is notified for broadleaved, beech <i>Fagus sylvatica</i> woodland and is important for a range of rare species, including the moss <i>Zygodon forsteri</i> . The Site is also supports a range of fungi and dead-wood invertebrates including stag beetle <i>Lucanus cervus</i>
Maryon Wilson Park and Gilbert's Pit LNR	Maryon Park and Gilbert's Pit LNR is 2km south west of the Site. It contains acid grassland which supports an assemblage of burrowing bees and wasps in addition to gorse <i>Ulex</i> sp. and broom <i>Cytisus scoparius</i> scrub and secondary woodland. A small stream and associated areas of wet grassland support a number of locally rare plants, including bristle club-rush <i>Isolepis setacea</i> and bog stitchwort <i>Stellaria alsine</i> , both are noted by the citation to be rare in London.
The River Thames and its Tidal Tributaries SMI	The nearest section of SMI is 0.4km north of the Site. The inner Thames is of national importance (as defined by the Nature Conservancy Council as containing over 1% of the United Kingdom winter population for three species of waterfowl, mute swan <i>Cygnus olor</i> , shelduck <i>Tadorna tadorna</i> and pintail <i>Anus acuta</i>).
St Mary's Churchyard,	St Mary's Churchyard, Woolwich SLI is 0.86km to the west of the Site. It supports a range of common wildflowers and mature trees. A wall supports

¹⁵ MAGIC map was checked for Natural England information on SSSI Impact Risk Zones. The Site is not in an Impact Risk Zone that Natural England considers of concern for impacts on a SSSI resulting from residential development.

¹⁶ Natural England (2019) Magic [Online] available at: magic.defra.gov.uk [16/10/19]

¹⁷ Riding, A., Critchley, N., Wilson, L. and Parker, J. (2010). *Definition and mapping of open mosaic habitats on previously developed land: Phase 1. Defra Research Report WC0722*. London, Department for Environment Food and Rural Affairs.

Ecological Feature	Description
Woolwich SLI	the locally scarce ferns common polypody <i>Polypodium vulgare</i> and maidenhair spleenwort <i>Asplenium trichomanes</i> .
Royal Victoria Gardens SLI	Royal Victoria Gardens SLI is 0.87km north north west of the Site. It is primarily of amenity value, comprising ornamental shrubs, mature trees and amenity grassland.
Habitats of Principal Importance	
Coastal saltmarsh	A small fragment (0.02ha) of habitat is present on the south bank of the River Thames adjacent to Gallions Reach development, 1.9km north east from the Site.
Intertidal Mudflats	Intertidal mudflats line both sides of the Thames, covering a total are of 31.04ha within the desk study area. The nearest area of mud flat is 0.4km north of the Site.
Good quality semi-improved grassland	Greater London Authority (GLA) survey in 2002 identified 4.1ha of <i>possible dry acid grassland</i> with eight acid grassland indicator species recorded, within Charlton Cemetery.
Good quality semi-improved grassland	GLA survey in 2002 identified, " <i>herb-rich neutral grassland</i> " adjacent to White Hart Lane and South off Nathan Way. Seven indicator species for lowland meadow habitat were recorded.
Deciduous woodland	Fragments of deciduous woodland are distributed throughout the desk study area. The nearest of which is 0.4ha adjacent to Anglesey Road (0.5km south west of the Site). An area of 9.3ha is recorded 1.5km south west of the Site at Repository Wood, a further area of 10.5Ha is located 1.4km south of the Site, within Shrewsbury park.
Wood-pasture and Parkland	41.5 ha of wood-pasture and parkland is present within Plumstead Common and Woolwich Common, which are 0.8 km south east and 1.6km south west of the Site respectively.
European Protected Species	
Amphibians – including great crested newts	No waterbodies or habitat suitable to support amphibians is present on Site. The nearest waterbody is a water feature within the Royal Arsenal Woolwich development on Cadogan Road, 320m to the north. All waterbodies in the desk study area are separated from the Site by large expanses of hardstanding and built development.
Bats	There are two permanent buildings within the Site, a brick built, flat-roofed substation and a newly constructed station building. Both buildings have negligible protentional to support roosting bats. There are no trees on Site. The lack of natural or semi natural habitat will limit invertebrate numbers and as such the bat foraging resource on Site are negligible.
Badgers	There is no natural or semi natural habitat within the Site, to allow badgers to forage. The entire Site and immediate surroundings co hardstanding, or compacted hardcore, preventing the construction of setts.

Ecological Feature	Description
Birds	There is no suitable vegetation on Site for birds to nest within. The lack of natural or semi natural habitat will limit invertebrate numbers and as such the foraging resource for birds offered by the habitat on Site is negligible.
Hazel dormice	The Site has been cleared of vegetation and contains no suitable habitat to support hazel dormice
Reptiles	The Site has been cleared of vegetation and contains no suitable habitat to support reptiles
Terrestrial Invertebrates	The Site has been cleared of vegetation and is comprised entirely of hard standing. There is an area with a hardcore substrate, however this appears to be recently created. It is unlikely to support burrowing solitary bees, wasps or other brownfield specialists of invertebrate.

- 4.5.5. A detailed ecological baseline, including an assessment of potential ecological impacts, is provided in the Preliminary Ecological Appraisal (PEA) (November 2019). No further ecological impact assessment is considered necessary beyond the PEA to inform a planning submission for the Proposed Development.
- 4.5.6. In its current condition, the Site has negligible ecological value. All of the ecological features identified in Table 4-1 are outside the Proposed Development boundary and are separated from this by dense urban development, roads and areas of hard standing. No significant effects are predicted on nearby designated nature conservation sites due to the lack of a direct or indirect pathway for an impact. There are no hydrological connections between the Proposed Development and any of the ecological features identified in Table 4-1. It is expected that air quality changes arising from construction or operation of the Proposed Development will be controlled by best practice construction measures, and would not result in significant impacts on ecological features.
- 4.5.7. Based on the baseline information provided in Table 4-1, the lack of ecological features present within the Site, and the absence of significant effects on designated nature conservation sites, it is proposed that the topic of Ecology be scoped out of the ES.

4.6. HEALTH AND WELLBEING

- 4.6.1. Where appropriate, the technical chapters of the ES will consider any potential significant effects on the health and wellbeing of the existing and future residents/workers. Due to the nature of the Proposed Development, it is unlikely to have significant effects on the health and wellbeing of individuals and the local community. There is unlikely to be any change to the accessibility or provision of health services as a result of the construction or operation of the Proposed Development.
- 4.6.2. Temporarily, construction may cause the emissions of dust and noise, however, these emissions will be controlled and managed through the implementation of a CEMP so as to avoid health impacts. This will include measures relating to construction access and traffic to ensure disruption to journeys is reduced as much as possible. Any potential impacts on health of the existing and future residents/workers can be assessed through the Air Quality, Noise and Vibration, Socio-Economics, and Transportation and Access chapters within the ES for the Proposed Development.

- 4.6.3. Furthermore, a rapid Health Impact Assessment will be prepared and submitted in support of the application. Therefore, it is proposed that the topic of Health and Wellbeing be scoped out of the ES.

4.7. MAJOR ACCIDENTS AND DISASTERS

- 4.7.1. Schedule 3 of the EIA Regulations states that: *“The characteristics of the development must be considered with particular regard to – (f) the risk of major accidents and/or disasters relevant to the development concerned, including those caused by climate change, in accordance with scientific knowledge”*
- 4.7.2. Where appropriate, the technical chapters of the ES will consider any potential significant effects on Major Accidents and Disasters (MA&D) both on the Proposed Development and as a result of the Proposed Development. Due to the nature and location of the proposed development, there is unlikely to be a significant risk of MA&D events occurring that would not be accounted for within the technical chapter assessments to be included in the ES and by mitigation measures associated with these assessments and general health and safety (H&S) obligations.
- 4.7.3. The National Risk Register for Civil Emergencies 2017¹⁸ outlines the risks and major emergencies that could affect the UK in the next five years. This document has been reviewed on the basis of establishing a list of potential MA&D events relevant to the Proposed Development, this is summarised below:
- Flooding – The Proposed Development is within 1km of the River Thames and borders a Flood Zone 3 area. However, the Site itself is in a Flood Zone 1 area considered at a very low risk of surface water flooding. The risks as a result of flooding will be assessed within the Water and Flood Risk chapter of the ES and no additional assessment is deemed necessary;
 - Severe Weather – The Proposed Development is located within London and is subject to the Urban Heat Island effect, as a result there is the potential for severe weather in the form of heatwaves to occur. This will be accounted for within the design of the Proposed Development (with measures such as mechanical ventilation) to provide suitable resilience to severe weather effects;
 - Poor Air Quality – The Proposed Development is located within London which is known to have significantly poor air quality. The Site is located within the Greenwich AQMA, designed by RBG for the exceedance of Nitrogen Dioxide (NO₂) and particulate matter (PM₁₀). The potential effects in relation to Air Quality will be assessed within the Air Quality ES chapter and as such no further assessment will be required;
 - Malicious Attacks (Terrorism) – Recent terror events in London (2017) suggest that London is at a higher risk of terrorism than other areas of the UK. The risks to the Proposed Development as a result of terrorism will be accounted for by best practice measures in regard to site security and will not require further assessment in the ES; and

¹⁸ Cabinet Office (2017) National Risk Register of Civil Emergencies 2017 Edition. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/644968/UK_National_Risk_Register_2017.pdf. Accessed: October 2019.

- Unexploded Ordnance (UXO) – The Proposed Development is located in an area of High Risk from UXO that remains from the Second World War. In particular, the Site (Woolwich Arsenal) was a designated Luftwaffe target from this period. The construction of Crossrail's Woolwich station includes below ground works and is likely to uncover any UXO that persists on the Site. Further UXO assessment for the Proposed Development will therefore not be required.

4.7.4. Following a qualitative appraisal, it is considered that MA&D events are unlikely to give rise to significant effects and do not need to be considered further, MA&D will therefore be scoped out of the ES.

4.8. SERVICES AND UTILITIES

4.8.1. Existing services and utilities and any required diversions or new provision are being taken into consideration as part of the design process for the Site and emerging Application Plans and suitable solutions are being agreed with the relevant service providers such that no significant effects are anticipated. A separate Utilities Statement will be submitted in support of the application and as a result scoped out of the ES.

4.9. SUSTAINABILITY AND ENERGY STATEMENTS

4.9.1. Separate application reports will be submitted with the application to address the relevant sustainability and energy planning policy context for the area at the national, regional and local level. Relevant design details relating to Energy and Sustainability will be described in the ES and used to inform various assessments to be reported in the ES where appropriate such as Air Quality. Therefore, a standalone chapter for this topic will be scoped out of the ES.

5. AIR QUALITY

5.1. STUDY AREA

5.1.1. The study area for the scoping assessment will be as follows:

- Assessment of the Site, as well as the surrounding area of the Site up to 500m away from the Site boundary for sensitive receptors will take place.

5.1.2. The study area for the air quality assessment will be as follows:

- Construction Phase: residential properties within 350m from the site boundary, or, 500m from the site entrance extending 50m either side of the route used by construction vehicles on the public highway as required guidance¹⁹ published by the Institute of Air Quality Management for the assessment of dust from demolition and construction activities; and,
- Operational Phase: sensitive receptors within 200m of the modelled road network.

5.2. BASELINE CONDITIONS

5.2.1. Baseline air quality refers to the existing concentrations of pollutants present in the ambient air. The baseline air quality in the study area and at the site has been determined based on the reports and data described below.

ROYAL BOROUGH OF GREENWICH REVIEW AND ASSESSMENT

5.2.2. RBG declared the whole Borough an Air Quality Management Area (AQMA) due to exceedances of the UK Air Quality Strategy objectives for nitrogen dioxide (NO₂) and particulate matter (PM₁₀) concentrations. The main source of pollution in the vicinity of the Site is road traffic emissions.

LOCAL MONITORING DATA

The RBG undertake monitoring at 52 locations across the Borough. There are three monitoring locations within 500m from the Site, including an automatic monitoring station, which is approximately 40m south of the Site. This monitoring station measures concentrations of NO₂, PM₁₀ and PM_{2.5}. Details of the monitoring sites and the annual mean concentrations measured at them over the last five calendar years have been taken from the RBG Air Quality Annual Status Report²⁰ and are summarised in Table 5-1, Table 5-2 and Table 5-3. below.

¹⁹ Institute of Air Quality Management (Version 1.1 Updated June 2016). *Guidance on the Assessment of Dust from Demolition and Construction*

²⁰ Royal Borough of Greenwich (2019) Air Quality Annual Status Report for 2018.

Table 5-1 – Annual Mean NO₂ Concentration (µg/m³) near to the Site

Monitoring Site	Type of Monitor	Distance from Site (m)	2014	2015	2016	2017	2018
GN0 - Greenwich - A206 Burrage Grove	Automatic Monitor/Roadside	40 (south)	39	35	39	35	35
GW60 - Burrage Grove (Triplicate co-located site)	Diffusion Tube/Roadside	40 (south)	32.7	31.6	40.0	32.2	29.5
GW102 - Plumstead Road	Diffusion Tube/Roadside	25 (south)	<u>67.1</u>	57.7	43.8	48.0	50.5

Notes: Exceedance of the NO₂ annual mean Air Quality Objective of 40 µg/m³ are shown in **bold**. NO₂ annual means in excess of 60 µg/m³ indicating a potential exceedance of the NO₂ hourly mean AQS objective are shown in **bold** and underlined.

- 5.2.3. At monitoring site GW102, roadside annual mean NO₂ concentrations exceeded the air quality objective (40 µg/m³) between 2014 and 2018. In 2014, the measured annual mean concentration for NO₂ was above 60 µg/m³, indicating the potential for exceedances of the NO₂ hourly mean objective.
- 5.2.4. Annual mean NO₂ concentrations at the two monitoring locations in Burrage Grove met the objective from 2014 and 2018.

Table 5-2 – Annual Mean PM₁₀ Concentration (µg/m³) near to the Site

Monitoring Site	Type of Monitor	Distance from Site (m)	Averaging Period	2014	2015	2016	2017	2018
Greenwich - A206 Burrage Grove	Automatic Monitor / Roadside	40 (south)	Annual Mean	-	22	23	18	18
			Daily mean >50 µg/m ³	-	5	10	8	3

Notes: Exceedance of the PM₁₀ annual mean Air Quality Objective of 40µg/m³ are shown in **bold**. Daily mean >50 µg/m³ not to be exceeded more than 35 times in a calendar year

Table 5-3 – Annual Mean PM_{2.5} Concentration (µg/m³) near to the Site

Monitoring Site	Type of Monitor	Distance from Site (m)	2014	2015	2016	2017	2018
Greenwich - A206 Burrage Grove	Automatic Monitor/Roadside	40 (south)	-	-	-	-	13

Notes: Exceedance of the PM_{2.5} annual mean Air Quality Objective of 25µg/m³ are shown in **bold**.

- 5.2.5. Table 5-2 and Table 5-3 show PM₁₀ and PM_{2.5} concentrations around the Site are below the relevant air quality objectives.

SUMMARY

- 5.2.6. The Site is likely to experience similar concentrations to those measured at the nearby monitoring locations. The PM₁₀ and PM_{2.5} concentrations are most likely to be well below the relevant Air Quality Objectives, however, NO₂ concentrations could potentially be close to, or in exceedance of Air Quality Objectives, based on local monitoring data.

5.3. IDENTIFICATION OF SENSITIVE RECEPTORS

- 5.3.1. For the construction phase assessment, guidance by the Institute of Air Quality Management advises that a construction dust assessment is required if there are human receptors within 350m of the boundary of the Site or within 50m of the routes used by construction vehicles up to 500m beyond the site entrance. There are no ecological receptors present within 50m of the site boundary or within 50m of the route used by construction vehicles up to 500m from the site entrance.
- 5.3.2. For the operational phase, the air quality assessment will include selected sensitive receptors within 200m of the modelled road network including:
- Future occupants within the Application Site; and
 - Existing residential properties, schools, hospitals, etc.
- 5.3.3. There are several existing sensitive receptors in the vicinity of the Site. Sensitive receptor locations include, but are not limited to the following:
- Residential properties on Duke of Wellington Avenue, Arsenal Way, Cornwallis Road, Skeffington Street, Carriage Street, Spray Street, Parry Place, Burrage Grove, Jessup Close, Maxey Road Perrot Street, Macbean Street, Invermore Place and Villas Road; and
 - Greenwich Community College and Heronsgate Primary School.

5.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

- 5.4.1. Impacts during the construction phase are likely to be significant to the existing sensitive receptors, located in the vicinity of the Site, prior to the application of mitigation measures. The impacts will be direct, temporary and short-term.
- 5.4.2. During the operational phase, it is likely that the additional traffic generated by the Proposed Development will adversely impact airborne pollutant concentrations in the vicinity of the Site, as will emissions from any energy generation plant. These impacts will be indirect, permanent and long-term, and if they are significant, mitigation measures will be required.
- 5.4.3. A summary of likely significant effects to be **scoped in** to the Air Quality Assessment is provided in Table 5-4 below.

Table 5-4 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Change in ambient concentrations of dust and particles due to demolition and construction activities	Construction	Residential properties and other sensitive receptors	Potential for significant dust-soiling and human health impacts prior to mitigation.

Impact	Phase	Receptor	Justification
Change in NO ₂ , PM ₁₀ , PM _{2.5} concentrations associated with exhaust emissions from non-road mobile machinery and construction traffic	Construction	Residential properties and other sensitive receptors	Potential for increases in pollutant concentrations as a result of construction vehicles and machinery at sensitive receptors.
Changes in NO ₂ , concentrations associated with emissions from development generated traffic and onsite energy generation plant	Operation	Residential properties and other sensitive receptors	Potential for significant increases in pollutant concentrations as a result of operational traffic and onsite energy generation emissions associated with the Proposed Development
Changes in PM ₁₀ and PM _{2.5} concentrations associated with the operational traffic emissions	Operation	Residential properties and other sensitive receptors	Potential for significant increases in pollutant concentrations as a result of additional traffic associated with the Proposed Development

INSIGNIFICANT EFFECTS

- 5.4.4. The effects outlined in Table 5-5 below are anticipated to be insignificant and hence are proposed to be **scoped out** of the Air Quality Assessment.

Table 5-5 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Change in dust and particular matter beyond 350m from the site boundary and 500m beyond the site entrance during demolition and construction activities	Construction	Residential properties and other sensitive receptors	Receptors at this distance from the Site are unlikely to experience significant impacts as a result of changes in levels of dust and particular matter
Change of NO ₂ , PM ₁₀ and PM _{2.5} concentrations at receptors beyond 200m from the modelled road network associated with the construction and operational traffic	Construction and Operation	Residential properties and other sensitive receptors	Receptors beyond 200m of the modelled road network are unlikely to experience significant impacts as a result of changes in levels of dust and particular matter

5.5. MITIGATION

- 5.5.1. The nature and type of mitigation measures required will be dependent on the findings of the assessment.
- 5.5.2. The embedded mitigation measures proposed will include best practice measures that need to be applied on site during construction activities to minimise the generation and dispersion of dust and PM₁₀ during this phase of the development.

- 5.5.3. For the operational phase, embedded mitigation measures include a mechanical ventilation system with filtration to prevent exposure of future residents to high NO₂ concentrations, measures to reduce the traffic movements generated by the development and ensuring that the flues associated with any energy generation plant are of sufficient height to allow for adequate dispersal of emissions, if relevant.
- 5.5.4. Operational phase mitigation measures will be applied in accordance with the GLA's Sustainable Design and Construction guidance²¹, if relevant.

5.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 5.6.1. In terms of local air quality, the implementation of sustainable travel plans, including the incorporation of electric vehicles charging points, promotion of public transport, and a low emission energy strategy, will provide a reduction in the emissions associated with the operational phase of the Site.

5.7. ASSESSMENT METHODOLOGY

- 5.7.1. The air quality assessment will be based on the methodology set out in Section 3.5. This will be adjusted for air quality effects by utilising following methodology and guidance:
- Consultation with the RBG Environmental Health Department to confirm the assessment methodology;
 - Qualitative assessment of dust and particulate impacts during the construction stage in accordance with GLA²² and Institute of Air Quality Management (IAQM)²³ guidance to determine the likely impacts on sensitive receptors;
 - Qualitative assessment of construction traffic and plant emissions with reference to Environmental Protection UK (EPUK) and IAQM joint guidance²⁴ to determine the likely impacts on sensitive receptors;
 - A quantitative assessment of the impact of emissions from traffic using the road network surrounding the site on concentrations of NO₂ and particulate matter (PM₁₀ and PM_{2.5}) across the Site using the dispersion model ADMS Roads in order to assess the likely exposure of future users/occupants of the proposed development to concentrations of these pollutants. We will also assess the impact of any traffic generated by the Site on local air quality (if traffic generation exceeds the Environmental Protection UK/Institute of Air Quality Management Planning criteria)²⁶. The assessment will be completed in accordance with current best practice and technical guidance;
 - A qualitative assessment of the impact of emissions to air from any significant proposed energy generation plant on local air quality using the dispersion model ADMS 5 and one year of meteorological data, if relevant; and

²² Mayor of London (2014). *The Control of Dust and Emissions during Construction and Demolition – Supplementary Planning Guidance*.

²³ Institute of Air Quality Management (Version 1.1 Updated June 2016). *Guidance on the Assessment of Dust from Demolition and Construction*

²⁴ Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017). *Land Use Planning & Development Control: Planning for Air Quality*

- A quantitative assessment of the air quality neutrality of the proposed development will be undertaken in accordance with the GLA's Sustainable Design and Construction guidance and Air Quality Neutral Policy²⁵ contained in the London Plan.

5.7.2. Where adverse effects are identified, embedded and additional mitigation measures will be proposed.

5.8. LIMITATIONS AND ASSUMPTIONS

5.8.1. No limitations or assumptions have been identified for air quality at this stage.

²⁵ AQC and ENVIRON UK Ltd (2014). *Air Quality Neutral Planning Support*

6. GROUND CONDITIONS

6.1. STUDY AREA

- 6.1.1. This Chapter of the ES will establish the existing ground conditions on the Site and within the vicinity of this upon which to assess the likely significant effects of the Proposed Development on ground conditions and/or the likely significant effects of existing ground conditions on the Proposed Development. The study area includes the area within the Proposed Development boundary and also areas outside this boundary that may influence the Proposed Development. The assessment will include a detailed study of the area up to 500m from the boundary of the Site, which is in general accordance with current contaminated land guidance²⁶.

6.2. BASELINE CONDITIONS

SITE HISTORY

- 6.2.1. A review of historical mapping from 1850 and 1870 has shown that the Site was occupied by a number of buildings. The Proposed Development is located within the vicinity of the 'Military Store Department' and 'Royal Arsenal', therefore it is considered likely that these buildings were part of the Royal Arsenal. Mapping between 1896 and 1982 does not show any features on the Site or in the surrounding area to the north (which are called Plumstead Marshes in mapping from 1962). It is considered likely that this is due to the Site being part of the Royal Arsenal, and therefore omitted from mapping in the interest of national security. Russian military mapping from 1985 indicates a building to be present in the north of the Site. From the mapping in 1985, features are not shown on the Site until 1996 when a large building is present to the north of the Site and extending across the northern portion of the Site. The building is shown to have changed configuration in 2006 and to no longer be present in 2019.
- 6.2.2. The Site is in an area considered at 'High' risk from unexploded ordnance that may remain from World War II.

GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

- 6.2.3. Based on British Geological Survey (BGS)²⁷ the Site is indicated to be underlain by a superficial geology comprising Head Deposits. Bedrock geology comprises the Thanet Sand Formation which is underlain by the Lewes Nodular Chalk Formation. Geological mapping also indicates the Site to have Made Ground present described as 'mainly landfill, flood defences or road and railway embankments'.
- 6.2.4. The Environment Agency classifies the Head deposits as a Secondary Undifferentiated Aquifer which is assigned where it is not possible to attribute either category A or B to a rock type due to variable characteristics of the rock type. The Thanet Sand Formation is classified as a Secondary A Aquifer which is assigned to permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. The

²⁶ R&D Publication 66: 2008, Guidance for the Safe Development of Housing on Land Affected by Contamination.

²⁷ BGS (2019) Geology of Britain

Chalk Group is classified as a Principal Aquifer which is assigned to geology that exhibit high permeability and/or provide a high level of water storage and may support water supply and/or base flow on a strategic scale.

6.2.5. The Site is not located within a Source Protection Zone (SPZ) or a Nitrate Vulnerable Zone (NVZ).

6.2.6. The nearest surface water features include a pond associated with a residential development located approximately 350m north of the Site and the River Thames located approximately 400m north of the Site. The pond associated with the residential development is considered likely to be lined with clay or concrete and therefore not in continuity with groundwater.

6.3. IDENTIFICATION OF SENSITIVE RECEPTORS

6.3.1. Based on the baseline information available, the following sensitive receptors have been identified relating to the Proposed Development:

- Future Site users (high sensitivity);
- Construction workers (medium sensitivity);
- Third-party neighbours (medium to high sensitivity);
- Secondary Undifferentiated Aquifer (low sensitivity);
- Secondary A Aquifer (medium sensitivity);
- Principal Aquifer (high sensitivity); and
- River Thames (medium sensitivity).

6.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

6.4.1. The baseline information and the historical and current uses of the Proposed Development site and the immediate surrounding area has been used to identify likely significant effects. The likely significant effects during the construction phase are discussed in Table 6-1. These comprise:

- Potential effect on construction workers and third party neighbours from potential contamination within the underlying soils/groundwater (if present); and
- Potential effect to Controlled Waters.

Table 6-1 – Summary of Likely Significant Effects for Ground Conditions

Impact	Phase	Receptor	Justification
Potential effect on construction workers and third party neighbours from potential contamination within the underlying soils/groundwater (if present)	Construction	Construction workers Third party neighbours	Potential for direct contact with contaminants during ground works or from the migration of contaminated dust/fibres. Potential for the inhalation of ground gases/vapours within building spaces or excavations.
Potential effect to Controlled Waters	Construction	Groundwater (Secondary Undifferentiated Aquifer,	Potential for increased mobilisation of chemical contaminants.

Impact	Phase	Receptor	Justification
		Secondary A aquifer and Principal Aquifer) River Thames	Potential for presence and migration of contaminated groundwater.

- 6.4.2. Once the development has been constructed there will be no operational effects likely on ground conditions.

INSIGNIFICANT EFFECTS

- 6.4.3. It is anticipated that any contaminants found during the construction phase will be remediated in line with the proposed uses. It is assumed clean cover layers (and any imported material), if required, will be validated for depth and chemical quality prior to occupation. This negates the requirement for consideration of potential impacts to future Site users, third party neighbours, potable water supply and plants during the operational phase of the Proposed Development. Therefore, the potential exposure of future Site users, third party neighbours, potable water supply and plants to contaminated during the operation phase will be insignificant and not be assessed within the Ground Conditions Chapter.
- 6.4.4. The Ground Conditions Chapter will assess potential effects from chemical contamination on Controlled Waters. Potential effects relating to physical contamination of surface water (i.e. sediment) and changes to groundwater recharge and flow will be considered within the Water Resources and Flooding Chapter.

MITIGATION

- 6.4.5. It is expected that the embedded mitigation measures (e.g. materials management, suitable storage of fuels) during construction would be secured via a CEMP.
- 6.4.6. In addition, the following embedded and additional mitigation measures are anticipated to address construction effects:
- Further UXO risk assessment;
 - Targeted ground investigation and related contamination risk assessments;
 - Remediation Strategy (if required);
 - Remediation (if required)
 - Permanent controlled drainage scheme; and
 - Ground gas protection measures in new buildings (if required following risk assessment).
- 6.4.7. Following assessment, any additional mitigation measures will be identified in the ES where necessary, to reduce the magnitude of impacts.

6.5. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 6.5.1. The National Planning Policy Framework (NPPF) requires newly developed or redeveloped sites to be 'suitable for use' in relation to ground contamination. Therefore, should contamination be present beneath the Site, redevelopment would provide a beneficial effect through remediation works.

6.6. ASSESSMENT METHODOLOGY

LEGISLATIVE CONTEXT

6.6.1. The following legislative frameworks considered applicable to the assessment of ground conditions are summarised as follows:

- Part 2A of the Environmental Protection Act (EPA), 1990²⁸;
- Environment Act, 1995²⁹;
- Control of Substances Hazardous to Human Health, 2002³⁰;
- Dangerous Substances Directive (Amendment), 2006;
- Groundwater Directive 2006/118/EC³¹;
- Control of Asbestos Regulations, 2012³²;
- National Planning Policy Framework 2019³³;
- Contaminated Land (England) (Amendment) Regulations, 2012³⁴;
- Construction (Design & Management) Regulations, 2015³⁵;
- Environmental Damage (Prevention and Remediation) Regulations, 2015³⁶;
- The Environmental Permitting (England and Wales) Regulations, 2016³⁷; and,
- The Water Environment (Water Framework Directive) (England and Wales) Regulations, (2000/60/EC) 2017³⁸.

GUIDANCE

6.6.2. The assessment will take in to account the following guidance:

- British Standard (BS) BS8576 (2013) Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds³⁹;
- Construction Industry Research and Information Association (CIRIA) C552 (2001) Contaminated Land Risk Assessment. A Guide to Good Practice⁴⁰;

²⁸ Environmental Protection Act, 1990.

²⁹ Environment Act, 1995. Available at: https://www.legislation.gov.uk/ukpga/1995/25/pdfs/ukpga_19950025_en.pdf

³⁰ Control of Substances Hazardous to Human Health (2002). Available at:

http://www.legislation.gov.uk/ukxi/2002/2677/pdfs/ukxi_20022677_en.pdf

³¹ Groundwater Directive 2006/118/EC. Available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0019:0031:EN:PDF>

³² Control of Asbestos Regulations, 2012. Available at: http://www.legislation.gov.uk/ukxi/2012/632/pdfs/ukxi_20120632_en.pdf

³³ National Planning Policy Framework (NPPF), 2019. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

³⁴ Contaminated Land (England) (Amendment) Regulations, 2012. Available at:

http://www.legislation.gov.uk/ukxi/2012/263/pdfs/ukxi_20120263_en.pdf

³⁵ Construction (Design & Management) Regulations, 2015. Available at:

http://www.legislation.gov.uk/ukxi/2015/51/pdfs/ukxi_20150051_en.pdf

³⁶ Environmental Damage (Prevention and Remediation) Regulations, 2015. Available at:

https://www.legislation.gov.uk/ukxi/2015/810/pdfs/ukxi_20150810_en.pdf

³⁷ The Environmental Permitting (England and Wales) Regulations, 2016. Available at:

http://www.legislation.gov.uk/ukxi/2016/1154/pdfs/ukxi_20161154_en.pdf

³⁸ Available at: http://www.legislation.gov.uk/ukxi/2017/407/pdfs/ukxi_20170407_en.pdf

³⁹ British Standards Institute (2013). Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).

⁴⁰ Rudland, D J, Lancefield, R M, Mayell, P N (2001). Contaminated Land Risk Assessment. A Guide to Good Practice (C552). Construction Industry Research and Information Association (CIRIA).

- CIRIA C532 (2001) Control of Pollution from Construction Sites⁴¹;
- Environment Agency (EA) (2004) Model Procedures for the Management of Contaminated Land (CLR11)⁴²;
- CIRIA C665 (2007) Assessing Risks Posed by Hazardous Gases to Buildings⁴³;
- CIRIA C681 (2009) Unexploded Ordnance - A Guide for the Construction Industry⁴⁴;
- CIRIA C682 (2009) The VOCs Handbook⁴⁵;
- Department for Environment Food & Rural Affairs (DEFRA) (2012) Contaminated Land Statutory Guidance⁴⁶;
- CIRIA C733 (2014) Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks⁴⁷;
- BS5930 (2015) Code of Practice for ground investigations⁴⁸;
- BS 8485: 2015+A1 (2019) Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings⁴⁹;
- BS 10175:2011+A2 (2017) Investigation of Potentially Contaminated Sites – Code of Practice⁵⁰; and
- EA (2017) Groundwater Protection Technical Guidance⁵¹.

PROPOSED ASSESSMENT METHODOLOGY

- 6.6.3. The EA's guidance CLR11 (2004)⁵² advocates the use of a conceptual risk assessment model (Conceptual Site Model). The basis of this approach comprises three elements: a source, a pathway and a receptor. Without each of these, there can be no contamination risk. Therefore, the presence of measurable concentrations of contaminants within the ground and subsurface environment does not automatically imply that a contamination risk exists, since the contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors, which are relevant to a particular Site, will vary according to the intended use of the Site, its characteristics and its surroundings. The potential for harm to occur required three conditions to be satisfied:

⁴¹ Masters-Williams, H et al. 2001. Control of Pollution from Construction Sites. CIRIA C53.

⁴² Environment Agency (2004). Model Procedures for the Management of Land Contamination (CLR11). Available at: <https://webarchive.nationalarchives.gov.uk/20140328160926/http://cdn.environment-agency.gov.uk/scho0804bibr-e-e.pdf>

⁴³ Wilson, S et al. Assessing Risks Posed by Hazardous Gases to Buildings (C665). CIRIA.

⁴⁴ Stone, K et al. 2009 Unexploded Ordnance - A Guide for the Construction Industry (C681). CIRIA

⁴⁵ Baker, K. et al. (2009). The VOCs Handbook (C682). CIRIA.

⁴⁶ Department for Environment Food & Rural Affairs (1990). Environmental Protection Act 1990:

Part 2A Contaminated Land Statutory Guidance. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223705/pb13735cont-land-guidance.pdf

⁴⁷ Nathanail, C P, et al. (2014). Asbestos in soil and made ground: a guide to understanding and managing risks (C733). CIRIA.

⁴⁸ British Standards Institute (2015). 5930:2015: Code of Practice for ground investigations.

⁴⁹ British Standards Institute (2019). BS 8485: 2015+A1: Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings

⁵⁰ British Standards Institute (2017). BS 10175:2011+A2: Investigation of Potentially Contaminated Sites – Code of Practice.

⁵¹ Environment Agency (2017). Ground Water Protection Technical Guidance. Available at:

<https://www.gov.uk/government/publications/groundwater-protection-technical-guidance>

⁵² Environment Agency (2004). Model Procedures for the Management of Land Contamination (CLR11). Available at: <https://webarchive.nationalarchives.gov.uk/20140328160926/http://cdn.environment-agency.gov.uk/scho0804bibr-e-e.pdf>

- The presence of substances (potential contaminants/pollutants) that may cause harm (the 'Source' of pollution);
- The presence of a receptor that may be harmed (e.g. the water environment or humans, buildings, fauna or flora) (the 'Receptor'); and
- The existence of a linkage between the source and receptor (the 'Pathway').

- 6.6.4. CLR11 will be used as a technical framework in the understanding of how contamination issues that may arise on the Site could be managed.
- 6.6.5. The Conceptual Site Model will be used to identify and assess the potential effects on the identified sensitive receptors (including human health, controlled waters, buildings and services) and outline mitigation measures to manage the risks identified in the assessment. The assessment will be prepared in accordance with the legislation and guidance referenced above.
- 6.6.6. The potential effect of the Proposed Development on ground conditions, and/or the effect of ground conditions on the Proposed Development, will be assessed during the construction phase. The significance level attributed to each effect will be assessed based on the magnitude of change due to the Proposed Development and the importance/sensitivity of the affected receptor / receiving environment to change.
- 6.6.7. The magnitude, sensitivity and overall significance criteria are different from the process outlined in Section 3.5.

MAGNITUDE CRITERIA

- 6.6.8. Risk, probability and consequence inform the magnitude of change (CIRIA C552 guidance). The magnitude of change will be assessed on a scale of high, medium, low and negligible as defined in **Table 6-2**.

Table 6-2 – Magnitude Criteria

Magnitude of Impact	Definition
High	A severe or acute impact to human health. Major derogation of aquifer / surface water quality or status. Impacts which are predicted to result in a major or irreversible change in the habitat / community of ecosystems.
Medium	Minor detrimental impact to human health. Minor derogation of aquifer / surface water quality or status. Impacts with potential to affect key attributes or habitats / communities but without changing overall viability.
Low	A discernible effect that is, however, unlikely to significantly alter human health, aquifer / surface water quality, or the attributes of receptor habitats.
Negligible	Unlikely to have a discernible impact to human health, aquifer / surface water quality or status, or the attributes of receptor habitats / communities.

RECEPTOR IMPORTANCE / SENSITIVITY

- 6.6.9. The sensitivity of the affected receptor / receiving environment will be assessed on a scale of high, medium and low as defined in **Table 6-3**.

Table 6-3 – Sensitivity / Importance Criteria

Sensitivity / Importance	Receptor
High	<p>On-site occupants</p> <p>Off-site occupants (residential)</p> <p>Surface water bodies of high quality and/or in use as public water supply.</p> <p>Aquifers currently used, or likely to be suitable for use, as public potable supplies (e.g. Principal Aquifers, Source Protection Zone for a potable groundwater supply).</p> <p>Controlled waters that are nationally designated areas e.g. SSSI; internationally designated areas e.g. SAC, SPA, RAMSAR.</p>
Medium	<p>Construction and maintenance workers</p> <p>Off-site occupants (non-residential)</p> <p>Surface water bodies of moderate quality.</p> <p>Aquifer providing abstraction water for agricultural or industrial use. (e.g. Secondary A Aquifers).</p> <p>Controlled waters that are regionally designated areas e.g. local nature reserves</p>
Low	<p>Local water bodies of poor or worse chemical or biological status.</p> <p>Secondary B and undifferentiated aquifers; unproductive strata.</p> <p>Undesignated sites or controlled waters features which appreciably enrich the local habitat resource.</p>

OVERALL SIGNIFICANCE CRITERIA

The terms presented in **Table 6-4** will be used to define the effects. The impacts will be described as beneficial or adverse. An effect will be considered significant if assessed as moderate or above.

Table 6-4 – Effect Significance

Sensitivity Value of Receptor	Magnitude of Impact				
		No Change	Low	Medium	High
	High	Negligible	Minor	Minor or Moderate	Moderate or Large
	Medium	Negligible	Negligible or Minor	Minor	Moderate
	Low	Negligible	Negligible or Minor	Negligible or Minor	Minor
	Negligible	Negligible	Negligible	Negligible or Minor	Negligible or Minor

TEMPORAL SCOPE

6.6.10. The assessment of environmental impacts relating to ground conditions will comprise:

- Short and medium term, temporary effects; and,
- Long term, permanent effects.

6.7. LIMITATIONS AND ASSUMPTIONS

To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- The assessment relies on available data, and best endeavours have been made to ensure that the data is accurate and up to date, however the accuracy of third party information cannot be confirmed.
- It is assumed that any potential effects arising from ground gas (including radon and volatile vapours) will be appropriately mitigated prior to the completion of the construction phase. Therefore, the potential for the presence of ground gas to pose an increased risk to third party users (either as an explosive and asphyxiant risk) during the operational phase is considered to be insignificant and will not be assessed within the Ground Conditions chapter.

7. NOISE AND VIBRATION

7.1. STUDY AREA

- 7.1.1. The study area for the noise and vibration assessment will focus on future occupants of the proposed development as well as existing sensitive receptors in the immediate vicinity of the site (as identified below). It is considered that any potential effects will be most significant at receptors in the immediate vicinity of the site, with lower levels predicted further back and/or screened from the source of the noise.
- 7.1.2. The noise and vibration study area will also depend on the extent of the traffic data provided, and will incorporate any road traffic links for which data have been provided that are appropriate and relevant to the noise and vibration assessment.

7.2. BASELINE CONDITIONS

EXISTING BASELINE

- 7.2.1. The existing noise climate is dominated by road traffic noise from the A206 Plumstead Road to the south, Arsenal Way, Cornwallis Road and the Duke of Wellington Avenue, aircraft noise associated with City Airport, and any noise associated with the surrounding commercial/retail units.
- 7.2.2. Environmental noise surveys will be undertaken on site to establish the existing noise climate. The exact monitoring locations and duration of the survey will be subject to site access and security. Where possible, unattended measurements will be undertaken over a period of at least three days, supplemented with attended measurements where required.

FUTURE BASELINE

- 7.2.3. The future noise climate may also be affected by noise associated with Crossrail ventilation shafts. The exact location and noise break-out from these shafts is not known at the time of writing, but will be included for consideration in the assessment of the suitability of the site for residential development.
- 7.2.4. The Proposed Development is an over-station development, with the potential for the rail infrastructure to be connected via concrete elements to the proposed development. Therefore, consideration will also be given to the potential for rail-induced groundborne noise and vibration into the future residential spaces.

7.3. IDENTIFICATION OF SENSITIVE RECEPTORS

- 7.3.1. The nearby noise and vibration sensitive receptors which may be considered in this assessment are:
- Residential properties fronting the A206 Plumstead Road;
 - Future residential properties on Station Way (Royal Arsenal Riverside development);
 - Royal Arsenal Medical Centre on Arsenal Way;
 - Residential properties on Arsenal Way;
 - Residential properties on Burrage Road;
 - Heronsgate Primary School on Burrage Grove;
 - Residential properties on Jessop Close; and
 - Future occupants of the proposed development itself.

- 7.3.2. The above will be reviewed upon receipt of the traffic data, to incorporate any additional sensitive receptors along affected road traffic links.

7.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

- 7.4.1. Table 7-1 presents those impacts that have the potential to result in significant effects in terms of noise and vibration.

Table 7-1 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Construction noise	Construction	Existing sensitive receptors	As the construction plant working to clear the ground and construct the proposed development would be in the vicinity of existing sensitive receptors, there is the potential for significant adverse effects.
Construction vibration	Construction	Existing sensitive receptors	As the construction plant working to clear the ground and construct the proposed development would be in the vicinity of existing sensitive receptors, there is the potential for significant adverse effects.
Development-generated road traffic noise	Operational	Existing sensitive receptors	There is the potential for a change (both increase and decrease) in road traffic noise at existing sensitive receptors as a result of development-generated traffic using the local road network.

- 7.4.2. An assessment of the suitability of the site will be undertaken in line with relevant guidance and based on the results of any noise and vibration surveys. The assessment will consider any new future sources of noise and vibration. However, this future noise and vibration assessment falls outside of the scope of the EIA and therefore significance will not be assigned.

INSIGNIFICANT EFFECTS

- 7.4.3. The table below presents those impacts that are considered not to result in any significant effects in terms of noise and vibration.

Table 7-2 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Construction road traffic noise	Construction	Existing sensitive receptors	It is considered that any additional heavy vehicles as a result of the construction of the proposed development are unlikely to significantly affect the road traffic noise levels, given the existing heavy flow on the A206 Plumstead Road. Embedded mitigation measures will be identified in the ES chapter for inclusion in the CEMP to minimise any adverse effects.

External fixed plant items	Operational	Existing and future sensitive receptors	<p>Any fixed external plant items associated with the proposed development will be subject to noise emission limits, determined in line with the background sound levels and the guidance contained within BS 4142: 2014 + A1:2019 <i>Methods for Rating and Assessing Industrial and Commercial Sound</i>.</p> <p>Consequently, no significant effects are anticipated. It is expected that the Planning Application would include a condition requiring that the noise emission limits are met.</p>
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7.5. MITIGATION

- 7.5.1. Where significant adverse effects are identified during the construction phase and/or once the proposed development is operational, outline recommendations for embedded and additional mitigation measures will be provided. Residual effects will also be identified and presented.

7.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 7.6.1. No opportunities for enhancing the environment have been identified.

7.7. ASSESSMENT METHODOLOGY

CONSTRUCTION NOISE AND VIBRATION

- 7.7.1. The effects of noise and vibration during construction on existing sensitive receptors and future residential properties on Station Way (depending on programme) will be assessed based on guidance contained within British Standard (BS) 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites* (Part 1: Noise and Part 2: Vibration).
- 7.7.2. It is anticipated that neither the exact type of construction plant nor a detailed construction programme will be available at the time of the assessment. Therefore, it is proposed that the construction phase noise and vibration effects should be assessed in outline at representative sensitive locations, based on the techniques and plant likely to be employed for similar sized projects. The focus of the construction assessment will be on the identification of mitigation measures to be included in a CEMP.

OPERATIONAL ROAD TRAFFIC NOISE

- 7.7.3. The change in noise levels resulting from additional traffic flows associated with the proposed development will be predicted based on traffic data provided and in line with guidance contained within the Department of Transport and Welsh Office memorandum *Calculation of Road Traffic Noise* (1988). The magnitude of the impact will then be assessed in general accordance with the guidance contained in *Design Manual for Roads and Bridges* (DMRB) Volume 11 Section 3 Part 7 – HD 213/11 *Noise and Vibration* (2011), using, in particular, the magnitude of noise impact classifications contained in that document.

SITE SUITABILITY

- 7.7.4. The suitability of the site for residential development will be assessed in accordance with the relevant policy documents, standards and guidance, including:

- Department for Communities and Local Government 'National Planning Policy Framework' (NPPF) (2019);
- Defra 'Noise Policy Statement for England' (NPSE) (2010);
- Ministry of Housing, Communities and Local Government 'Planning Practice Guidance', (2018);
- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings';
- World Health Organisation 'Guidelines for Community Noise' (1999);
- Professional Practice Guidance (ProPG) on 'Planning and Noise: New Residential Development' (2017);
- BS 4142:2014 'Methods for rating and assessing industrial and commercial sound';
- BS 6841:2005 'Guide to the evaluation of human exposure to vibration in buildings' Part 1 'Vibration sources other than blasting', and
- Royal Borough of Greenwich Core Strategy, adopted in 2014, where policies are relevant to noise and vibration.

7.7.5. The aim of this assessment would be to ensure that a suitable internal and external noise climate is achieved for future residents of the proposed site for development.

7.8. LIMITATIONS AND ASSUMPTIONS

7.8.1. The following limitations and assumptions have been identified at this stage:

- The above scoping input has been prepared in the absence of any detailed drawings for the proposed development. Therefore, a detailed methodology for the noise and vibration survey has not been provided. Consultation will be held with the RBG Environmental Health Officer before undertaking the noise and vibration survey.
- Further to the above, in the absence of any detailed drawings for the proposed development, the methodology for the vibration assessment is yet to be confirmed. This will be discussed and agreed with the Environmental Health Officer once this information is available.
- The extent of the available traffic data for the assessment of operational road traffic noise is not yet known. Therefore, the extent of the study area may be subject to change.
- It is anticipated that neither the exact type of construction plant nor a detailed construction programme will be available at the time of the assessment. Therefore, it is proposed that the construction phase noise and vibration effects be assessed in outline at representative sensitive locations, based on the techniques and plant likely to be employed for similar sized projects.
- The type, location and orientation of any external fixed plant items associated with the proposed development is not known at this stage. Any mitigation measures required to meet the plant noise emission limits will also be determined at the detailed design stage, to ensure no significant adverse effects arise.
- The location of and noise break-out from the Crossrail ventilation shafts are not known at the time of writing the scoping report. However, this information will be requested and will be used in the assessment of the suitability of the site for residential development.

8. WATER RESOURCES AND FLOOD RISK

8.1. STUDY AREA

- 8.1.1. The study area will focus on the 0.84ha of the Red Line Boundary of the Proposed Development which is shown in **Figure 1-1**. The Site is located in an urban industrial area, where portions of the Site are anticipated to discharge to a public foul and surface water drainage network. The Site is currently considered impermeable.
- 8.1.2. The study area will encompass direct surface water features up to approximately 0.5km from the Site boundary (i.e. associated with overland migration of pollutants directly to surface features, pollutants conveyed in drainage systems, and watercourses). The study area will also encompass indirect surface water features typically up to 1km, or further where appropriate, from the Site boundary. These features will be considered based on professional judgement of the assessor and current knowledge of the surface water features in the area that are in hydraulic connectivity (i.e. including surface water abstractions and downstream watercourses).

8.2. BASELINE CONDITIONS

- 8.2.1. The baseline conditions of the site have been identified from publicly available information and the Woolwich Station East End Over Site Development -Armourers Court, Arsenal Way Environmental Statement December 2013 and the related EIA Scoping Report 2012, which refer in particular to the Crossrail development in particular the Design Package C158 Woolwich Station.
- 8.2.2. According to EA's Flood Map for Planning (**Figure 8-1**), the Site lies entirely within Flood Zone 1 meaning that there is a probability of fluvial and tidal flooding of less than 0.1% every year; the Site is located adjacent to the defended tidal floodplain of the River Thames.

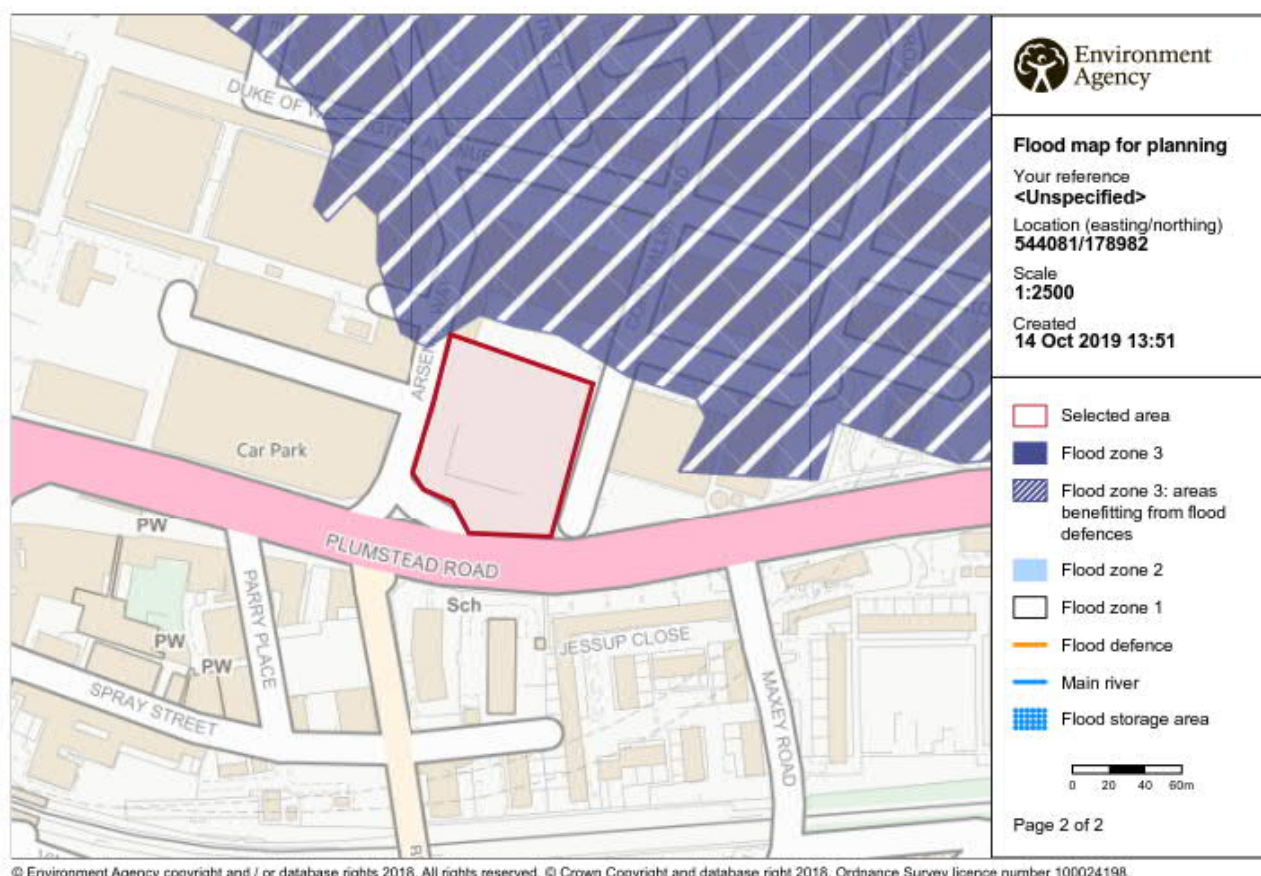


Figure 8-1 - EA Flood Map for Planning

- 8.2.3. This is confirmed by GOV.UK's Long Term Flood Risk Map (Figure 8-2) which shows that the Site is not at risk of flooding from rivers or the sea, the map also shows that the Site is not at risk from flooding from reservoirs.
- 8.2.4. GOV.UK's Long Term Flood Risk Map shows that the Site is at very low risk of surface water flooding, which means that each year this area has a chance of flooding of less than 0.1%. In the central portion of the site there is an area identified as being at low risk of flooding each year (between 0.1% and 1%). Within the low risk area there is a smaller area identified as being at medium risk of flooding each year (between 1% and 3.3%). No surface water flow paths are identified in the map which suggest flooding is representative of localised low spots within the site.

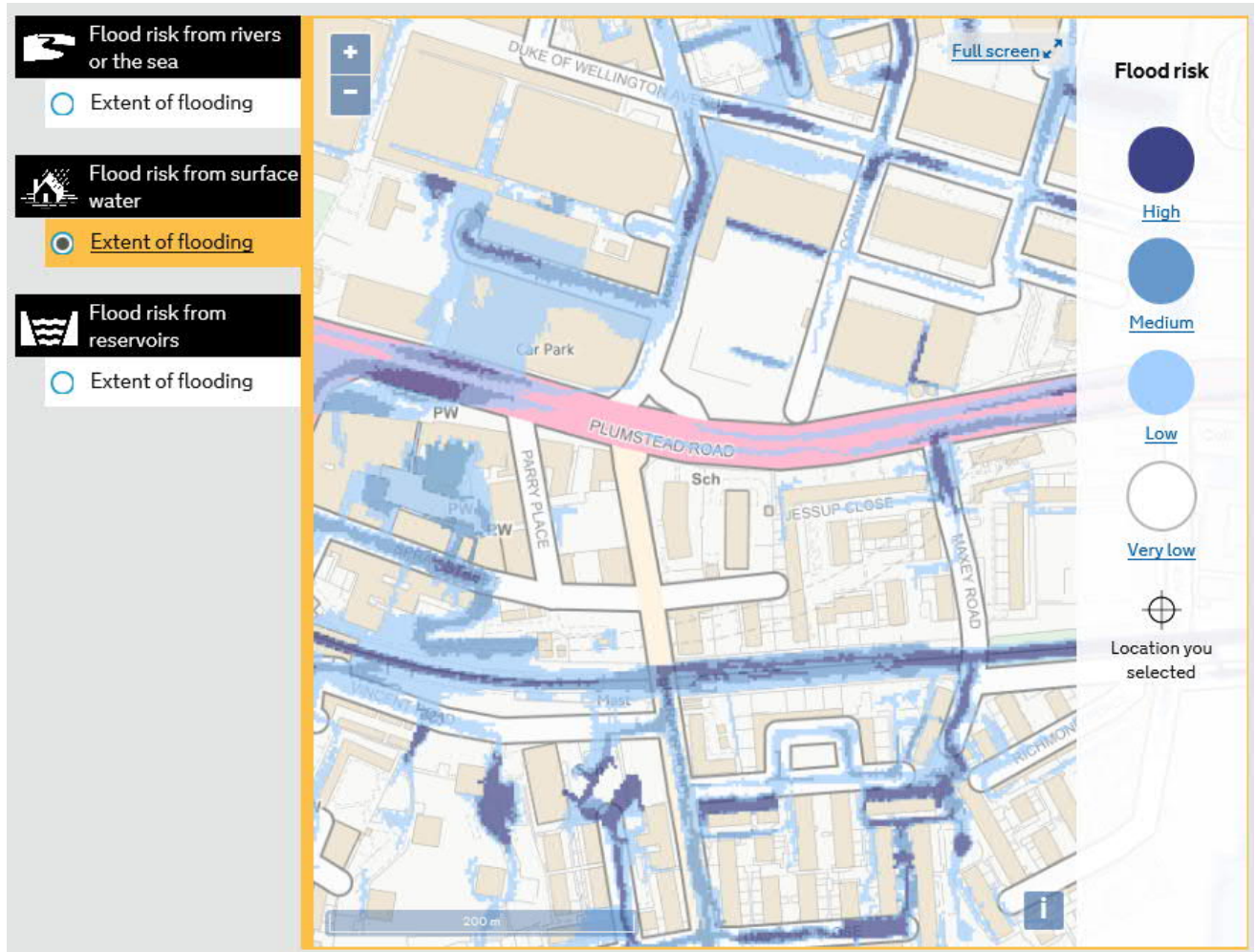


Figure 8-2 - GOV.UK flood risk from surface water

- 8.2.5. The geology in this route window comprises superficial deposits consisting of Made Ground and Terrace Gravels. These are underlain by Lambeth Group and Thanet Sands (part of the deep aquifer). Groundwater is also contained within the Chalk that underlies all of these deposits. The quality of this groundwater is likely to be non-potable because is affected by saline intrusion from the River Thames.
- 8.2.6. The site is in a Zone A 'Limited potential for groundwater flooding to occur', as identified in Figure 9 'Potential groundwater flooding zones' of the Royal Borough of Greenwich Strategic Flood Risk Assessment 2017 (SFRA), which used the Potential Groundwater Flooding Zones provided by MWH Consulting, carrying out a Groundwater Flooding study. This is identified as low risk in the SFRA.
- 8.2.7. The Woolwich Station East End Over Site Development -Armourers Court, Arsenal Way EIA Scoping Report 2012 indicated that there are no groundwater or surface water abstractions within the route window. There is one surface water discharge located on the northern bank of the River Thames.

8.3. IDENTIFICATION OF SENSITIVE RECEPTORS

- 8.3.1. Potential receptor which may be considered in this assessment are:
- Human receptors affected by flood risk;

- Watercourses and surface water drainage patterns – water quantity and quality;
- Public surface and foul water drainage networks – water quality and quantity;
- Groundwater - water quantity and quality; and
- Public Water Supply Network – water demand.

8.3.2. The groundwater quality issues in respect to chemical contamination are discussed as part of the Ground Conditions assessment, although the findings will also inform this chapter.

8.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

8.4.1. The baseline information and the historical and current uses of the Proposed Development site and the immediate surrounding area has been used to identify likely significant effects during the construction and operational phases. These are summarised in Table 8-1 and comprise:

- Change in surface water drainage, both quantity and quality, during construction.
- Change in groundwater, both quantity and quality (physical contamination), during construction.
- Changes to quantity of foul water discharged to the foul water drainage network and changes to potable water demand during operations.

Table 8-1 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Surface Water quality	Construction	Public surface and foul water drainage networks – any existing watercourses	Construction activities may cause pollution incidents
Groundwater quality (Physical contamination)	Construction	Groundwater	Construction activities may create pathways to groundwater and cause Physical contamination
Water quantity – discharge of surface water from the site	Construction	Public drainage Network – any existing watercourses	Soil use, site layout and drainage system may be modified during construction creating and/or modifying runoff flowpaths on site and elsewhere
Water quantity - groundwater	Construction	Groundwater	Excavation and/or piling required might increase infiltration and change pathways
Water quantity – foul water	Operation	Foul network	Changes in foul water discharged due to new development
Potable water demand	Operation	Water Supply network	Increase demand on water supply due to new development

INSIGNIFICANT EFFECTS

8.4.2. As the site is wholly in Flood Zone 1, fluvial and tidal flooding are not expected to have a significant effect on the development. No other significant sources of flooding have been identified at the site.

- 8.4.3. A small part of the site is identified in the GOV.UK's Long Term Flood Risk Map as being potentially at risk of surface water flooding however this does not appear to be associated to any surface water flow path and is expected to be representative of local levels which would be modified within the development.
- 8.4.4. As the site is already impermeable it is not expected that development would significantly affect runoff and flow paths at the site. The development will incorporate an appropriate drainage strategy which will reduce discharge off site in line with policy and best practice avoiding any negative impact elsewhere.
- 8.4.5. It is proposed to scope out potential effects in relation to flood risk during construction and operation. Those effects are not expected to be significant and will not be further considered in the ES.
- 8.4.6. Once operational, it is anticipated that the Proposed Development will incorporate an appropriate drainage strategy as embedded mitigation. There is anticipated to be a low volume of physical contaminants (sediment) which could potentially be entrained in surface run-off over hardstanding and landscaping and discharged to sensitive receptors. However, this will be subject to a controlled drainage regime. Potential effects in relation to physical contamination (i.e. sedimentation) during the operational stage are unlikely to be significant and will not be considered further within the ES.
- 8.4.7. Impacts on groundwater quantity and quality during operation are scoped out as infiltration is not proposed.
- 8.4.8. Changes to the quantity of foul water discharged during construction are not expected to be significant and are scoped out. Same applies for water supply requirements during construction.

Table 8-2 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Flood Risk	Construction and operations	Construction workers, residents and users of the area	The Site is in Flood Zone 1. No other significant sources of flooding are identified. A drainage strategy is proposed as part of embedded mitigation.
Surface Water Quality	Operation	Public surface and foul water drainage networks – any existing watercourses	Low volume of physical contaminants which will be controlled via the surface water drainage strategy.
Groundwater quality (Physical contamination)	Operation	Groundwater	No infiltration is proposed.
Water quantity – discharge of surface water from the site	Operation	Public drainage Network – any existing watercourses	The operational development will incorporate an appropriate drainage strategy which will limit discharge off site in line with policy and best

			practice avoiding any negative impact elsewhere.
Water quantity – Foul water	Construction	Foul water drainage networks	Not significant as there are limited additional users.
Potable water demand	Construction	Public Water Supply Network	Not significant as there are limited additional users.
Water quantity - groundwater	Operation	Groundwater	No infiltration is proposed.

8.5. MITIGATION

- 8.5.1. A CEMP will be produced to manage any potential impacts on water quantity and quality (both surface and groundwater) during construction.
- 8.5.2. The surface water drainage strategy would be an embedded mitigation as it will be inherent to the scheme design. It is not envisaged that any additional mitigation would be required as part of the development proposal.
- 8.5.3. The mitigation measures to prevent, reduce and offset any significant adverse effects on water resources will be determined through additional mitigation methods. This would include best practice measures to minimise pollution of surface water and groundwater onsite.

8.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 8.6.1. SuDS will be an opportunity to enhance the environment.

8.7. ASSESSMENT METHODOLOGY

LEGISLATIVE AND POLICY CONTEXT

- 8.7.1. The assessment of water resources and flood risk will be undertaken in the context of and considering the following:
- Water Framework Directive 2007;
 - The Floods Directive (2007/60/EC);
 - The Flood Risk Regulations, 2009;
 - The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015 and (Amendment) 2017;
 - Water Resources Act 1991 and (Amendment) 2009;
 - Environment Act 1995;
 - Water Act 2003 and 2014;
 - The Anti-Pollution Works Regulations 1999;
 - The Water Industry Act 1991 and 1999;
 - Land Drainage Act 1991 and 1994;
 - Flood and Water Management Act 2010;
 - The Environmental Damage (Prevention and Remediation) (England) Regulations 2015;

- The Environmental Permitting (England and Wales) Regulations (2010) and (Amendment) (No. 110) 2018;
- The Environmental Protection Act 1990;
- National Planning Policy Framework (NPPF) (2018);
- The London Plan; and
- Relevant Royal Borough of Greenwich (RBG) policies.

PROPOSED ASSESSMENT METHODOLOGY

- 8.7.2. As part of the water resources and flooding ES chapter, the following key elements will be undertaken as part of the assessment to inform the baseline:
- A desk study to establish site geology, history and current water regime (surface and groundwater);
 - Consultation and data review with relevant stakeholders, such as such as the Environment Agency (EA), Thames Water (TW) and Royal Borough of Greenwich (RBG), as appropriate and depending on the information already available through other studies (e.g. outline surface water drainage strategy); and
 - The assessment will include a staged approach involving an examination of baseline conditions, followed by impact assessment considering both construction and operational stages of the Proposed Development, identification of mitigation measures (i.e. pollution prevention measures) and a review of residual effects.
- 8.7.3. This desk-based assessment will be carried out in parallel with the ground conditions assessment, as ground conditions and water quality/quantity issues are closely interrelated.
- 8.7.4. A qualitative assessment of construction and operational effects will be completed, taking into consideration the supporting technical studies. Where feasible and appropriate, a quantitative assessment will be undertaken (based on other studies' results including the Outline Drainage Strategy and capacity checks among others) to assess for example volume of surface water storage and discharge rates.
- 8.7.5. The significance level attributed to each effect will be assessed based on the magnitude of the effect due to the Proposed Development and the sensitivity of the affected receptor to change. This is a variation on the methodology presented in Section 3.5. The magnitude of the effect and sensitivity of the affected receptor will be assessed by adapting the relevant tables within the following documents:
- Design Manual for Roads and Bridges (DMRB) LA 113: Road Drainage and the Water Environment; the DMRB provides guidance for appraising significance of potential impacts that road projects may have on the water environment; and
 - TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment chapter.

8.8. LIMITATIONS AND ASSUMPTIONS

- 8.8.1. To ensure transparency within the EIA process, the following limitations and assumptions have been identified:
- Limited information where available at the time of the assessment, which has been based on information available online and the information available on the Woolwich Station East End Over

Site Development -Armourers Court, Arsenal Way Environmental Statement December 2013 and the related EIA Scoping Report 2012.

- Consultation has not been carried out yet.
- The assessment is based on the 'Preferred Options Report'.
- Groundwater risk is confirmed to be low and construction of basement levels is not planned.
- Cumulative effects are only likely to arise from schemes on land in proximity to the Proposed Development. Due to the location within Flood Zone 1, the expected implementation of a surface water drainage strategy including SuDS, and compliance with relevant policy, legislation and best practice for new developments in London, it is not expected that the scheme will have a negative cumulative effect however this will be reviewed as part of the study.

9. SOCIO-ECONOMICS

9.1. INTRODUCTION

- 9.1.1. This chapter identifies the likely effects of the Proposed Development on Socio-economics, the scope of the assessment and the methodologies that will be used for the EIA. This chapter also provides an overview of the existing baseline conditions related to socio-economics and potential mitigation that could be required in relation to the Proposed Development.

9.2. STUDY AREA

- 9.2.1. The study area has been defined on a topic specific basis in terms of the extent and characteristics of the Proposed Scheme, it's location (e.g. characteristics and sensitivities of communities and associated amenities / facilities), past experience of mixed used residential led schemes and expert judgement.
- 9.2.2. Taking this into account, the study areas are as follows:
- **Economy and Employment:**
 - Employment generation during construction and operation – Greater London; and
 - Local spending – Borough level.
 - **Housing:**
 - Provision of housing – Borough level; and
 - Provision of affordable housing – Borough level.
 - **Social Infrastructure:**
 - Effects on capacity and demand for education – Average travel to school area; primary education 2.3km, secondary education 4.7km from the Proposed Development⁵³;
 - Effects on capacity for primary healthcare – 1km radius from the Proposed Development;
 - Provision of open space – 0.4km, 1.2km and 3.2km⁵⁴; and
 - Provision of play space – 100m, 400m and 800m⁵⁵.

9.3. BASELINE CONDITIONS

- 9.3.1. The baseline conditions described for socio-economics are derived from the following desk study sources:
- Office for National Statistics (ONS) Labour Market Profiles (NOMIS);
 - ONS Subnational Population Projections;
 - The Greater London Authority Population and Household Projections;

⁵³ National Travel Survey states that the average distance travelled to school by primary school pupils in London is 2.3km and for secondary pupils is 4.7km

⁵⁴ In line with the London Plan, 2016

⁵⁵ In line with GLA SPG 'Providing for Children and Young People's Play and Informal Recreation', 2012

- Royal Borough of Greenwich, Parks and Open Spaces Strategy⁵⁶;
- Indices of Multiple Deprivation, 2019; and
- London's Poverty Profile.

9.3.2. Where relevant, and available, data within this chapter is presented for the following areas:

- National (England and Great Britain);
- Regional (Greater London); and
- Local Authority (Royal Borough of Greenwich).

EXISTING BASELINE

9.3.3. Key existing baseline conditions relevant to the assessment of socio-economics are as follows, and will be outlined in further detail within the socio-economics ES chapter:

POPULATION

9.3.4. The resident population of Greenwich is 286,322, of which 50.3% (144,227) are males and 49.6% (142,095) are females⁵⁷. The most highly represented ethnicity within Greenwich is 'White British' residents (46.2%) followed by Black, Asian, and Minority Ethnic (BAME) residents (40.8%)⁵⁸.

9.3.5. Over the next 20 years, the population is projected to continue to rise by 20.5%, meaning by 2039 the population in Greenwich is set to stand at 346,600. The greatest population increases are predicted to be amongst those aged over 55, whilst small decreases are projected in those aged between 30-34 and 35-39⁵⁹.

ECONOMIC ACTIVITY & EMPLOYMENT

9.3.6. In Greenwich, 67.6% of residents are of working age (16-64 years old), of which 78.2% are economically active, which is similar to both the London (78.1%) and the national (78.7%) averages⁶⁰. The unemployment rate in the Borough is 4.3%, which lower than London average of 4.7% but higher than the national average of 4.1%⁶⁰.

9.3.7. The local (Greenwich) economy comprises a broad range of industries, with the Human Health and Social Work; Education; and the Wholesale and Retail Trade sectors being the largest employment industries within the Borough (17.6%, 14.1% and 12.9% respectively). The Human Health and Social Work and Education sectors within Greenwich have considerably higher proportion of employees than the Greater London averages (10.6% and 7.8%)⁶¹.

⁵⁶ Royal Borough of Greenwich, Royal Greenwich Parks and Open Spaces Strategy, 2017, online: https://www.royalgreenwich.gov.uk/downloads/download/833/parks_and_open_spaces_strategy (Accessed on: 10/10/2019)

⁵⁷ Greater London Authority, GLA Population and Household Projections, 2018

⁵⁸ ONS, Ethnic Groups by Borough, 2018

⁵⁹ ONS, 2016-Based Subnational Population Projections for Local Authorities and Higher Administrative Areas in England, 2018

⁶⁰ NOMIS, Labour Market Profile – Greenwich, online:

<https://www.nomisweb.co.uk/reports/lmp/la/1946157268/report.aspx?town=greenwich#tabeinaact> (Accessed on: 10/10/19)

⁶¹ Trust for London, London's Poverty Profile, Greenwich, online:

<https://www.trustforlondon.org.uk/data/boroughs/greenwich-poverty-and-inequality-indicators/> (Accessed on: 10/10/2019)

DEPRIVATION

- 9.3.8. According to the Indices of Multiple Deprivation (IMD) 2019, Greenwich was ranked as the 60th most deprived local authority out of 326 local authorities in England and the 13th most deprived of the 33 London Boroughs⁶². Of the Borough's 151 Lower Super Output Areas (LSOAs)⁶³, one LSOA is ranked amongst the top 10% of most deprived neighbourhoods in the country and 32 are ranked amongst the top 20% of most deprived neighbourhoods.
- 9.3.9. Deprivation does not affect all of the population groups equally. Of the 151 LSOAs in Greenwich 10 are within the top of 10% most deprived neighbourhoods nationally, with regards to Income Deprivation Affecting Children Index (IDACI). With regards to Income Deprivation Affecting Older People Index (IDAOPI) 41 LSOAs are amongst the top 10% nationally⁶⁴.

HOUSING & TENURE

- 9.3.10. There are approximately 111,840 dwellings in Greenwich. In terms of tenure, 32.9% of dwellings are rented from the local authority or housing association, 18.1% are rented privately, 32.7% have a mortgage and 16.3% own their homes outright. On average, properties within the borough are purchased for £418,000, which is the 11th cheapest of London's 33 boroughs.
- 9.3.11. Greenwich has built more social / affordable housing than any other borough in London. In the three years leading up to 2015/16, 1,211 social / affordable homes were built, as well as 552 new shared ownership homes. These combined made up 40% of the borough's total housing completions⁶¹.

LOCAL SERVICES & GREEN SPACE

- 9.3.12. The National Travel Survey states that the average distance travelled to school by primary school pupils in London is 2.3km and for secondary pupils is 4.7km. From the Site, the 2.3km radius encompasses Greenwich and Newham, while the 4.7km radius extends into the boroughs of Newham, Lewisham and Bexley and Barking and Dagenham.
- 9.3.13. Data from the Department for Education's Local Authority Cross Border Movement Survey⁶⁵ indicate that leakage to neighbouring boroughs is relatively high for secondary schools (approximately 30% leakage to neighbouring boroughs) and as such, cross border movement is likely to be relatively high from the Site. Considering primary schools within Greenwich and Newham, and secondary schools within Greenwich and the surrounding boroughs of Newham, Lewisham, Bexley and

⁶² Ministry of Housing, Communities & Local Government, English Indices of Multiple Deprivation, 2019, File 10 Local Authority District Summaries (lower-tier)

⁶³ 'Lower-Layer Super Output Areas (LSOAs) are a standard statistical geography designed to be of a similar population size, with an average of approximately 1,500 residents or 650 households. There are 32,844 LSOAs in England. They were produced by the ONS for the reporting of small area statistics and are a standard way of evenly dividing up the country by population. For ease of communication, LSOAs are sometimes referred to as 'neighbourhoods'. Ministry of Housing, Communities & Local Government, English Indices of Multiple Deprivation, 2019, Frequently Asked Questions.

⁶⁴ Ministry of Housing, Communities & Local Government, English Indices of Multiple Deprivation, 2019, File 3 Supplementary Indices - Income Deprivation Affecting Children Index (IDACI) and Income Deprivation Affecting Older People Index (IDAOPI)

⁶⁵ Department for Education, Schools, Pupils and their Characteristics: January 2018, Cross-border Movement Local Authority Tables, Table 13

Barking and Dagenham, there are currently 24 primary schools within 2.3km of the Site and 22 secondary schools within 4.7km.

- 9.3.14. The Proposed Development site is located within the NHS Greenwich Clinical Commissioning Group area which comprises 48 GP practices across four local care networks within the Borough. There are currently six GP practices and one hospital located within 1km of the Proposed Development site (a typical walking distance).
- 9.3.15. According to the Borough's Parks and Open Spaces Strategy⁶⁶ there are a total of 300 open spaces, totalling 1,390 hectares of land, which is approximately 28% of the Borough's total area. There are no playgrounds but a number of 'playable' green spaces within 800m of the Site (in line with GLA guidance 'Children and Young People's Play and Informal Recreation Facilities').

9.4. IDENTIFICATION OF SENSITIVE RECEPTORS

- 9.4.1. Potential sensitive receptors likely to be affected by the Proposed Development have been identified based on desktop studies, knowledge and understanding of the Site, and past experience of similar developments within Woolwich.
- 9.4.2. The following sensitive receptors have therefore been identified:
 - Construction phase: Construction phase employees working at the site.
 - Operation phase: Population affected by the development which includes future residents and employees at the Proposed Development, and other residents and employees in the local area who utilise existing social infrastructure (education, open space, play space and health facilities) as well as the new facilities and amenities which could be delivered by the Proposed Development.

9.5. SCOPE OF ASSESSMENT

ESTABLISHING THE BASELINE

- 9.5.1. The socio-economics baseline will include a review of any relevant policy at the local (Greenwich), regional (Greater London), and national levels to identify the key issues of relevance to the Proposed Development. It will include a baseline assessment which provides local context and a description of the existing socio-economic conditions surrounding the Site including: population and labour force; skills and unemployment; the local economy; and housing. The baseline assessment will also include a review of community and social facilities provision relevant to socio-economics and the Proposed Development including education (primary and secondary schools), primary healthcare (GP surgeries), open space, and child play space.

STANDARDS AND GUIDANCE

- 9.5.2. The socio-economic assessment will be carried out using a number of recognised data sources including (but not limited to) Census 2011 and ONS Labour Force Statistics, and wherever possible

⁶⁶ Royal Borough of Greenwich, Royal Greenwich Parks and Open Spaces Strategy, 2017, online: https://www.royalgreenwich.gov.uk/downloads/download/833/parks_and_open_spaces_strategy (Accessed on: 10/10/2019)

the impacts of the socio-economic assessment will be appraised against relevant national standards such as those provided by HM Treasury and the Homes and Communities Agency. Where relevant standards do not exist, professional experience and expert judgement by competent experts will be applied and justified.

LIKELY SIGNIFICANT EFFECTS

9.5.3. Table 9-1 summarises the likely significant effects of the development, which have therefore been scoped in for the next stage.

Table 9-1 – Summary of Likely Significant Effects

Impact	Phase	Receptor/s	Justification
Housing provision	Operation	<ul style="list-style-type: none"> ▪ Social Infrastructure ▪ Local residents 	The Proposed Development will comprise of up to 515 new dwellings, and once built will deliver a considerable number of new homes within Greenwich.
Employment generation	Construction and Operation phases	<ul style="list-style-type: none"> ▪ Construction employees ▪ Local residents ▪ Local (Greenwich) and regional (Greater London) economy 	During the demolition and construction phase, there is likely to be a significant increase in direct (i.e. on-site) indirect, and induced employment opportunities at the local and regional levels. During operation, there is likely to be a significant increase in direct (i.e. on-site) indirect, and induced employment opportunities at the local and regional levels.
Affordable housing provision	Operation	<ul style="list-style-type: none"> ▪ Social Infrastructure ▪ Local residents 	RBG outlines a target of 50% affordable housing on all new developments. The Proposed Development would deliver affordable dwellings (subject to negotiations and viability) which could make a significant contribution towards the delivery of affordable housing in the Borough.
Additional local spending	Operation	<ul style="list-style-type: none"> ▪ Social Infrastructure ▪ Local residents ▪ Local economy 	Once the Proposed Development is completed and occupied, it is anticipated that the new residential units will result in an increased local population. While the likely numbers of residential occupants will not be significant in the context of Greenwich as a whole, there will be an associated increase in local spending which is anticipated to be beneficial.
Effects on open space and play space	Operation	<ul style="list-style-type: none"> ▪ Social Infrastructure ▪ Local residents 	There is likely to be an increase in the demand for open space and play space due to the arrival of new residents within the Proposed Development, some of whom will be families with children.

Impact	Phase	Receptor/s	Justification
			The change in demand for open space and play space and provision of any these spaces on-site, as part of the Proposed Development, will be considered.
Effects on education and health provision	Operation	<ul style="list-style-type: none"> Social Infrastructure Local residents 	<p>During the operational phase, there is likely to be an increase in the demand for education and healthcare facilities due to the arrival of new residents within the Proposed Development.</p> <p>The change in demand for education and healthcare in the context of existing supply will be considered.</p>

INSIGNIFICANT EFFECTS

9.5.4. Table 9-2 below summarises the likely insignificant effects of the development, which have therefore been scoped out of the next stage.

Table 9-2 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor/s	Justification
Housing provision for workforce	Construction	<ul style="list-style-type: none"> Social Infrastructure Local residents 	Given the large majority of workers will be drawn from the regional labour market (Greater London) and are likely to live within Greater London it is anticipated that the majority of construction workers will continue to reside within their current locations without any requirement to move home. Therefore, there is unlikely to be a significant increase in demand for accommodation local to the Site during the construction phase. Therefore, effects on housing and affordable housing for construction workers will be scoped out and not considered further within the ES.
Effects on education, health, open and play space provision for workforce	Construction	<ul style="list-style-type: none"> Social infrastructure 	Whilst limited elements of the construction phase could require the employment of specialist contractors, it is assumed that the majority of the construction workforce will be drawn from the regional labour market (Greater London) and are likely to reside within Greater London. Therefore, that the skills necessary to construct the Proposed Development are available locally. Given the large majority of workers will reside close to the Site it is anticipated that the majority of construction workers will continue to reside within their current locations. Therefore, there is unlikely to be a significant increase in workers moving into the local area and associated increased demand for local services is not anticipated. Therefore, effects on local services for construction workers will be scoped out and not considered further within the ES.

Impact	Phase	Receptor/s	Justification
Effects on crime and safety	Construction	<ul style="list-style-type: none"> Local residents 	During the construction stage there is the potential for vandalism and theft of on-site equipment. It is assumed that Site security arrangements for the Proposed Development will be in line with the requirements set out within the Construction (Design and Management) Regulations 2015 and appropriate security (CCTV/Personnel) will be provided on-site. Therefore, effects in relation to crime and safety will not be considered further within the ES.
Effects on crime and safety	Operation	<ul style="list-style-type: none"> Local residents 	It is anticipated that the Proposed Development will be designed to incorporate 'Secured by Design' principles and liaison will be undertaken with the Police Architectural Liaison Officer at the detailed design stage. Therefore, effects in relation to crime will not be considered further within the ES.

9.6. MITIGATION

- 9.6.1. The Socio-economics ES chapter will outline the facilities and proposals that could reduce the identified effects. Embedded and additional mitigation measures, both temporary and permanent, will be identified as necessary, to avoid or reduce any potential adverse effects and to maximise the beneficial effects of the Proposed Development. Measures will be identified to ensure the impact on the local community is minimised as part of the Proposed Development and/or wider cumulative developments.

9.7. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 9.7.1. Potential enhancement opportunities will be assessed to maximise the beneficial effects of the proposed development on the environment and local community. The inclusion of environmental and community enhancement measures within the Proposed Development have potential to increase the positive impacts on the local community and residents.

9.8. ASSESSMENT METHODOLOGY

- 9.8.1. For the assessment of impacts, the approach used within the Socio-economics chapter is outlined below:

CONSTRUCTION AND OPERATIONAL EMPLOYMENT

- Generation of direct, indirect, and induced employment opportunities during construction and operation of the Proposed Development will be assessed. Calculations relating to employment generation will be undertaken using Excel based analysis, which will use publicly available data sources.
- Employment generation during the construction phase will be based on the construction duration and cost and will be estimated by applying an average gross output per construction industry employee to the estimated total construction cost to determine gross and net construction employment generation per annum.
- Leakage rates will be applied to construction and operational employment calculations. Leakage effects are the benefits to those outside the effect area. On the basis of travel to work data,

21.4% of people working in Greater London live outside the area. This corresponds to a low to medium leakage rate as set out by English Partnerships Additionality Guidance.

- Displacement will be applied to construction and operational employment calculations. Displacement refers to the outputs / outcomes accounted for by reduced outputs/outcomes elsewhere in the target area (in this case Greater London). A displacement rate of 25% is applied, which corresponds to a Low rate as set out by English Partnerships Additionality Guidance, where there is expected to be some displacement effects but only a limited extent.
- A multiplier will be applied in relation to the generation of indirect and induced employment opportunities. Multiplier effects describe the economic activity (jobs, expenditure or income) associated with additional local income and local supplier purchases. A multiplier of 1.7 will be applied on the basis that there are strong supply linkages associated with the Proposed Development, based on its location within Greater London.

INCREASE IN HOUSING STOCK AND CONTRIBUTION TO AFFORDABLE HOUSING NEEDS

- A qualitative assessment of effects relating to housing stock will be undertaken by evaluating the quantum of market and affordable housing proposed, against the annual housing delivery targets outlined in Greenwich's Local Plan and the London Plan (and Draft London Plan).

ADDITIONAL LOCAL SPEND

- Additional local spend arising from new residents inhabiting the Proposed Development will be assessed by applying annual average spend per person to the projected new residential population of market and intermediate dwellings, taking account of leakage and displacement rates.

CHANGE IN LOCAL SERVICE DEMAND

- A qualitative assessment of effects relating to changes in local service demand (i.e. education and healthcare facilities) will be undertaken by estimating the additional number of residents based on the quantum of residential units as part of the Proposed Development. The additional population generated by the Proposed Development will be evaluated against the existing capacity of local services (i.e. educational and healthcare facilities) within the adopted study area.
- Local education facilities (primary and secondary schools) will be assessed according to relevant Department for Transport pupil travel distances and proportions of cross-border movement.
- Primary healthcare facilities will be assessed within a 1km catchment of the Site (taken to be a typical walking distance travelled to access services).

CHANGE IN DEMAND FOR OPEN AND PLAY SPACE

- The assessment of the change in demand for recreational / open space will be undertaken qualitatively based on a review of existing levels of recreation / open space and the anticipated increase in resident population as a result of the Proposed Development. The magnitude of change will be determined through an evaluation of the likely demand evaluated against the existing baseline conditions identified and provision proposed within the Proposed Development.
- Open and play spaces will be assessed according to the accessibility levels outlined in the London Plan and GLA's Shaping Neighbourhoods: Play and Informal Recreation Supplementary Planning Guidance (SPG).

ASSESSMENT CRITERIA

- 9.8.2. The methodology for assessing socio-economic impacts will follow standard EIA guidance and will involve:
- Consideration of local policy, plans and development constraints;
 - Assessment of the likely scale, permanence and classification of impacts; and
 - An assessment of the residual and cumulative impacts of the Proposed Development.
- 9.8.3. The assessment will consider the likely direct, indirect and cumulative impacts associated with socio-economics during construction and operation. For socio-economics there is no accepted definition of what constitutes a significant (or not significant) socio-economic effect. It is recognised that classification of an effect reflects the relationship between the scale of an impact (magnitude) and the sensitivity (or value) of the affected resource or receptor. This methodology differs from the process outlined in Section 3.5.
- 9.8.4. Socio-economic effects will be assessed on the basis of:
- Consideration of sensitivity to effects: specific values in terms of sensitivity are not attributed to socio-economic resources/receptors due to their diverse nature and scale, however the assessment takes account of the qualitative (rather than quantitative) 'sensitivity' of each receptor and, in particular, their ability to respond to change based on recent rates of change and turnover (if appropriate);
 - Magnitude of the impact: this entails consideration of the size of the effect on people or business in the context of the area in which effects will be experienced; and
 - Scope for adjustment or mitigation: the socio-economic study is concerned in part with economies. These adjust themselves continually to changes in supply and demand, and the scope for the changes brought about by the project to be accommodated by market adjustment will therefore be a criterion in assessing significance.
- 9.8.5. The assessment aims to be objective and quantifies effects as far as possible. However, some effects can only be evaluated on a qualitative basis.

9.9. LIMITATIONS AND ASSUMPTIONS

- 9.9.1. To ensure transparency within the EIA process, the following limitations and assumptions have been identified:
- The assessment would rely, in part, on data provided by third parties (e.g. OS Mapping, Local Authorities, ONS) which are the most up-to-date, available at the time of the assessment. No significant changes or limitations in these datasets have been identified that would affect the robustness of the assessment for EIA purposes;
 - The assessment impact on users of community infrastructure would be based on desktop study. No consultation would be undertaken to verify user levels;
 - The assessment would identify population impacts down to the lowest defined population group available according to ONS survey outputs (lower super output areas). Further granularity of data is not available. No significant changes or limitations in these datasets have been identified that would affect the robustness of the assessment for EIA purposes; and
 - Any limitations found or assumptions used in the final assessment will be highlighted within the ES.

10. TELECOMMUNICATIONS

10.1. INTRODUCTION

- 10.1.1. This section reviews and analyses the likely significant environmental effect of the Proposed Development on broadcast radio and television (TV) reception. In particular it considers the likely effects on properties in the survey area surrounding the Proposed Development due to interference with broadcast TV and radio signals.
- 10.1.2. Unless otherwise stated, all bearing measurements quoted are relative to True North as opposed to Magnetic North.

10.2. STUDY AREA

- 10.2.1. The study area consists of the area affected by the proposed scale and massing of the Proposed Development located at TQ 440 789 (postcode SE18 7HR). It also includes consideration of the positions of local transmitters of broadcast radio and TV.
- 10.2.2. The transmission sites considered are shown in Figure 10-1. The red line indicates the bearing to the Astra 2 Satellite cluster.

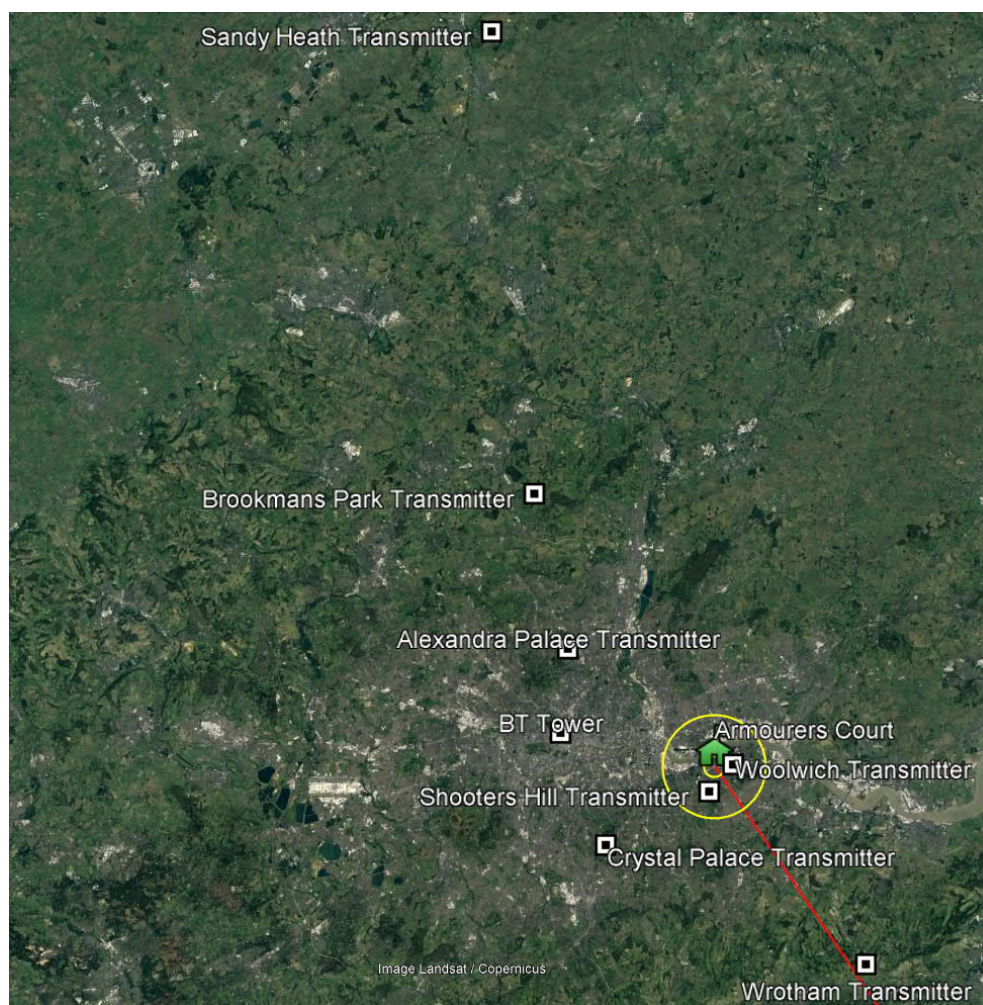


Figure 10-1 - Location of transmission sites

10.3. BASELINE CONDITIONS

- 10.3.1. Baseline characterisation was based on a desk study using information gathered from the following sources:
- Transmitter locations and elevations from BBC; (<http://downloads.bbc.co.uk/reception/pdfs/Nationaldab>); and
 - Satellite details from the “Dish Pointer” application (<http://www.dishpointer.com/>).
- 10.3.2. A Site visit will be undertaken at a future date to obtain information on the following:
- Adjacent building uses;
 - Approximate heights of neighbouring buildings; and
 - Presence of TV receiving equipment (aerials and face mounted dishes on buildings).
- 10.3.3. Additional topographical data is obtained from Ordnance Survey (OS).
- 10.3.4. There are four platforms in the UK by which users receive TV services to their homes: satellite and terrestrial, which are covered by this report, and Cable and Digital Subscriber Line (DSL), which are not affected by buildings and are therefore not covered by this report. Cable and DSL TV services are received via cables connected directly into a receiver. Although still in wide use, the use of terrestrial TV (also known as over-the-air) or broadcast TV is decreasing in many densely-populated areas. Terrestrial TV works via radio waves transmitted through open space, which are received by (usually roof mounted) aerials, usually unencrypted (commonly known as ‘free-to-air’ TV). Satellite services are received via a satellite dish connected to a receiver, e.g. a digital set-top-box.
- 10.3.5. The UK TV transmission network comprises many transmitters, rebroadcast links, microwave links and landlines.
- 10.3.6. Not all households and other buildings in the area are dependent on terrestrial TV as their primary source of TV. In general, it can be assumed that large commercial establishments are less likely to depend on terrestrial TV reception and are more likely to have cable and satellite TV services. The increasing uptake of cable and satellite TV services is likely to further reduce the number of households affected by shadows to terrestrial TV signals caused by a development.

BROADCAST TELEVISION

- 10.3.7. Within the UK, TV is currently transmitted in digital format. The transmitters serving the Proposed Development area are listed in Table 10-1 and displayed in Figure 10-2.

Table 10-1 - Transmitter locations

Transmitter Name	Grid Reference	Distance (Km)	Bearing (Degrees)	Antenna Height (m)
Crystal Palace	TQ 3394 7122	12.94	232.97	209
Woolwich	TQ 4602 7939	2	80.05	48
Sandy Heath	TL 2047 4944	72.1	162.69	238

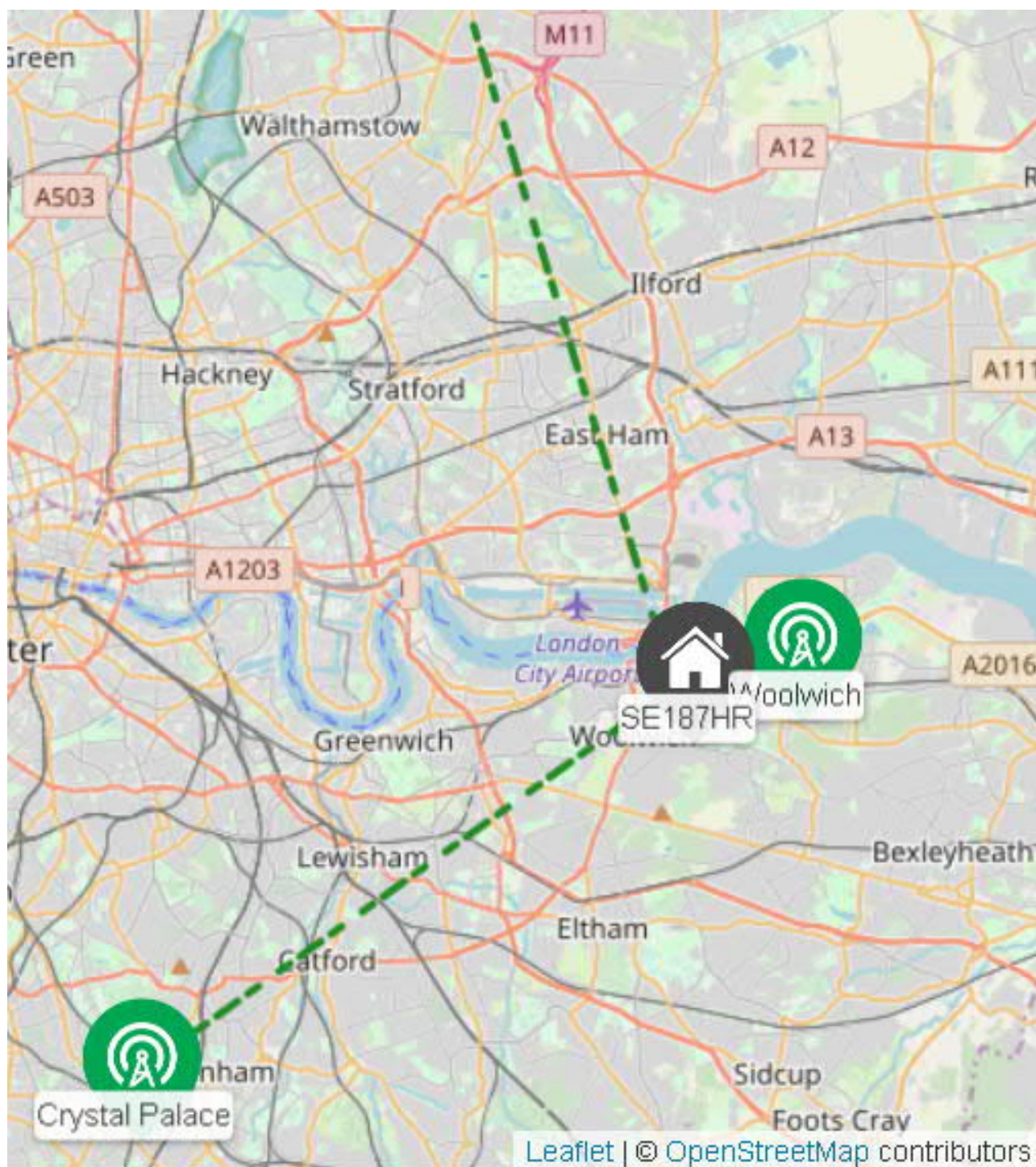


Figure 10-2 - Location of Crystal Palace and Woolwich TV Transmitters

- 10.3.8. The quality of terrestrial TV reception achieved is dependent on the equipment used at the receiving point. In many cases, a standard roof-top wide gain aerial is sufficient to obtain adequate signal reception in strong reception areas. In weak reception areas high gain, more directional antenna, and / or masthead amplifiers are employed.
- 10.3.9. The existing TV aerials located on residential properties around the Proposed Development and within 1km on a complementary bearing to the transmitters (as indicated to be within the theoretical

shadow zone and immediately surrounding Proposed Development) will be determined during the field survey.

BROADCAST RADIO

10.3.10. BBC digital radio broadcasts to the Woolwich area are provided by the transmitters listed in Table 10-2 and displayed in Figure 10-3.

Table 10-2 – Digital radio transmitters serving Woolwich

Transmitter Name	Grid Reference	Distance (Km)	Bearing (Degrees)	Antenna Height (m)
Alexandra Palace	TQ 296 900	18	308.72	65.5
Crystal Palace	TQ 3394 7122	12.94	232.97	209
BT Tower	TQ 292 819	15.14	202.89	191
Shooters Hill	TQ 438 767	2.5	189.07	124

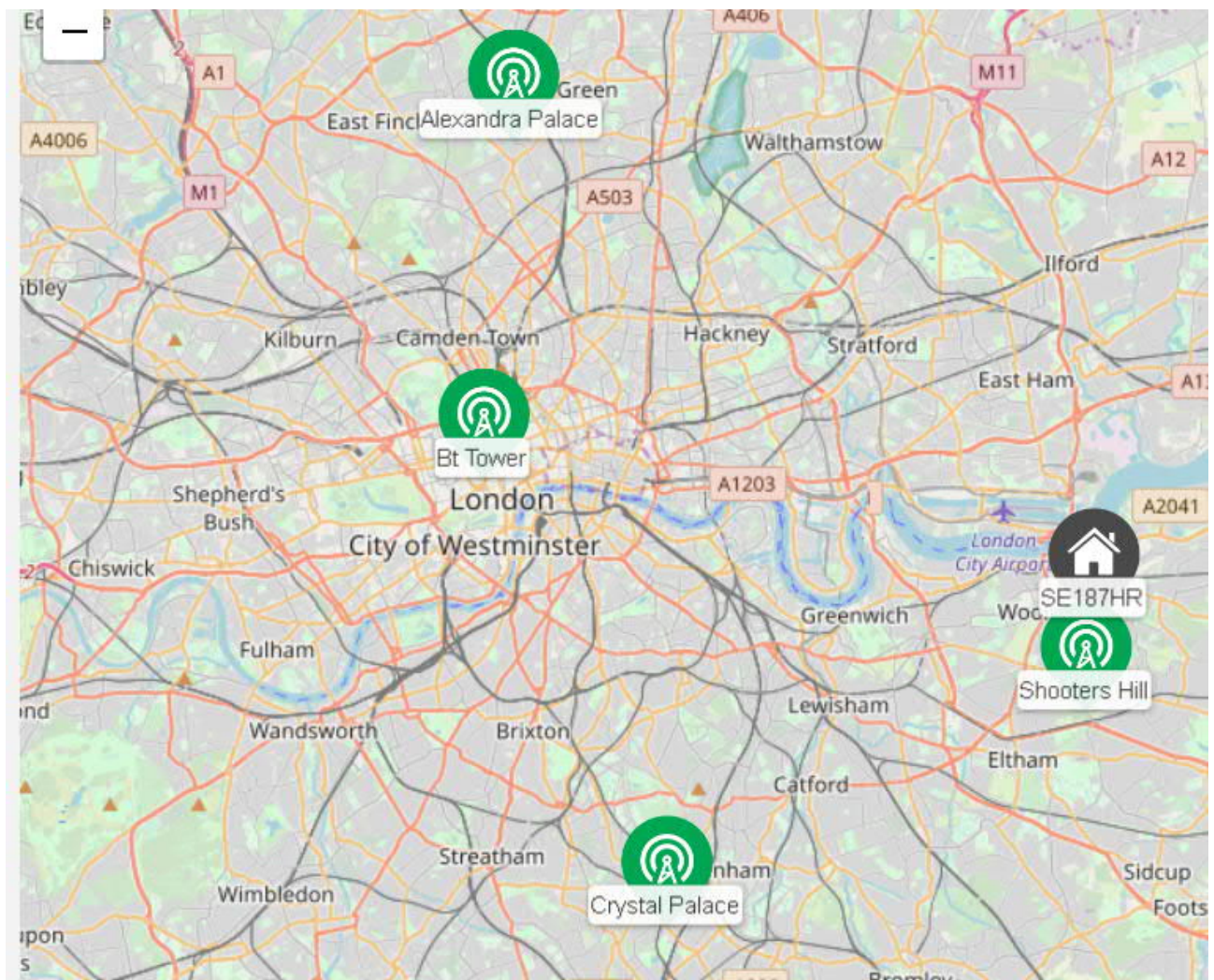


Figure 10-3 - Digital radio transmitters serving Woolwich

10.3.11. BBC FM radio broadcasts to Woolwich are provided by the transmitters listed in Table 10-3 and displayed in Figure 10-4.

Table 10-3 – FM Radio transmitters serving Woolwich

Transmitter Name	Grid Reference	Distance (Km)	Bearing (Degrees)
Crystal Palace	TQ 3394 7122	12.94	232.97
Wrotham	TQ 595 604	24.19	142.32

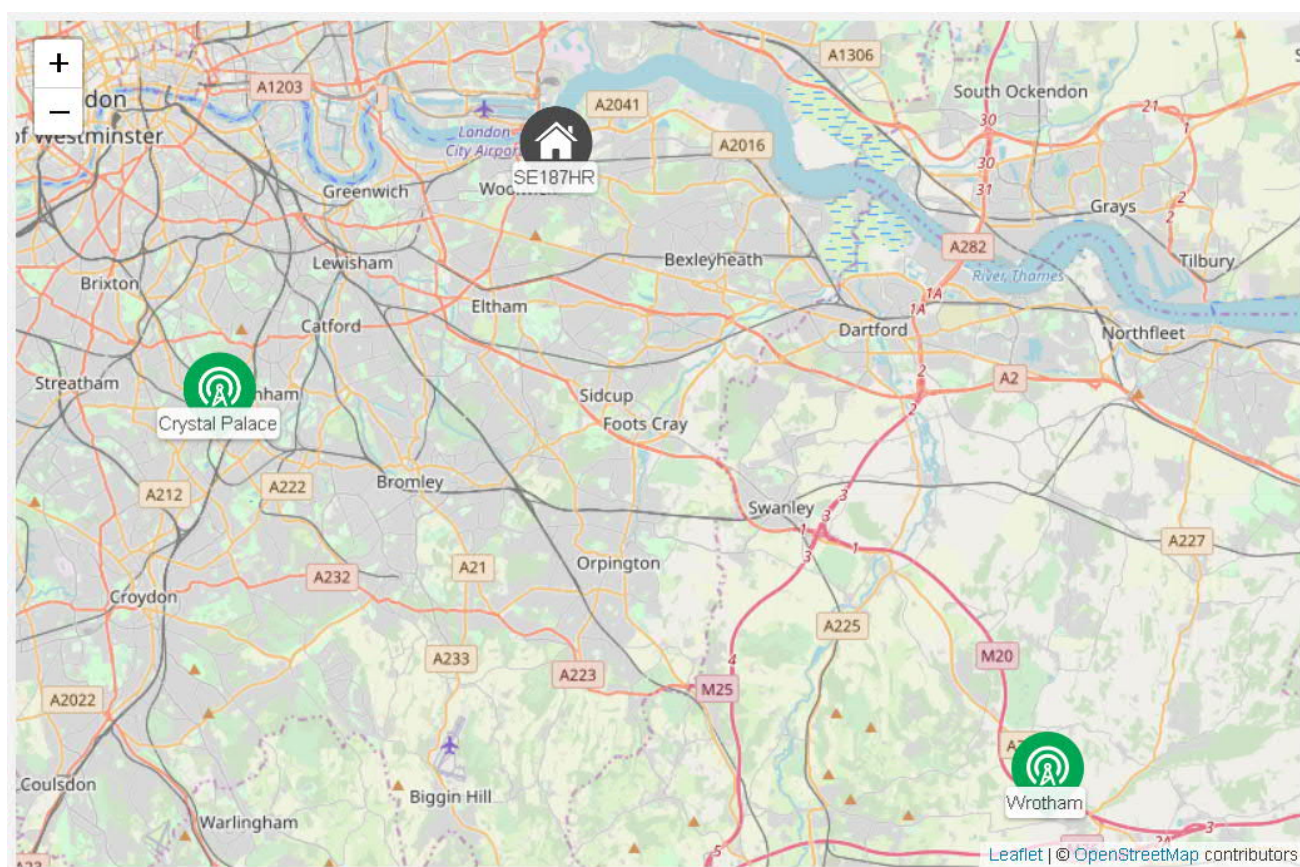


Figure 10-4 - FM Radio transmitters serving Woolwich

10.3.12. BBC AM ('Medium Wave') radio broadcasts to Woolwich are provided by transmitters listed in Table 10-4 and displayed in Figure 10-5.

Table 10-4 - AM (medium wave) transmitters serving Woolwich

Transmitter Name	Grid Reference	Distance (Km)	Bearing (Degrees)
Crystal Palace	TQ 3394 7122	12.94	232.97
Brookmans Park	TL 259 050	31.46	326.33

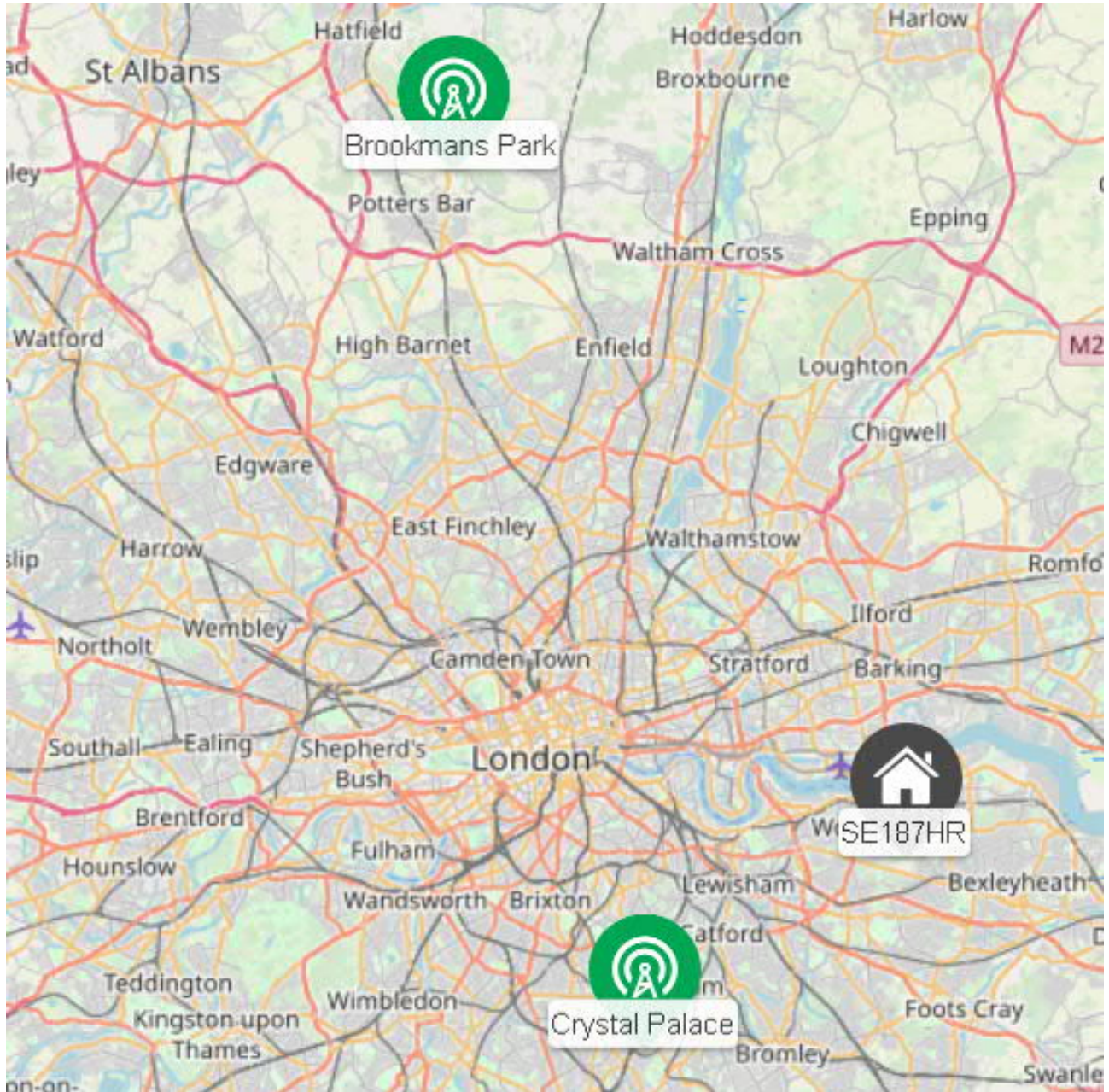


Figure 10-5 - AM (medium wave) transmitters serving Woolwich

10.3.13. BBC AM ('Long Wave') radio broadcasts are provided by the Droitwich transmitter located in the West Midlands (174.6 Km bearing 301.63 degrees).

10.3.14. Radio transmissions are less affected by broadcast shadowing from buildings. This is because the lower frequency radio signals can more easily refract around buildings and hills, although some loss of signal strength can occur the effects are less severe than for signals which travel in a more direct line of sight such as television signals. It is not expected that mitigation will be required to maintain access to broadcast radio transmissions.

SATELLITE TV AND RADIO

- 10.3.15. The major Satellite TV broadcast services (BBC, ITV, Channel 4, Five, Freesat, Sky) are provided by the ASTRA 2 satellite cluster (ASTRA 2E, 2F and 2G) located at a geo-stationary orbital location of 28.2 degrees east. For properties located in this area of London area, optimum reception is obtained by aligning dishes to the south east on a bearing of 145.6 degrees and an elevation to the horizontal of 25.5 degrees (Figure 10-6).
- 10.3.16. There are other satellite services available, but they offer extremely limited service to the general UK population and have therefore been disregarded for the purposes of this exercise.

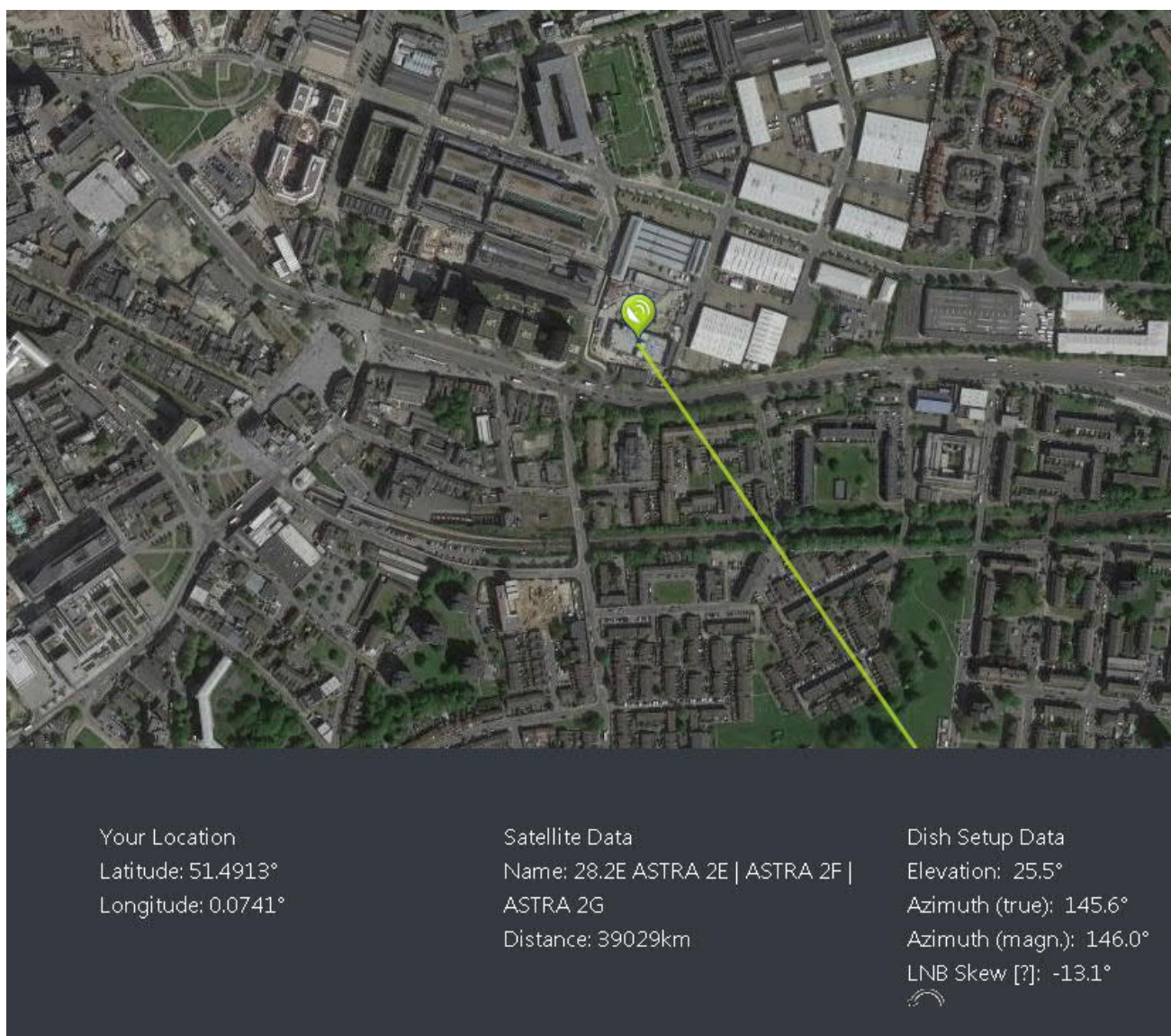


Figure 10-6 - Satellite dish alignment

FUTURE BASELINE

- 10.3.17. There is likely to be greater uptake of satellite, cabled and internet services and a corresponding reduction in the use of terrestrial transmitted signals. This assessment has been undertaken for the current conditions.

10.4. IDENTIFICATION OF SENSITIVE RECEPTORS

- 10.4.1. The sensitive receptors include buildings in regions around the Proposed Development that fall into the radio shadow of the building taking into consideration the type of radio signal and the transmission point.

10.5. SCOPE OF ASSESSMENT

- 10.5.1. The assessment consists of a desktop review of published telecommunications data together with a visual assessment of the Proposed Development and its surroundings to determine:

- The baseline transmission;
- Likely significant effects based upon the Proposed Development, sensitive receptors to the effects, the magnitude of change and significance of the effects;
- Potential effects identification for domestic TV, radio and satellite reception; and
- Mitigation measures and assessment of the likely significance of the residual effects following mitigation.

LIKELY SIGNIFICANT EFFECTS

- 10.5.2. Likely transmission effects to be considered within the ES are as follows:

- 10.5.3. There are two mechanisms that can affect broadcast transmissions:

- Attenuation caused by a physical obstruction; and
- Structures that reflect and diffract transmitted signals.

- 10.5.4. Broadcast shadowing can occur when a large structure blocks the reception of a TV or radio signal. This blocking effect creates a broadcast shadow behind the structure. The effect is the reduction (or elimination) of the signal strength within the shadow zone. The most significant factors affecting the potential for broadcast shadowing are a building's size and height above the surrounding sky line.

- 10.5.5. Broadcast TV signals do not create as 'hard' a shadow as, for means of comparison, visible light. For the purposes of explanation, a 'shadow' zone can be considered as having three sub-zones:

- Within a few hundred metres from a proposed building, the reduction in signal strength is significant;
- Further away from a building, within the limit of the 'shadow' zone, signal reduction is determined by diffraction at the edges of the structure and reflection off surrounding structures. The simple condition of whether or not a location has an optical view of the transmitter is not enough to classify the potential interference zone adequately. In general, the effect is that (i) the signal appears to bend around the sides of the structure; (ii) the shadow zone reduces in size; and (iii) the signal strength is reduced by much less than simple ray optics would suggest; and
- Even further away from the structure (approximately 5km), complex multiple reflections and diffraction, caused by structures in the locality, may result in the 'shadow' zone becoming almost non-existent.

Table 10-5 - Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Effects on broadcast TV reception	Demolition and construction	Properties with TV receivers	<p>There is a potential effect on TV signals associated with the temporary use of cranes. This effect would be intermittent as the cranes moves across the Proposed Development.</p> <p>Properties located within the theoretical line of sight shadow caused by the construction equipment could experience a reduction in TV signal strength if they are receiving signals from the transmitter.</p>
Effects on broadcast radio reception	Demolition and construction	Properties with radio receivers	<p>There is a potential effect on radio signals associated with the temporary use of cranes. This effect would be intermittent as the cranes moves across the Proposed Development.</p> <p>Properties located within the theoretical line of sight shadow of the radio transmitter, could experience a very slight reduction in signal strength.</p>
Effects on satellite reception	Demolition and construction	Satellite signal receivers	<p>Cranes and other plant could block out the satellite signal. This would affect satellite reception for the satellite dishes mounted on a direct line of sight through the development.</p>
Effects on broadcast television reception	Operation	Properties with TV receivers	<p>The Proposed Development would cast a broadcast TV shadow, the orientation and length of which are fixed by the location and elevation of the source transmissions</p> <p>Properties located within the theoretical line of sight shadow of a transmitter could experience a reduction in TV signal strength. This would include properties immediately adjacent to the north, and north-west side of the Proposed Development.</p>
Effects on broadcast radio reception	Operation	Properties with radio receivers	<p>Radio reception (particularly FM radio) may be affected for residents in the radio shadow of the Proposed Development.</p> <p>Medium wave, long wave and short-wave transmissions are less affected by broadcast shadowing</p>
Effects on satellite reception	Operation		<p>There is the potential for a reduction in satellite reception associated with the Proposed Development related to shadowing / signal blocking caused by the physical size of the buildings.</p>

10.6. MITIGATION

10.6.1. Mitigation required for TV Reception could include one of, or a combination of, the following:

- Realigning end-user reception aerials in to an alternative transmitter;
- Realigning end-user aerials to ensure maximum reception strength;
- Upgrading end-user equipment (television reception aerials, cables and / or signal boosters / amplifiers);
- Relocating end-user aerials or satellite dishes on building façades or rooftops to maintain a direct line of sight; and
- Switching end users' systems to satellite, subscription cable or DSL services.

10.6.2. Additional mitigation measures would have to be carried out by end users, and could include the following:

- Realigning end-user reception aerials in to an alternative transmitter; and
- Realigning end-user aerials to ensure maximum reception strength

10.6.3. Embedded mitigation measures for Satellite TV and Radio could include one of, or a combination of, the following:

- Upgrading end-user equipment;
- Relocating end-user satellite dishes on building façades or rooftops to maintain a direct line of sight;
- Relocating satellite dishes remotely to maintain a direct line of sight; and
- Switching end users' systems to subscription cable or DSL services.

10.7. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

10.7.1. None

10.8. ASSESSMENT METHODOLOGY

LEGISLATIVE CONTEXT

10.8.1. The specific applicable legislative framework is summarised as follows:

- HM Government (2003), Communications Act
- This detailed Act of Parliament spells out technical aspects of regulation, implementing and enforcing the law with regard to Communications and ensures the transmission medium for high-quality television and radio is protected.
- HM Government (1949, 1967, 1998 and 2006), Wireless Telegraphy Act (2006)
- Under the Wireless Telegraphy Act 2006 (Ref 2), the Proposed Development must satisfy the requirements that electromagnetic and physical interference to telecommunication have been fully taken into account and appropriate mitigation measures provided where necessary. These requirements are considered in assessing the effect of the Proposed Development on radio and TV reception.
- HM Government (2003), The Radio Equipment and Telecommunications Terminal Equipment (Amendment No. 2) Regulations 2003
- Details actions to enforce a regulation that relates to the protection and management of the radio spectrum (Ref 3).

- 10.8.2. Guidance on assessing the effects of new developments on telecommunications and broadcast transmissions is provided by the British Broadcasting Corporation (BBC) and Office of Communications (Ofcom) and include:
- BBC information on 'Transmitters' from the BBC website (<http://www.bbc.co.uk/reception/transmitters/>);
 - BBC and Office of Communications (2009) The Impact of Large Buildings and Structures (including Wind Farms) on Terrestrial Television Reception (http://licensing.ofcom.org.uk/radiocommunication-licences/fixed-terrestrial-links/guidance-for-licensees/wind-farms/tall_structures/); and
 - Ofcom (no date), 'Information for Viewers' accessed from the Ofcom website (<http://www.ofcom.org.uk/advice/>)
- 10.8.3. The assessment is based on the application plans for the Proposed Development. The following components of the Proposed Development are relevant to the assessment of the likely significant effects in relation to broadcast radio and TV:
- Heights;
 - Scale; and
 - Massing
- 10.8.4. The baseline conditions are determined from a visual site inspection and desk study information. The behaviour of radio signals includes reflection, refraction and diffraction depending on factors such as the material of the Proposed Development.
- 10.8.5. The assessment uses wave propagation theory to estimate line of sight shadows caused by the Proposed Development and the potential for signal reflections off building façades. Assessing the reception quality based on a direct line of sight approach highlights a worst-case scenario where a site is situated in a city or large town. TV and radio signals diffract around and reflect off buildings and other objects. In built up areas there is a significant chance that a secondary signal will be present which enables residents to receive a signal.
- 10.8.6. The assessment of potential effects as a result of the Proposed Development take into account the construction and operational phases. The significance level attributed to each effect is assessed based on the magnitude of change due to the Proposed Development and the sensitivity of the affected receptor / receiving environment to change. Magnitude and sensitivity are both assessed on a scale of high, medium, low and negligible.
- 10.8.7. The assessment of significance considers the magnitude of change (from the baseline conditions), the sensitivity of the affected environment receptors and (in terms of determining residual effects) the extent to which mitigation and enhancement measures will reduce or reverse negative effects. Each effect is assessed against the change of magnitude and the sensitivity of the receptor
- 10.8.8. The receptor sensitivity level is used to define how easily affected the users around the Proposed Development would be to any changes to television and radio receptions. The definitions of each sensitivity level and magnitude of change are detailed below:
- **High:** users surrounding the Proposed Development can only receive signals from a single source and already suffer from weak signal strength; or can only receive from a single direction.
 - **Medium:** users surrounding the Proposed Development can receive television and radio signals from multiple sources and have medium to weak signal strength;

- **Low:** users surrounding the Proposed Development can receive television and radio signals from multiple sources and have medium to strong signal strength; and
- **Negligible:** users surrounding the Proposed Development can receive television and radio signals from multiple sources and have strong signal strength.

10.8.9. The magnitude of change is used to define how large an effect the Proposed Development has on the existing telecommunications reception in the surrounding area. The definitions of each magnitude of change level are detailed below:

- **High:** where the Proposed Development would cause a substantial permanent change (either positive or negative) to the existing telecommunications signal strength and end user reception. Once the Proposed Development is in place, the situation will be fundamentally changed;
- **Medium:** where the Proposed Development would cause a measurable but not substantial change (either positive or negative) to the existing telecommunications signal strength and end user reception. Once the Proposed Development is in place, the situation will be partially changed;
- **Low:** where the Proposed Development would cause a slight permanent change (either positive or negative) to the existing telecommunications signal strength and end user reception. Once the Proposed Development is in place, the situation will be similar to the baseline; and
- **Negligible:** change to telecommunications signal strength and end user reception will be barely or not perceptible.

10.8.10. The following terms are used to define the significance of the effects identified:

- **Major effect:** where the Proposed Development could cause a substantial permanent change (either positive or negative) to the existing telecommunications signal strength and end user reception. Once the Proposed Development is in place, the situation will be fundamentally changed;
- **Moderate effect:** where the Proposed Development would cause a substantial temporary change (either positive or negative) to the existing telecommunications signal strength and end user reception. Once the Proposed Development is in place, the situation will be partially changed;
- **Minor effect:** where the Proposed Development could cause a slight permanent change (either positive or negative) to the existing telecommunications signal strength and end user reception. Once the Proposed Development is in place, the situation will be similar to the baseline; and be expected to result in a small, barely noticeable effect (either positive or negative); and
- **Negligible:** where no discernible effect is expected as a result of the Proposed Development on telecommunications signal strength and end user reception will be barely or not perceptible.

10.8.11. The matrix presented in Table 10-6 will be used as the basis in the ES to determine the significance of a given effect

Table 10-6 - Matrix for Determining the Significance of Effects

		Sensitivity of Receptor / Receiving Environment to Change / Effect			
		Negligible	Low	Medium	High
Magnitude of Change / Effect	High	Negligible	Minor to Moderate	Moderate to Major	Major
	Medium	Negligible	Minor	Moderate	Moderate to Major
	Low	Negligible	Negligible to Minor	Minor	Minor to Moderate
	Negligible	Negligible	Negligible	Negligible	Negligible

10.9. LIMITATIONS AND ASSUMPTIONS

- 10.9.1. In order to proceed with a meaningful assessment of the radio shadow's cast by the proposed development, accurate dimensioned shape information is required.
- 10.9.2. It has been assumed that none of the transmitters will change during the period to which this report relates.

11. DAYLIGHT, SUNLIGHT AND OVERSHADOWING

11.1. STUDY AREA

- 11.1.1. Given the scale and design of the Proposed Development, along with its proximity to potentially sensitive receptors, a daylight, sunlight, overshadowing and solar glare assessment is considered necessary.
- 11.1.2. The study area will be determined combining the methodology outlined in the Research Establishment (BRE)⁶⁷ guidelines with professional judgement. As a rule of thumb, the guidelines suggest that surrounding properties from whose windows the Proposed Development subtends an angle greater than 25 degrees will be assessed. Sensitive viewpoints will be identified at road junctions including pedestrian crossings, and traffic signals where the Proposed Development can be seen by a road user.
- 11.1.3. The assessment will consider the likely significant effects of the Proposed Development on daylight and sunlight at existing, neighbouring residential properties and overshadowing of existing public and private open spaces. Additionally, the potential solar glare effects at sensitive viewpoints will be assessed.

11.2. BASELINE CONDITIONS

- 11.2.1. The daylight and sunlight levels within each of the relevant surrounding sensitive receptors will be defined firstly under the existing site conditions by reference to the Vertical Sky Component (VSC), No-Sky Line (NSL) and Annual Probable Sunlight Hours (APSH) methods, in line with the BRE guidelines, the regional⁶⁸ and local⁶⁹ planning policies.
- 11.2.2. With regard to the relevant existing surrounding outdoor areas, the Transient Overshadowing (TOS) and Sun Hours On Ground methodology (SHOG) will be used.
- 11.2.3. The daylight, sunlight and overshadowing effects of the Proposed Development will then be assessed against this baseline condition.
- 11.2.4. Solar Glare is not a comparative assessment; the fact it may occur in the baseline does not necessarily justify its occurrence as a result of the Proposed Development. Consequently, the assessment will consider the effect of the Proposed Development in absolute terms using professional judgement.

⁶⁷ British Research Establishment, 2011. Guidelines: Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice, Second Edition.

⁶⁸ The London Plan - The Spatial Development Strategy for London Consolidated with Alterations Since 2011 (2016);

The London Plan – The Spatial Development Strategy for Greater London, Draft for Public Consultation (December 2017);

Housing Supplementary Planning Guidance (March 2016).

⁶⁹ Royal Greenwich Local Plan (2014)

- 11.2.5. Owing to the limited provision of non-residential uses within the Proposed Development, a light pollution assessment has not been deemed necessary and is therefore scoped out.
- 11.2.6. To better understand the level of deviation from the previously consented project (Planning Reference: 13/3307/F), an additional study will be undertaken to assess the impact of the Proposed Development on surrounding receptors.

11.3. IDENTIFICATION OF SENSITIVE RECEPTORS

DAYLIGHT AND SUNLIGHT RECEPTORS

- 11.3.1. The daylight and sunlight analysis scope will focus on the adjoining residential properties where the occupants have a reasonable expectation of daylight and sunlight as per the BRE guidelines.
- 11.3.2. The following residential receptors have been identified as sensitive in relation to daylight and sunlight as shown in Figure 11-1:
 - 16 to 68 Jessup Close;
 - 4 to 35 Gill Court;
 - 24A Plumstead Road;
 - Duncombe House;
 - Bentham House;
 - Berkeley House;
 - 1 to 4 Foundry House; and
 - 1 to 28 Cornwallis Road.
- 11.3.3. Whilst the guidelines do not provide numerical values for commercial properties, they do state that they may be applied to non-domestic uses where the occupants may have a reasonable expectation of daylight such as schools, hospitals and religious buildings. In addition to the residential receptors listed above the following sensitive receptors have been assessed for daylight and sunlight:
 - Heronsgate Primary School Royal Arsenal.

OVERSHADOWING RECEPTORS

- 11.3.4. Areas of open space are considered sensitive to overshadowing effects resulting from the Proposed Development. With shadows being cast in a northerly direction in the northern hemisphere, open spaces located to the north of the Proposed Development require consideration in relation to overshadowing.
- 11.3.5. The following areas have been identified as sensitive receptors in relation to the Proposed Development as shown Figure 11-1:
 - Wellington Park;
 - Rear gardens of properties on Hastings Street; and
 - Rear gardens of properties on Cornwallis Road.

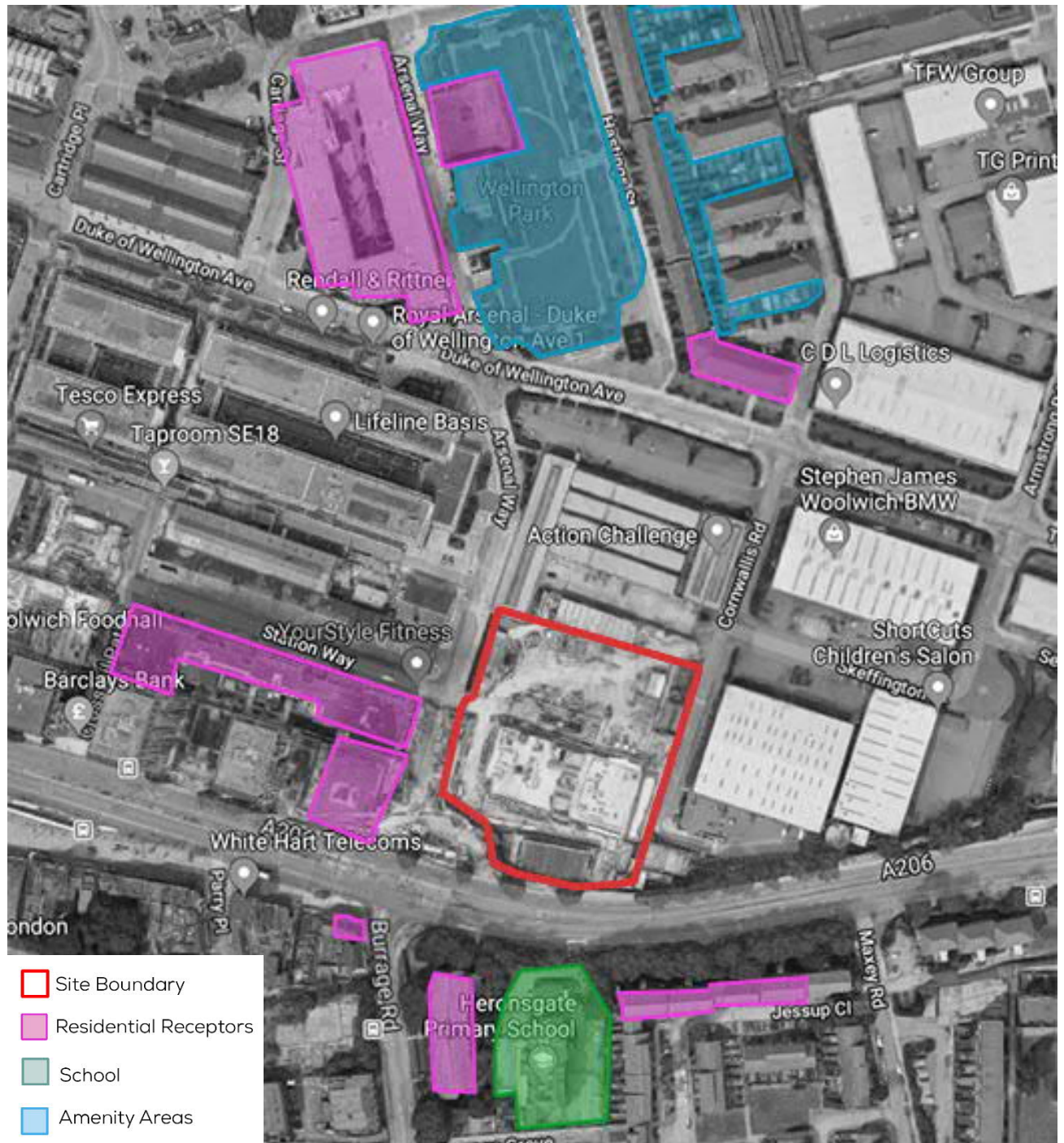


Figure 11-1 - Sensitive receptors

SOLAR GLARE RECEPTORS

- 11.3.6. The BRE guidelines provide that '*glare or solar dazzle can occur when sunlight is reflected from a glazed façade or area of metal cladding*'. This is considered a potential issue in relation to road users and train drivers whereby sun reflections can obscure the view of traffic signals, consequently reducing the driver's visibility and responsiveness.

- 11.3.7. Owing to the close proximity of the Proposed Development to a main road (Plumstead Road, A206), several surrounding road junctions are considered likely to be sensitive and therefore will be assessed. The viewpoints will be selected once the detailed elements of the Proposed Development are finalised. These are generally located at the minimum stopping distance and at the driver's eye level with the focal point being a relevant traffic element, such as signals or incoming traffic.

11.4. SCOPE OF ASSESSMENT

- 11.4.1. The potential daylight, sunlight, overshadowing and solar glare effects associated with the Proposed Development are considered to be as follows:

Table 11-1 - Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Change in daylight and sunlight amenity	Demolition and construction	Residential properties	Temporary changes to the daylight and sunlight amenity within surrounding residential properties and other properties identified which have a reasonable expectation to natural light, because of the demolition and construction works
Overshadowing	Demolition and construction	Outdoor amenity spaces	Temporary changes to the overshadowing of surrounding outdoor amenity spaces, because of the demolition and construction works;
Solar glare	Demolition and construction	Road users and pedestrians	The potential for solar glare effects at sensitive viewpoints of the surrounding road users during the construction of the Proposed Development
Change in daylight and sunlight amenity	Operation	Residential properties	Changes to the daylight and sunlight amenity to surrounding residential properties and other properties identified which have a reasonable expectation to natural light because of the completed Proposed Development;
Overshadowing	Operation	Outdoor amenity spaces	Changes to overshadowing of surrounding outdoor amenity spaces because of the completed Proposed Development;
Solar glare	Operation	Road users and pedestrians	The potential for solar glare effects at sensitive viewpoints of the surrounding road users because of the completed Proposed Development.

11.5. MITIGATION

- 11.5.1. GIA (Daylight, Sunlight and Overshadowing Specialists) are working alongside the design team to advise on potential effects that may occur as a result of the Proposed Development. Preliminary tests are undertaken to gauge the likely impacts on the sensitive receptors and inform the design.

- 11.5.2. Mitigation measures such as changes in massing to reduce potential daylight, sunlight and overshadowing impacts are explored and embedded throughout the design process.
- 11.5.3. The consultation and design process will inform the façade design in order to mitigate potential solar glare effects.

11.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 11.6.1. No opportunities for enhancing the environment through the DSO assessment have been identified.

11.7. ASSESSMENT METHODOLOGY

- 11.7.1. The assessments will be carried out in accordance with the BRE Guidelines: Site Layout Planning for Daylight and Sunlight 2011, A Guide to Good Practice, Second Edition and BS EN 17037:2018 Daylight in Buildings⁷⁰. The analysis will be calculated from a 3D computer model based upon specialist software.

DEMOLITION AND CONSTRUCTION STAGE

- 11.7.2. Owing to the evolving and changing nature of demolition and construction activities, a qualitative assessment will be undertaken using professional judgement, with the worst-case scenario in terms of the effects quantitatively modelled and analysed through the assessment of the completed Proposed Development (see below for further details).

COMPLETED DEVELOPMENT

DAYLIGHT AND SUNLIGHT

- 11.7.3. In line with the BRE Guidelines, both the Vertical Sky Component (VSC) and No Sky Line (NSL) assessments will be undertaken for the Baseline, Proposed Development and Cumulative Scenarios for all of the sensitive receptors identified above.
- 11.7.4. The sunlight amenity to the surrounding receptors will be considered by reference to the Annual Probable Sunlight Hours (APSH) method of assessment. Due to the southerly rotation of the sun, this assessment will consider those windows serving living areas which face the site and are located within 90 degrees of due south.
- 11.7.5. The significance of effects will be determined using professional judgement and by reference to Appendix I of the BRE Guidelines.

OVERSHADOWING

- 11.7.6. The overshadowing analysis on surrounding areas of amenity space will be undertaken by reference to the TOS method of assessment.
- 11.7.7. For the TOS assessment, the path of shadow will be mapped for each of the Scenarios on the following dates as suggested by the BRE:
 - 21st March (Spring Equinox)

⁷⁰ British Standards Institution, 2018. BS EN 17037:2018. Daylight in buildings. BSI.

- 21st June (Summer Solstice)
- 21st December (Winter Solstice)

11.7.8. The nature (beneficial or adverse), scale (negligible, minor, moderate or major) and ultimately the significance of overshadowing effects will be determined using professional judgement.

11.7.9. Depending on the outcome of this analysis, the SHOG assessment may be required for any amenity areas that appear to be significantly impacted by the Proposed Development. The SHOG assessment considers the proportion of a designated amenity space which receives 2 hours of direct sunlight on 21st March.

SOLAR GLARE

11.7.10. The assessment of solar glare identifies the time of the day and year that solar reflections will be visible from the assessed viewpoints, as well as their relationship to a driver's line of sight. The assessment does not however, measure the intensity of the reflection but merely the occurrence and duration.

11.7.11. The nature (beneficial or adverse), scale (negligible, minor, moderate or major) and ultimately the significance of solar glare effects will be determined using professional judgement and taking into consideration the duration of solar reflections, location of these in relation to a driver's line of sight and the probability of these occurring.

11.8. LIMITATIONS AND ASSUMPTIONS

11.8.1. The assessments will be undertaken based on a photogrammetric 3d-model of the wider area. This 3d-model will be upgraded based on an on-site survey and relevant due diligence for all sensitive receptors. Where access to buildings for surveying is unavailable, it is common practice to use standard assumptions for room use and internal configuration to enable the evaluation of the distribution of daylight within each of the rooms via the NSL.

11.8.2. For Solar Glare, although great care is taken in identifying typical viewpoints, this does not guarantee that there are no additional sensitive locations further from the area of assessment where reflected solar glare could present a particular risk. This assessment is based on the assumption that in an urban environment moving traffic represents the biggest risk factor and so viewpoints and focus points are selected accordingly. For practical reasons the area is defined using professional judgement.

11.8.3. This chapter will not include an assessment of daylight, sunlight and overshadowing internal to the Proposed Development. This will be presented in a standalone report accompanying the planning application.

12. ENVIRONMENTAL WIND

12.1. STUDY AREA

- 12.1.1. The objective of the proposed wind assessment will be to determine the impact of the proposed development on the pedestrian level wind environment of the site and its surroundings. The wind assessment will take into account the effect of the surrounding context and will pay particular attention to wind effects in open amenity spaces, building entrances and pedestrian routes to determine the level of compliance with the recommended standards. The extent of study area is covers a 500m radius from the Site in line with best practice Guidance. Buildings beyond this radius will be represented in the model if their distance from the region of interest is less than six times their height, in line with best practice guidelines.

12.2. BASELINE CONDITIONS

- 12.2.1. The urban density of the surrounding areas of the site will be an important factor in the wind microclimate as the wind arriving at the site will be highly influenced by the surrounding context and terrain roughness which affects wind speeds at pedestrian level. This will be modelled and considered carefully during the assessment. The baseline assessment will be carried out as a representation of the existing condition, i.e. the existing buildings on the site within the existing surroundings. Any buildings under construction within 500m from the site will be considered as completed as part of the baseline assessment. The baseline assessment will be used as a reference point from which the magnitude of change will be measured once the proposed development is assessed under equal conditions.

12.3. IDENTIFICATION OF SENSITIVE RECEPTORS

- 12.3.1. The following sensitive receptors (Table 12-1) have been identified and will be considered within the EIA.

Table 12-1 – Sensitive receptors

Impact	Receptor
High Sensitivity	Areas intended for sitting and standing (e.g. benches, restaurants and bars, building entrances)
Medium Sensitivity	Areas intended for leisure walking (i.e. commercial or residential streets)
Low Sensitivity or Negligible	Areas intended for business walking (e.g. thoroughfares, streets leading to back-of-the-house or maintenance entrances, areas intended for car parks and high-speed roads); roof tops for maintenance only.

12.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

CONSTRUCTION STAGE

- 12.4.1. Temporary effects on pedestrians due to non-permanent changes in the local wind environment may occur during the construction of the Proposed Development. This would affect personnel on the construction site and members of the public.
- 12.4.2. As construction develops, the potential effects during various stages of construction will vary and are likely to increase progressively in areas prone to be windy such as building corners and wind tunnel areas such as urban canyons. As construction of the Proposed Development proceeds, the wind conditions at the Proposed Development site would gradually approach those of the completed Development.

OPERATION STAGE

- 12.4.3. Buildings and terrain affect the speed and direction of wind flows. Over a ground surface of uniform roughness, the wind speed increases with height. In an urban context wind speeds at pedestrian level are generally low compared with upper-level wind speeds. However taller buildings can affect wind speeds in areas near the ground due to downwash flows and other local wind effects caused by buildings.
- 12.4.4. The assessment of significance in the context of wind microclimate refers to the Lawson Comfort Criteria.
- 12.4.5. The likely significant effects are listed in the Table 12-2 below.:

Table 12-2 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Long-terms effects on the relative pedestrian comfort on completion of the Proposed Development	Operation	Pedestrians and users of external spaces within the site and the surrounding area	Localised zones of wind acceleration may result in pedestrian discomfort. These effects will vary according to the intended use for each area. For example, wind conditions at building entrances should be within the comfort range for people standing while an area designed to function as an outdoor café should have a wind environment which is suitable for a more sedentary activity such as sitting.
Long-term effects on pedestrian safety on completion of the Proposed Development	Operation	Pedestrians and users of external spaces within the site and the surrounding area	If within the localised zones of wind acceleration, the wind speed exceeds the Lawson Safety Criteria this area will be considered unsuitable for pedestrians.

INSIGNIFICANT EFFECTS

Construction Stage

- 12.4.6. The potential effects on wind microclimate at the Site during the demolition and construction works will not be quantitatively assessed as this will continuously vary as construction progresses. However, using professional judgement, it can be anticipated that the effects on the wind microclimate on the Site will be a function of the massing of the Development which would progressively increase during construction across the different phases. Wind speeds can increase locally in newly demolished areas as parts of the Site become relatively free of obstructions.
- 12.4.7. As construction develops, the potential effects during various stages of construction will vary and are likely to increase progressively in areas prone to be windy such as building corners and wind tunnel areas such as urban canyons, although of these are likely to be of lesser magnitude than those that will be experienced once the Development has been completed. As construction of the Development proceeds, the wind conditions at the Site would gradually vary, approaching those of the completed Development.

Operation Stage

- 12.4.8. The assessment will take into consideration all external wind effects at pedestrian level. Other potential wind effects including wind loads, structural response, natural ventilation and internal flows buildings are not within the scope this assessment. The assessment scopes also excludes impacts on vehicles or waterways.
- 12.4.9. The wind effects on areas beyond 500m from the Site will be considered insignificant in line with best practice guidelines.

Table 12-3 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Temporary effects on pedestrians due to temporary changes in the local wind environment during the phased construction of the development	Construction	Pedestrians around the Site	As construction develops, the potential effects during various stages of construction will vary and are likely to increase progressively in areas prone to be windy such as building corners and wind tunnel areas such as urban canyons, although of these are likely to be of lesser magnitude than those that will be experienced once the Development has been completed.
Potential wind effects on buildings.	Construction, Operation	Surrounding buildings and Proposed Development.	Potential wind effects on buildings are not considered in line with best practice guidelines.
Potential wind effects on vehicles waterways.	Construction, Operation	Vehicles and waterways within the site and at the surrounding area.	Potential wind effects on vehicles and waterways are not considered within UK practice guidelines.

12.5. MITIGATION

- 12.5.1. The local wind environment is likely to change following the completion of the Project. However, most areas will need to be suitable for a variety of activities such as sitting, standing, leisure walking and business walking depending on the seasons and the specific location considered.
- 12.5.2. Where the results of the assessments identify areas where the recommended standards are not met or where the suitability exceeds that of the intended use, mitigation measures will be identified to limit the adverse effect of the Project and/or achieve suitability for the designated uses.
- 12.5.3. In general, mitigation measures to improve the wind environment in addition to optimising the massing and orientation of the building can include trees, landscape features, low level planting, wind screens/porous barriers and building canopies. The potential benefits of wind mitigation measures are described below:
 - Canopies: tend to provide shelter from wind being driven downwards if large enough; however, they provide little shelter for horizontal ground level winds.
 - Planting and Landscaping: wind tolerant species of trees and shrubs may provide shelter from both downward driven winds and horizontal winds around corners and passage ways. The aerodynamic losses caused by the wind passing through the tree's foliage ameliorate the wind environment during winter. However, if too dense this may cause an increase in wind speed below the foliage.
 - Physical Barriers ameliorate wind environment by disconnecting the windward and leeward wind pressure areas that determine air flow.
 - Porous Barriers: Urban sculptures and baffles ameliorate horizontal wind speeds providing local shelter by dissipating the wind's energy. The sheltered area depends on the barrier's size.
 - Solid Barriers: Screens and solid barriers interrupt high speed winds locally but tend to displace the problem elsewhere. It is thus important to use caution when implementing this type of measures.

12.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 12.6.1. The pre-application process will inform the design development and any enhancement opportunities on creating a comfortable pedestrian environment with regard to wind levels. Therefore, enhancement opportunities will be identified to optimise the benefits and positive aspects of the Proposed Development. Where the effect is minor, moderate or major, good design may reduce or remove potential harm or provide enhancement, and design quality may be the main consideration in determining the balance of harm and benefit.

12.7. ASSESSMENT METHODOLOGY

- 12.7.1. A quantified assessment of the existing wind environment at the site will be used to establish the 'baseline scenario'. This will be followed by an assessment of the proposed development modelled within the existing surroundings. A further assessment of the Proposed Development will include the consented developments to determine the cumulative effects.
- 12.7.2. The assessment of the wind microclimate impacts comprises 3 scenarios:
 - Baseline Scenario: Assessment of the existing site with the existing building on the site with the existing surrounding context.
 - Proposed Scenario: As above but with the proposed development on the site.

- Cumulative Effects: This scenario includes the effects of the proposed scheme in combination with other future (consented) schemes.

- 12.7.3. The methodology to be adopted for the study incorporates Computational Fluid Dynamics (CFD) modelling to predict air flows and wind velocities around the Proposed Development.
- 12.7.4. CFD as a tool for pedestrian wind modelling is well validated against wind tunnel tests and real-world data and is often considered advantageous due to the sophisticated visualization and domain wide measurement characteristics. CFD is performed at full scale with a mesh made out of tens of millions of discrete points where speeds are calculated in the domain, allowing for a much larger amount of data to be used for the comfort and safety analyses. It has limitations in the same way that any other tool will have limitations, however good quality CFD is increasingly becoming an acceptable tool in modern standards and guidance documents (Wind Microclimate Guidelines, CoL, August 2019/NEN8100 Wind Comfort and Wind Danger in The Built Environment, Netherlands Standards, 2006).
- 12.7.5. The CFD assessment will be aimed at measuring the local fluctuating wind speeds in the vicinity of the Site at street level and, if required, at elevated levels (e.g. representative of balconies and terraces) for a full range of wind directions (36, in 10deg increments).
- 12.7.6. Long-term wind data records from London City Airport weather station will be adapted with Site specific roughness factors and used to assess the local wind conditions surrounding the Site.
- 12.7.7. The recommended guidance is based on the frequency of exceedance of wind speeds for all incoming wind directions; therefore, in addition to the wind testing, a statistical procedure to combine the wind speed frequencies with historical wind data will be carried out to determine the suitability of the Site and surrounding area for the various pedestrian categories (sitting, standing, strolling and business walking) as identified in T.V. Lawson (2001) 'Building Aerodynamics'.
- 12.7.8. The Lawson Comfort Criteria will then be applied and a comparison made between the modelled results of the CFD assessment in terms of the suitability for various pedestrian activities against the desired pedestrian activity in that location. The Lawson Comfort Criteria define a scale for assessing the suitability of wind conditions in the urban environment based upon threshold values of wind speed and frequency of occurrence.
- 12.7.9. Normally the wind CFD assessment and the actual Lawson criteria are specifically designed for pedestrian activities and are related to pedestrian comfort and safety. Therefore, the assessment will concentrate on assessing the areas with pedestrian use only.
- 12.7.10. To determine the significance of the effect of the Proposed Development on the wind environment, a comparison can be made with the existing conditions on the Site where applicable. However, because the pedestrian use of a Site can change between the existing and proposed uses, the assessment should also be based upon the suitability of the Site for the desired pedestrian use. The likely significance of effects is therefore based on the following parameters:
 - The magnitude of change of the wind environment in the 'Proposed Scenario' from the baseline;
 - Compliance with the Lawson Criteria; and
 - Sensitivity of the receptor.
- 12.7.11. Where the results of the assessments identify areas where the recommended standards are not met or where the suitability exceeds that of the intended use, mitigation measures will be identified to

achieve suitability for the designated uses and/or limit the adverse effect of the Proposed Development and an assessment of residual effects will be made.

12.8. LIMITATIONS AND ASSUMPTIONS

12.8.1. To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

- The study area will be limited to 500m from the Site, as effects beyond this are considered insignificant. Buildings beyond this will be represented in the model if their distance from the region of interest is less than six times their height, in line with best practice guidelines.
- Any buildings under construction within 500m from the site will be considered as completed as part of the baseline assessment.
- The model will exclude both soft and hard landscaping (trees, street furniture etc.), to represent the worst-case scenario. Landscaping which will generally improve the wind environment will be added in subsequent stages as part of the mitigation process should this become necessary.

13. TOWNSCAPE AND VISUAL IMPACT ASSESSMENT

13.1. STUDY AREA

- 13.1.1. The Townscape and Visual Impact Assessment (TVIA) study area will include both the site and its wider surrounding context at a 500m radius. This has been determined through establishing a zone of theoretical visibility (ZTV) around the Site as part of a field study. Further distant visual receptors and representative views will be considered over a two kilometre radius where identified and relevant.

13.2. BASELINE CONDITIONS

- 13.2.1. In determining the Site's baseline conditions and potential sensitive receptors to the Proposed Development, a desk-based review of relevant planning legislation, policy and guidance; characterisation studies; OS maps; and aerial mapping has been undertaken, along with a field study carried out on the 21 October 2019.
- 13.2.2. The Site and its immediate environs are characterised by built form which varies in typology, scale, footprint and land use (which includes residential, light industrial, retail and community land-uses together with transport infrastructure). Buildings and structures surrounding the Site are generally low to medium rise, with some taller buildings present around the Site and study area.
- 13.2.3. The Site falls within the Royal Arsenal Conservation Area. It is not located within an existing protected London View Management Framework (LVMF) view. It does fall within a Local View identified within RBG Core Strategy (No. 2 Shrewsbury Park towards the Lower Thames).
- 13.2.4. At a national level the Site falls on the boundary between the National Character Area: 81 Greater Thames Estuary and the National Character Area: 112 Inner London. At a regional level the London's Natural Signatures: The London Landscape Framework recognises it as falling on the boundary of the Landscape Character Types of Lower Thames Floodplain and South London Pebbly Sands. Both the assessments cover a wide area and, whilst they serve to provide useful background and context, the scale is such that there would be no notable effect resulting from the Proposed Development.
- 13.2.5. RBG have not undertaken a landscape or townscape character assessment for the borough. The TVIA will therefore consider the townscape features that contribute to the existing character of the established study area. Shaping Neighbourhoods: Character and Context SPG sets out how to assess such character areas. This will help establish townscape character areas within the study area, which will be based on a combination of the dominant land use, built form, layout and landform, along with consideration of aesthetic and perceptual factors.
- 13.2.6. The Site's baseline ZTV is limited to the immediate roads and properties that overlook it, due to the Site and surrounding area's flat landform and built form.
- 13.2.7. Within the baseline and proposed ZTV visual receptors, defined as "Individuals and/or defined groups of people who have the potential to be affected by a proposal" are likely to include (but are not limited to) the following:
- Low rise residential properties located adjacent to the Site and within 500m of its boundary and those on raised ground approximately two kilometres to the south;
 - High rise residential properties within two kilometres of the Site;

- Public open space located within two kilometres of the Site; and
- Public highways and rights of way located within two kilometres of the Site.

13.2.8. To test the visual effects of the Proposed Development on visual receptors representative views have been selected. This selection has been informed by considering regional and local planning policy. The Site does not fall within or adjacent to a LVMF strategic view. It is, however, located within a wider panoramic of the local view 'No. 2 Shrewsbury Park towards the Lower Thames' established within Policy DH(g) of RBG's Core Strategy.

13.2.9. Based on these findings and the field survey undertaken a series of representative views have been identified to test the Proposed Development in a series of Accurate Visual Representation (AVRs). These are based on the following:

- Accessibility to the public;
- Potential number and sensitivity of viewers who may be affected;
- Viewing direction, distance and elevation;
- Nature of the viewing experience; and
- Relationship to a designated heritage asset.

13.2.10. Following consultation with RBG, a selection of visual receptor representative views have been selected from the following areas to support the TVIA:

- Looking east and west along Plumstead Road and Duke of Wellington Avenue.
- In an area of open space, such as Shrewsbury Park, Wellington Park, Dial Arch Square and the Public Open Space near to Villas Road.
- Within the Royal Arsenal Conservation Area and Woolwich Conservation Area.
- In residential areas surrounding the Site, where appropriate.
- From the Thames Path, along the river's northern bank.

13.3. IDENTIFICATION OF SENSITIVE RECEPTORS

13.3.1. This section identifies the likely townscape character areas receptors and visual receptor's representative views. The latter are currently being consulted on with RBG. In determining the 'sensitivity' of these receptors, their identified baseline 'value' will be combined with its 'susceptibility of change' to the Proposed Development. It is considered that these receptors and representative views will have a varying sensitivity, which will be determined as part of the assessment.

TOWNSCAPE CHARACTER ASSESSMENT

13.3.2. The following townscape character areas receptors (TCA) that will be considered in the TVIA are likely to include (but are not limited to) the following:

- TCA1: Royal Arsenal;
- TCA2: Woolwich Town Centre;
- TCA3: Northwest Plumstead; and
- TCA4: West Thamesmead.

13.3.3. The Proposed Development, due to its position, will have a direct effect on TCA1: Royal Arsenal. There is also the potential to indirectly effect the context of the other TCAs. The conclusions of this element of the assessment will be informed by the results visual assessment.

VISUAL ASSESSMENT

13.3.4. Consultation has been undertaken with RBG as part of pre-application engagement regarding the selection of visual receptor representative views (RV). It has been agreed that the following RV should be tested:

- RV1: Beresford Street
- RV2: Burrage Road, close to its junction with Vincent Road
- RV3: Duke of Wellington Avenue, close to its junction with Arsenal Way
- RV4: Shrewsbury Park (Policy DH(g) local view no 2)
- RV5: Public Open Space near to Villas Road
- RV6: Grand Depot Road
- RV7: General Gordon Square
- RV8: Plumstead Road, close to Plumstead College
- RV9: Thames Path, close to Gallions Point
- RV10: Thames Path, close to Royal Victoria Gardens
- RV11: Thames Path, Barking Creek Park
- RV12: Dial Arch Square
- RV13: Artillery Square
- RV14: Wellington Park
- RV15: Duke of Wellington Avenue, close to its junction with Cornwallis Road
- RV16: Plumstead Road, close to its junction with Parry Place
- RV17: Burrage Road, close to its junction with Congleton Road

13.3.5. The Proposed Development has the potential to have a direct effect on these visual receptor representative views.

13.4. SCOPE OF ASSESSMENT

13.4.1. The view list is still being finalised, however, the scope of the assessment information below has been informed by currently available information.

LIKELY SIGNIFICANT EFFECTS

13.4.2. Likely significant townscape and visual assets effects to be considered within the ES are as follows (Table 13-1):

- Temporary visual intrusion during the construction.
- Changes to the townscape character, context and quality of the Site and its surrounds due to the presence of completed and operational Proposed Development in isolation, and in-combination with relevant Cumulative Schemes.
- Effects upon a selection of short, medium and long-range views (including the visual amenity experienced by people within the views) due to the presence of the completed and operational Development in isolation and in-combination with other Cumulative Schemes.

Table 13-1 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Direct	Construction and operational	TCA1: Royal Arsenal	Has the potential to change the areas characteristics
Direct	Construction and operational	RV2: Burrage Road, close to its junction with Vincent Road	Proximity to Site
Direct	Construction and operational	RV3: Duke of Wellington Avenue, close to its junction with Arsenal Way	Proximity to Site
Direct	Construction and operational	RV8: Plumstead Road, close to Plumstead College	Proximity to Site
Direct	Construction and operational	RV12: Dial Arch Square	Proximity to Site
Direct	Construction and operational	RV14: Wellington Park,	Proximity to Site
Direct	Construction and operational	RV15: Duke of Wellington Avenue, close to its junction with Cornwallis Road	Proximity to Site
Direct	Construction and operational	RV16: Plumstead Road, close to its junction with Parry Place	Proximity to Site

INSIGNIFICANT EFFECTS

- 13.4.3. Effects that are assessed to be not significant in regard to townscape and visual matters are presented in Table 13-2.

Table 13-2 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Indirect	Construction and operational	TCA2: Woolwich Town Centre	Proximity to Site
Indirect	Construction and operational	TCA3: Northwest Plumstead	Proximity to Site
Indirect	Construction and operational	TCA4: West Thamesmead	Proximity to Site
Direct	Construction and operational	RV1: Beresford Street	Proximity to Site
Direct	Construction and operational	RV4: Shrewsbury Park	Proximity to Site
Direct	Construction and operational	RV5: Public Open Space near to Villas Road	Proximity to Site
Direct	Construction and operational	RV6: Grand Depot Road	Proximity to Site
Direct	Construction and operational	RV7: General Gordon Square	Proximity to Site
Direct	Construction and operational	RV9: Thames Path, close to Gallions Point	Proximity to Site

Direct	Construction and operational	RV10: Thames Path, close to Royal Victoria Gardens	Proximity to Site
Direct	Construction and operational	RV11: Thames Path, Barking Creek Park	Proximity to Site
Direct	Construction and operational	RV13: Artillery Square	Proximity to Site
Direct	Construction and operational	RV17: Burrage Road, close to its junction with Congleton Road	Proximity to Site

13.5. MITIGATION

- 13.5.1. Mitigation measures to reduce the potential for likely significant effects on the townscape and visual amenity during the construction of the Proposed Development will be implemented, via a CEMP, prior to the commencement of any demolition and construction works.
- 13.5.2. To reduce the potential for likely significant effects once the Proposed Development is completed and operational, mitigation measures will be embedded into the design of the Proposed Development. These measures will likely relate to the layout, scale and façade design and material of the Proposed Development.

13.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 13.6.1. The Proposed Development has the potential to have a direct effect TCA1: Royal Arsenal and the visual receptor representative views. It will bring about a change to the built form, massing and land use of the Site. Such changes have the potential to alter (improve) the existing townscape character and quality of the Site and its surrounds, together with views to and from the Site. In addition, the Proposed Development has the potential to generate new local views.

13.7. ASSESSMENT METHODOLOGY

- 13.7.1. The townscape and visual assessment element of the assessment will be based upon the principles set out in Guidelines for Landscape and Visual Impact Assessment (GLVIA). Reference will also be made to relevant guidance, such as Natural England's An Approach to Landscape Character Assessment and the GLA's Character and Context SPG, and planning policies, as necessary.
- 13.7.2. A combination of desk-based study and field survey will be undertaken to confirm the relevant existing townscape and visual baseline conditions of the Site and its surrounds. This will include for the determination and evaluation of:
- The Zone of Theoretical Visibility (ZTV) of the Site (both existing and with the Proposed Development in place) will be described.
 - The townscape character within the study area, including their characteristics, qualities and sensitivity to change.
 - The identification of appropriate short-, medium- and long-range representative views for assessment, including establishing their characteristics, qualities and sensitivity to change. Visual receptors associated with the representative views will also be recognised and discussed.

The sensitivity of the townscape character area receptors and visual receptor representative views will be determined through establishing their value (as set out within Table 13-3 and Table 13-4) and then combining it with their susceptibility to change (as set out within Table 13-5 and Table 13-6) using the matrix set out within

13.7.3. Table 13-7.

Table 13-3 - Criteria for determining Townscape Character Area Receptors Value

Value	Typical criteria	Typical scale of importance/ rarity	Typical examples
Exceptional	A townscape in excellent condition; of high importance, rarity and high scenic quality. No potential for substitution	International	World Heritage Site
High	A townscape in very good condition; of high importance with good scenic quality and rarity. Limited potential for substitution	National, Regional, Local	National Park, Area of Outstanding Natural Beauty (AONB), and/or typically an area containing a high number of listed buildings that include grade I or II*, and/or Registered Park and Gardens.
Medium	A townscape in generally good condition; with moderate importance and scenic quality. Limited potential for substitution.	Regional, Local	Undesignated but value perhaps expressed through non-official publications and/or demonstrable use and/or local listing.
Low	A townscape in poor condition or with low scenic quality and importance. Considerable potential for substitution.	Local	Areas identified as having some redeeming feature or features and possibly identified for improvement.
Poor	A degraded townscape in poor condition and no scenic quality and low importance	Local	Areas identified for improvement / recovery.

Table 13-4 - Criteria for determining Visual Receptor's Representative View Value

Value	Typical criteria
Exceptional	The view from the representative viewpoint is: highly exceptional nature, identified with a designated heritage asset, or a planning policy designation; and/or mentioned in a number of guidebooks or on tourist maps; and/or referenced in art and literature.
High	Where the views have a generally high scenic value. The view may be within, from or towards a designated heritage asset, or a planning policy designation; and/or mentioned in a number of guidebooks or on tourist maps; and/or referenced in art and literature but there may be some incongruous features or elements within in the view.
Medium	The view from the representative viewpoint has a view of scenic value, with moderate local importance and scenic quality: it is typically identified to a non-designated heritage

	asset; and/or of local visual amenity importance. Limited potential for substitution of some elements within the view
Low	The view from the representative viewpoint is not related to designated, or non-designated, heritage asset, or a planning designation; and/or mentioned in a guidebooks or on tourist maps; and/or referenced in art and literature; and/or of little visual amenity importance. Considerable potential for substitution of some elements in the view.
Poor	The view from the representative viewpoint is unsightly and of low importance. Considerable potential for substitution of some or all elements in the view.

Table 13-5 - Criteria for determining Townscape Character Area Receptors Level of Susceptibility

Level of Susceptibility	Typical criteria
High	An area possessing particularly distinctive townscape elements, characteristics or sense of place, and few townscape detractors. A townscape with limited tolerance to change of the type proposed. Or where the Proposed Development would be in direct conflict with specific townscape management or planning policies.
Medium	An area with some distinctive townscape elements, characteristics, or clearly defined sense of place, but with some townscape detractors. A townscape which is partially tolerant to change of the type proposed.
Low	An area with recognisable townscape character, but few distinctive townscape elements, characteristics, and some, or a number of townscape detractors. The townscape is tolerant of some change of the type proposed. Or Where the character area is separated by distance or features so as to have little or no direct relationship with the site/and or Proposed Development.

Table 13-6 - Criteria for determining Visual Receptor's Representative View Level of Susceptibility

Level of Susceptibility	Typical criteria
High	Where the receptor is engaged in outdoor recreation including public rights of way and their attention is likely to be focused on the townscape or particular views. Visitors to heritage assets or visitor attractions where the views to the townscape or surroundings are an important part of the experience. Residents at home where views contribute to the setting of a residential area.
Medium	People visiting retail outlets or other destinations as a leisure activity, or at a place of work, where the views to the townscape or surroundings are part of the experience OR where the receptor, normally categorised as High is located in an area of poor scenic value where the views to the surrounding area are unlikely to be the main focus of attention (e.g. walking routes to work).
Low	People engaged in outdoor sport or recreation that does not depend on an appreciation of the view. People travelling by road or rail (unless the route is specifically identified for its views).

Level of Susceptibility	Typical criteria
	People at work or in a workplace or a place of education where the views to the townscape or surroundings are not important

Table 13-7– Matrix for Classifying Sensitivity

		Susceptibility to Change		
		Low	Medium	High
Value	Low / Poor	High	High to/or medium	Medium
	Medium	High to/or medium	Medium	Medium to/or low
	Exceptional / High	Medium	Medium to/or low	Low

- 13.7.4. The predicted effects are a straight comparison between the existing situation and that occurring at prescribed fixed stages in the future.
- 13.7.5. The magnitude of impact considers the size or scale of the Proposed Development, along with the geographical extent of the area influenced and its duration on the townscape character area receptors and visual receptor representative views as identified within Table 13-8. To establish the overall assessment of townscape and visual effects, the sensitivity of the identified receptor and the magnitude of change are combined, as set out in Table 13-9. It may be the case that there are no effects; in such instances this will be explained within the text.

Table 13-8– Magnitude Criteria

Magnitude	Typical criteria
High	<p>Where the proposals (or works to facilitate them) would result in the total loss or major alteration of the elements that make up the character of the baseline townscape or make up the view from a particular location.</p> <p>Where the introduction of elements are considered to be wholly uncharacteristic in the particular setting.</p> <p>Where the effects of the proposals would be experienced over a large scale and/or influence more than one townscape type/character area or would be visible over a large scale and / or at close range.</p>
Medium	Where the proposals (or works to facilitate them) would result in the partial loss or alteration of one or more of the key elements that make up the character of the baseline townscape or make up the view from a particular location.

Magnitude	Typical criteria
	<p>Where the introduction of new features may be prominent but not necessarily wholly uncharacteristic in the particular setting.</p> <p>Where the effects of the proposals would be largely experienced within the townscape type/character area within which they will sit.</p> <p>Where the effects of the proposals would be largely seen from further afield or as only part of a view.</p>
Low	<p>Where the proposals (or works to facilitate them) would result in minor loss or alteration of one or more of the key elements that make up the character of the baseline townscape or make up the view from a particular location.</p> <p>Where the introduction of elements would not generally be considered uncharacteristic in the particular setting and/or</p> <p>Where the proposal occur within other character areas or types and their introduction by virtue of distance will have limited or no effect on the baseline character area or view.</p>
Negligible / None	<p>Where the proposed scheme (or works to facilitate it) would result in very minor loss or alteration of one or more of the key elements that make up the character of the baseline townscape or view from a particular location.</p> <p>The introduction of elements that may not be uncharacteristic in the particular setting</p> <p>Where the proposal occur within other character areas or types and their introduction by virtue of distance will have limited or no effect on the baseline character area.</p> <p>Where the effects of the proposals would only be seen from a distance and be imperceptible within the context of the wider view.</p>

Table 13-9– Matrix for Classifying Significance of Effects

		Sensitivity Value of Receptor		
		Low	Medium	High
Magnitude of Impact	High	Moderate	Large to/ or Moderate	Large
	Medium	Moderate to/ or Minor	Moderate	Large to/ or Moderate
	Low	Minor to/ or Negligible	Moderate to/ or Minor	Moderate
	Negligible	Negligible or None	Minor to/ or Negligible	Moderate to/ or Minor

13.7.6. This corresponds to the extent to which the Proposed Development improves (beneficial effect), or causes damage (adverse effect), or has a neutral effect to the existing townscape receptors and visual receptor representative views. Neutral effects are those where the effect would be neither beneficial nor adverse or a balance of adverse and beneficial influences and could be considered significant in the context of this assessment.

13.7.7. This takes into account whether the Proposed Development:

- Conforms with the pattern, scale, mass, grain and historic features of the identified townscape character;
- Creates a loss or restoration of key townscape features;

- Contributes to the identified townscape character;
- Affects identified townscape receptors and representative viewpoints; and
- Accords with national, regional and local planning policy and guidelines.

13.7.8. The criteria considered is set out in Table 13-10.

Table 13-10 - Beneficial/Adverse/Neutral Criteria

Beneficial Criteria – Where the Proposed Development:
<p>Fits well with scale and/or pattern of the townscape / view</p> <p>Increases characteristic features or enhances the contribution to the wider setting</p> <p>Enhances balance of townscape elements</p> <p>Improves the sense of tranquillity or the view or an element within the view</p> <p>Do not result in an incongruous feature within the prevailing pattern of townscape</p> <p>Do not obstruct views towards a high quality or scenic townscape</p> <p>Do not obstruct views or detracts from the visual amenity of a view towards a heritage asset.</p> <p>Provides ability to include adequate or appropriate mitigation</p> <p>Complements local/national planning policies or guidance to protect townscape character or visual amenity or specific views</p>
Adverse Criteria – Where the Proposed Development:
<p>Is out of scale and/or pattern of the townscape / view</p> <p>Results in a loss of key townscape features or characteristics or a deterioration in contribution a view</p> <p>Disrupts the balance of townscape elements</p> <p>Results in incongruous features within the prevailing pattern of townscape</p> <p>Obstructs a view towards a high quality or scenic townscape.</p> <p>Obstructs views or detracts from the visual amenity of a view towards a heritage asset.</p> <p>Lacks ability to include adequate or appropriate mitigation</p> <p>Conflicts with local/national planning policies or guidance to protect /manage townscape character or visual amenity or specific views</p>
Neutral Criteria – Where the Proposed Development:
<p>Where the change (whatever the scale) resulting from the proposals will have an indiscernible effect on the character or characteristics of an area or in the view resulting from the proposals neither improves or damages the view or existing visual amenity of a view</p> <p>Where any change will see one or more elements replaced with another of similar form/extent so as to result in an effect that on balance is neither positive or negative</p>

13.7.9. The assessment representative views will be photographed using a precise methodology to ensure fully verified and accurate images. A 3D model of the Proposed Development in isolation and then the Proposed Development with relevant Cumulative Schemes will be superimposed within the fully verified and accurate images to produced AVRs of both scenarios within the assessment viewpoints. This will enable a 360-degree assessment of the scale of the Proposed Development. In consultation with RBG, it will be agreed which AVRs will be fully rendered and which will be wireline only.

13.8. LIMITATIONS AND ASSUMPTIONS

CONSTRUCTION STAGE

- 13.8.1. The assessment of construction effects will be undertaken on the basis of the information supplied on the construction period and estimated completion date.

OPERATIONAL STAGE

- 13.8.2. The assessment of operational effects will be undertaken on the basis of the information supplied on the Proposed Development. This includes the following:
- Drawings that comprise of the application and are submitted for approval.
 - Representative view's AVRs.
 - Illustrative material that accompanies the application within the Design and Access Statement
- 13.8.3. This approach allows for a balanced assessment that considers all the relevant material and allows for judgements to be made on design quality and associated mitigating effects.

14. BUILT HERITAGE

14.1. STUDY AREA

- 14.1.1. The study area will include both the Site and its wider surrounding context of up to a one kilometre radius depending on the above ground heritage asset type; this has been determined through desktop survey of HE and LBG records and a site visit. The study area includes all conservation areas and Registered Parks and Gardens of Special Historic Interest ('RPGSHI') within a 1km radius of the centre of the Site; all statutory listed buildings within a 500m radius from the centre of the Site; and all locally listed buildings within a 200m radius of the centre of the Site.
- 14.1.2. This assessment excludes archaeology, which has been dealt with in Section 4.3.

14.2. BASELINE CONDITIONS

- 14.2.1. The site lies on the north side of the busy Plumstead Road (A206). It is an area undergoing significant regeneration, which has transformed the area immediately to the west of the Site as a result of Crossrail.
- 14.2.2. The Site falls within the Royal Arsenal Conservation Area, in its south-east corner, and there will be a direct effect on this designated heritage asset. There are no listed buildings on Site.
- 14.2.3. The Proposed Development has the potential to affect the settings of statutory and non-statutory listed buildings and conservation areas surrounding the Site. There are four conservation areas in the study area (including the Royal Arsenal Conservation Area). There are no RPGSHI within the study area. There are 27 entries on the statutory list of listed buildings within the study area, including 4 buildings at Grade I or II*, and there are 11 local list entries within (or close to) the study area.

14.3. IDENTIFICATION OF SENSITIVE RECEPTORS

- 14.3.1. This section sets out the heritage assets in the study area and places some groups (each group dealt with as a single receptor) where they are of the same sensitivity and have a similar geographic relationship with the Site.

CONSERVATION AREAS

- 14.3.2. The site lies within the Royal Arsenal Conservation Area and there are three other conservation areas within a one kilometre radius of the centre of the Site. They are all of medium sensitivity.
- The Royal Arsenal Conservation Area was designated in 1981. It includes the Royal Arsenal, Britain's largest and most important centre for manufacturing military equipment and munitions from 1671 until 1994. Many of the historic buildings in the conservation area are listed. There is no written appraisal for this CA.
 - The Woolwich Conservation Area (designated in May 2019) lies 280m to the west of the Site.
 - Other conservation areas.
 - Plumstead Common Conservation Area (designated in 1976) lies 680m to the south-east
 - Woolwich Common Conservation Area (designated in 1975) lies 660m to the south-west

LISTED BUILDINGS

14.3.3. There are no statutory listed buildings within the Site. There are a number within 500m of the centre of the Site. The closest listed building to the Site is the Royal Arsenal Middle Gate and attached boundary wall to the West on Plumstead Road (listed Grade II).

- Royal Arsenal west group Grade I and II*:
 - Royal Arsenal Brass Foundry. Royal Foundry, Plumstead Row - listed Grade I;
 - Royal Arsenal Dial Square Entrance Range, Plumstead Road - listed Grade II*;
 - The Royal Arsenal, the Board Room, Plumstead Road - listed Grade II*.
- The Royal Arsenal, The Grand Store, west and south ranges, buildings 36, 37 and 46 / Royal Arsenal, The Grand Store, E range, building 49, Plumstead Road ('The Grand Store') is listed Grade II*:
- Royal Arsenal Middlegate House, Plumstead Road - listed Grade II;
- Royal Arsenal Middle Gate and attached boundary wall to the West, Plumstead Road- listed Grade II;
- Royal Arsenal north group Grade II:
 - The Royal Arsenal Rifle Shell Factory Gateway, Plumstead Road;
 - The Royal Arsenal Statue of the Duke of Wellington, Plumstead Road;
 - Royal Arsenal Armstrong Gun Factory, Plumstead Road.
- Royal Arsenal west group Grade II:
 - Royal Arsenal Main Guardroom, Plumstead Road;
 - Royal Arsenal Verbruggens House, Plumstead Road;
 - The Officers Block (Building 11), Royal Arsenal, Seymour Street;
 - Royal Arsenal Former New Carriage Store Building 10 appears on the Historic England list, but has been demolished;
 - The Royal Arsenal Royal Laboratory, East Pavilion, Plumstead Road;
 - The Royal Arsenal Royal Laboratory, West Pavilion, Plumstead Road;
 - The Royal Arsenal Building 41 and 41A, Royal Laboratory Square, Plumstead Road;
 - The Royal Arsenal West Riverside guardroom, Plumstead Road;
 - The Royal Arsenal East Riverside guardroom, Plumstead Road;
 - The Royal Arsenal Building 18, Plumstead Road;
 - The Royal Arsenal Former Paper Cartridge Factory Building 17, Plumstead Road;
 - The Royal Arsenal Building 19, Plumstead Road;
 - The Royal Arsenal Building 20, Plumstead Road.
- Town centre group Grade II
 - The Equitable House, General Gordon Place;
 - The Public House, nos. 18 & 19 Green End;
 - The former Woolwich Covered Market;
 - The Main entrance to the Royal Arsenal;

LOCALLY LISTED BUILDINGS

14.3.4. There are no locally listed buildings within the Site. There are 4 locally listed buildings within 200m of the centre of the Site, and a group just beyond to the south-west focused around Beresford Square.

- The Royal Arsenal group:
 - The Royal Arsenal steam hammer anvils, Arsenal Way
 - The Royal Arsenal Gunnery House, nos. 9 – 11 Gunnery Terrace (former Building 7: Carriage-Completing Workshops), Cornwallis Road
 - Royal Arsenal Building 21, Hopton Road
 - Royal Arsenal Buildings 47 and 48 (Grand Store additions), Marlborough Road
- Town centre group:
 - No. 5 Beresford Square
 - Nos. 13 – 14 Beresford Square
 - Nos. 15 – 19 Beresford Square
 - Telephone Exchange, no. 28 Spray Street
 - Nos. 1a-1c Woolwich New Road
 - Nos 2-2B Woolwich New Road
 - No. 3 Woolwich New Road

14.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

14.4.1. Likely significant effects on above ground heritage assets to be considered within the ES are as follows (Table 14-1):

- Temporary effects on heritage assets and their settings during the construction stage.
- Changes to the heritage assets or their settings due to the presence of the completed and operational Proposed Development in isolation and in-combination with other Cumulative Schemes, including:
 - Direct effects on the significance of the Royal Arsenal Conservation Area;
 - Indirect effects on the setting of other heritage assets.

Table 14-1 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Direct	Construction and operational	Royal Arsenal Woolwich Conservation Area	Will transform the site which lies in the conservation area
Indirect	Construction and operational	Royal Arsenal Middlegate House	Close to the Site
Indirect	Construction and operational	The Grand Store	Close to the Site
Indirect	Construction and operational	Royal Arsenal north group	Close to the Site

INSIGNIFICANT EFFECTS

14.4.2. Effects that are assessed to be not significant in regard to built heritage are presented in Table 14-2.

Table 14-2 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Indirect	Construction and operational	Woolwich Town Centre Conservation Area	Character of development between the receptor and the Site
Indirect	Construction and operational	Other Conservation Areas	Distance from Site
Indirect	Construction and operational	Royal Arsenal West group grade I and II*	Character of development between the receptor and the Site
Indirect	Construction and operational	Royal Arsenal West group grade II	Character of development between the receptor and the Site
Indirect	Construction and operational	Royal Arsenal Middle Gate and attached boundary wall to the West	Limited setting of boundary wall
Indirect	Construction and operational	Town centre group	Character of development between the receptor and the Site
Indirect	Construction and operational	Locally listed Royal Arsenal Conservation Area Group	Character of context and low sensitivity
Indirect	Construction and operational	Locally listed Royal Arsenal Conservation Area Group town centre group	Character of development between the receptor and the Site

14.5. MITIGATION

14.5.1. Mitigation measures have been embedded in the design process through the consideration of matters relating to heritage significance informing the approach to the development of the Site.

14.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

14.6.1. The redevelopment of the Site offers opportunities for the enhancement of public realm on site which would enhance the setting of nearby heritage assets.

14.7. ASSESSMENT METHODOLOGY

BASELINE DATA COLLECTION

14.7.1. A heritage receptor is defined as a heritage asset (HA) which has the potential to be affected by the proposals, either directly or indirectly. Effects can be temporary or permanent, and effects can occur in the short term or long term.

14.7.2. The process of collecting baseline data involved identifying the relevant HAs included in the following documentary and mapping resources:

- Historic England on-line National Heritage List for England;
- Statutory List of Buildings of Special Architectural and Historic Interest; and

- Royal Borough of Greenwich Local Plan and other guidance (including Conservation Area Character Appraisals and the local list).

14.7.3. A combination of desk-based study and field survey will be undertaken to establish the extent of the study area and the relevant existing above ground heritage baseline conditions of the Site and its surroundings. This will include consideration of:

- National and local heritage policy and guidance;
- The existing effects of the Site;
- The physical characteristics of the Site's context; and
- The nature of the Proposed Development.

14.7.4. Site visits were undertaken to check the desktop assessment with regard to the potential significance of effect of the Proposed Development on the HAs within the surrounding area (and to check for any additional HAs that were not originally identified). The site visit to the Site and the surrounding area was undertaken on 21 October 2019.

Significance criteria

14.7.5. The significance of the environmental effects of the Proposed Development upon the relevant receptors is determined by two variables: the sensitivity to change of the HA affected, and the magnitude of effect upon the HA's heritage significance either direct or indirect i.e. on those aspects of setting that contribute significance. The guidance and criteria set out in the following documents have been used for this assessment:

- The Planning (Listed Buildings and Conservation Areas) Act 1990.
- Section 16 of the National Planning Policy Framework (2019) (NPPF).
- National Planning Practice Guidance 2019 (PPG).
- Historic England Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets (Second edition, 2017).
- Historic England guidance: Conservation Area Designation, Appraisal and Management, 2019; and
- Department for Culture, Media & Sport Circular: Principles of Selection for Listing Buildings, 2010.

Sensitivity to change

14.7.6. The sensitivity to change of each HA or groups of assets is considered in relation to both direct and indirect impact. This is based on the designation and grade of the HA and an assessment of its heritage significance (in light of NPPF policy), i.e. what elements of its fabric / constituent parts and setting contribute to its heritage significance. The heritage significance of each assets and the elements of its setting that contribute to this, including the special architectural and historic interest of statutory listed buildings and the character and appearance of conservation areas, will be assessed.

Table 14-3 - Heritage Importance / Sensitivity of an Environmental Receptor

Sensitivity	Type of heritage asset (heritage designations and grades)
High	Grade I and II* listed buildings
Medium	Grade II listed buildings Conservation areas

Sensitivity	Type of heritage asset (heritage designations and grades)
Low	Locally Listed Buildings Others

- 14.7.7. The importance of a HA is determined based on the heritage designations and grades, as set out in Table 14-3.

Consideration of heritage importance and heritage significance together provides the basis for understanding the sensitivity to change of each of the HAs. The sensitivity to change is a professional judgment and assessed as high, medium or low and this overall assessment of sensitivity will not necessarily correspond with the assessment of the heritage importance of the HA as high, medium or low. The assessment of the sensitivity of the receptor under consideration takes into account a judgement about its quality in the round. For example: a Conservation Area or a Listed Building may have a good or a poor setting, and a good quality setting is more sensitive to change than a poor quality setting; Conservation Areas include within them areas of greater and lesser quality.

Magnitude of effect

- 14.7.8. The magnitude of effect is assessed according to the degree of change to the HA or its setting (direct or indirect effect) as set out in Table 14-4 below.

Table 14-4 - Magnitude of effect

Magnitude of Impact	Criteria
High	Considerable effect on the HA or its setting
Medium	Change to the HA or its setting that is readily noticeable
Low	Slight change to the HA or its setting
No Change	No change, or minor change that is barely perceptible

Significance of effects

- 14.7.9. The likely significance of effects is derived through consideration of the magnitude of impact and the sensitivity to change of the HAs as set out in Table 2.3. This assessment takes into account the heritage significance of the particular HA and how the Proposed Development would affect this. The terms in the boxes in Table 14-5 indicate the significance which results from the relevant combination of magnitude of change and sensitivity.

Table 14-5 - Matrix for Classifying Significance of Effects

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

- 14.7.10. Effects are also assessed qualitatively as beneficial, adverse, or neutral in respect of their effect on the heritage significance of the HA. This assessment, based on professional judgment, is in recognition of the fact that an effect on an HA or its setting can enhance its heritage significance (a beneficial effect), harm its heritage significance (an adverse effect) or leave its heritage significance unchanged (a neutral effect). This consideration is independent of whether it is a major, moderate or minor change.
- 14.7.11. This is in line with how decisions are made in relation to changes to HAs in the planning process as set out in the NPPF and described specifically in relation to elements of setting in Annex 2 of the NPPF. It is in line with the statutory requirement to preserve or enhance the character and appearance of a conservation area (which would be a neutral or beneficial effect); or to preserve the special architectural and historic interest of a listed building (which would be a neutral effect).
- 14.7.12. This assessment takes into account the nature and condition of the HA and its setting as found today and how these contribute to its heritage significance.
- 14.7.13. The general conclusions about the impact of the Proposed Development on HAs include consideration of the overall impact on the historic environment in the round.

14.8. LIMITATIONS AND ASSUMPTIONS

- 14.8.1. This assessment takes into account the nature and condition of the HA and its setting as found today and how these contribute to its heritage significance.

15. TRANSPORT AND ACCESS

15.1. STUDY AREA

- 15.1.1. The Study Area also encompasses key walking, cycling and public transport routes from the Site to key local destinations such as Woolwich Crossrail and Woolwich Arsenal Stations as well as Woolwich Town Centre.
- 15.1.2. Figure 15-1 shows the extents of the proposed Study Area as well as traffic locations that will be considered within the Traffic and Transport Chapter of the ES.

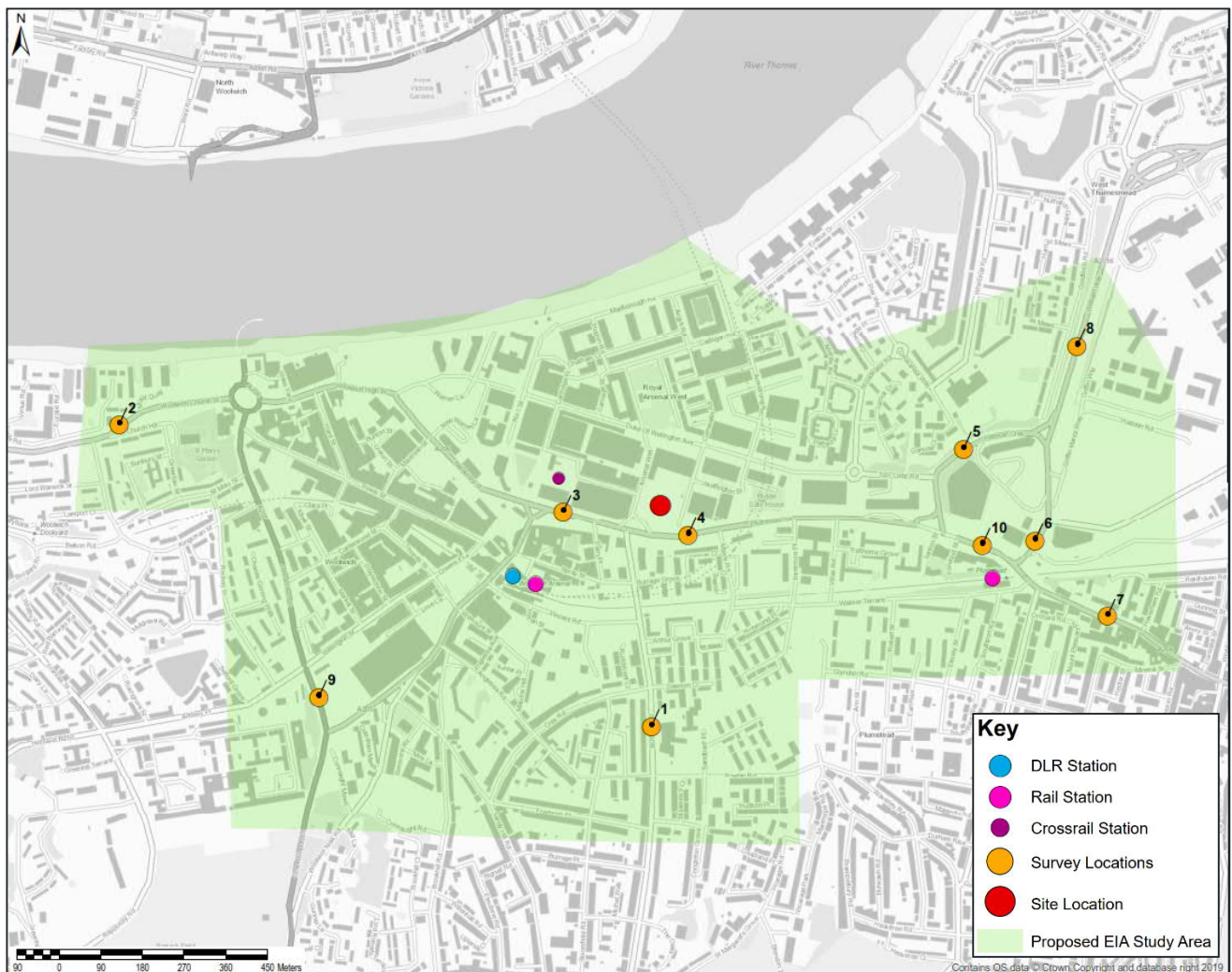


Figure 15-1 – Proposed Study Area and Traffic Locations

- 15.1.3. The Study Area represents an area of approximately 1km most likely to be impacted by the operational and construction trips routing to and from the Proposed Development and includes local pedestrian and cyclist routes. This includes the primary vehicular routes to the Site:
- A206 Plumstead Road, Pettman Crescent and Plumstead High Street;
 - A205;
 - A2016 Western Way; and

- Burrage Road.

15.1.4. The extent of the Study Area and proposed traffic survey locations also align with the requirements for the noise and air quality chapters of the ES.

15.1.5. It is proposed that the following transport related documents will be prepared for the planning submission:

- A Healthy Streets Transport Assessment (TA) which considers the impacts of the Proposed Development including an Outline Construction Logistics Plan, Draft Delivery and Draft Servicing Plan and Car Parking Management Plan;
- A Framework Travel Plan identifying strategies to ensure all users of the Site are able to make informed travel choices, minimising trips and encouraging sustainable modes; and
- A Site Waste Strategy.

15.1.6. The ES Chapter will refer to the TA as appropriate.

15.2. BASELINE CONDITIONS

15.2.1. The Site constitutes an OSD and is situated above the Woolwich Crossrail Station, approximately 400m to the north east of Woolwich Town Centre within the Royal Borough of Greenwich. It is bounded to the north by a warehouse/office building, to the east by Cornwallis Road, to the south by A206 Plumstead Road and west by Arsenal Way.

15.2.2. The Proposed Development is in an area of very high public transport accessibility with a Public Transport Accessibility Level (PTAL) of 6a, forecast to increase to 6b (i.e. the best) once Woolwich Crossrail Station opens. Woolwich Crossrail, Woolwich Arsenal and Plumstead Stations are all located within walking distance whilst there are bus services available on the A206 and on Woolwich New Road.

15.2.3. There are good quality walking links in the vicinity of the Site. The A206 Plumstead Road, Arsenal Way and Cornwallis Road provide continuous footways on both sides of the carriageway whilst there is a staggered signalised crossing across the A206 Plumstead Road west of its intersection with Arsenal Way providing access to Woolwich Town Centre and other local amenities.

15.2.4. There are a variety of facilities for people cycling within the surrounding area. National Cycle Route 1 can be accessed approximately 500m north of the Site where locally it runs along the Thames Path. The surrounding area has several shared pedestrian and cycle routes such as No.1 Street between the A206 Plumstead Road and Thames Path. In addition to the cycle network shown, the road speeds, carriageway widths and proximity of the site to the surrounding area act to encourage cycling.

15.2.5. The Traffic and Transport Chapter of the ES will consider the Baseline conditions in detail. Consideration will also be given to any other potential committed improvements proposed by the Royal Borough of Greenwich, TfL or any other development within the local area.

15.2.6. A review of the baseline conditions will consider the following elements:

- Walking Network;
- Cycling Network;
- Public Transport Provision; and
- Highway Network including traffic flows and Personal Injury Criteria (PIC).

- 15.2.7. It is proposed that new Automatic Traffic Counter (ATC) and/or Classified Link Count (CLC) traffic surveys are undertaken at locations on the study network to collect up to date baseline Annual Average Daily Traffic (AADT) flows and Annual Average Weekday Traffic (AAWT) flows. The locations of these surveys will encompass the A205, A206 and A2016 and are shown in Figure 15-2.
- 15.2.8. As the site constitutes an OSD over Crossrail, there is a requirement identified in Crossrail Guidance ‘Guidance on carrying out of Environmental Assessment in relation to Planning Applications for Crossrail Works’ (2009) that the baseline for the OSD assessment “should be the same as that for the Crossrail ES i.e. assuming conditions ‘pre-Crossrail’”.
- 15.2.9. Traffic flow data from the Woolwich Crossrail Station undertaken in 2009 will therefore be used to represent ‘pre-Crossrail’ baseline conditions. Due to limited data availability, only traffic flow data on Plumstead Road (A206) east and west of Arsenal Way has been sourced (equivalent to Counters Site 3 and 4 in Figure 15-2).
- 15.2.10. This approach with regards to considering ‘pre-Crossrail’ baseline conditions has been agreed in principle with the Crossrail Traffic Manager.



Figure 15-2 – Proposed Traffic Survey Locations

15.3. IDENTIFICATION OF SENSITIVE RECEPTORS

RECEPTOR IDENTIFICATION

- 15.3.1. As the Proposed Development constitutes a Crossrail OSD, the identification of sensitive receptors will be based upon the criteria identified in Volume 8a (Traffic and Transport) of the Crossrail Environmental Statement (2005). This is in accordance with Crossrail Guidance 'Guidance on carrying out of Environmental Assessment in relation to Planning Applications for Crossrail Works' (2009).
- 15.3.2. Section 3.14 of Volume 8a (Traffic and Transport) identifies that resources and receptors potentially affected by traffic and transport impacts are the following:
- **Vehicle Occupants and Operators:** drivers and passengers using private cars, commercial vehicles, buses and coaches, taxis and rail services including heavy rail, light rail, DLR and London Underground Services;
 - **Interchange Users:** those using bus and taxi facilities, and drop-off and pick-up facilities for car passengers;
 - **Vulnerable Road Users:** including pedestrians, cyclists, mobility impaired people and equestrians;
 - **Parking and Loading Facilities:** including on-street, public-off street and private off-street parking including facilities reserved for particular groups such as disabled people; and
 - **Waterway Users:** includes boat operators and people using navigable waterways and moorings.
- 15.3.3. Relevant receptors within the study area will be identified within the ES Chapter in accordance with this criteria.

SIGNIFICANCE ASSESSMENT CRITERIA

- 15.3.4. An assessment of the likely significant effects from a transport and traffic perspective will be based upon thresholds contained within Volume 8a (Traffic and Transport) of the Crossrail Environmental Statement (2005). This will consider both the temporary and permanent significant effects, considering both the construction and operational phases, respectively.
- 15.3.5. A summary of the temporary significant effects criteria extracted has been identified in Table 15-1.

Table 15-1 – Significance of Temporary Transport Impacts Assessment Criteria

Impact	Significant Effects Criteria
Traffic Levels and Delays to Vehicle Occupants	<p>A significant increase in traffic levels and driver and vehicle passenger delay (including delays to bus and coach passengers) is defined as:</p> <p>CT1a - A 30 per cent net increase in traffic (lorries or all vehicles) over future baseline two-way flows (or one-way flows where either the link or the lorry route is one-way) for links affected for more than four weeks in any 12-month period, and where the total increase in traffic is more than 40 vehicles a day, subject to the increase leading to delay. Individual temporary increases of up to five days do not count towards the four-week period.</p> <p>Or CT1b - A 100 per cent net increase in traffic (lorries or all vehicles) over future baseline two-way flows (or one-way flows where the link or the lorry route is one-way) for links affected for more than five days up to four weeks in any 12-month period, and where the total increase in traffic is more than 40 vehicles a day, subject to the increase leading to delay. Individual temporary increases of up to five days do not count towards the four-week period.</p>

Impact	Significant Effects Criteria
	<p>Or CT1c - A temporary diversion, for more than four weeks in any 12-month period, that leads to a maximum increase in length of journey of more than 2.5 km on a route carrying more than 100 vehicles a day, 5 km on a route carrying more than 50 vehicles a day, or 10 km on any other route.</p> <p>Or CT1d - A significant delay problem is forecast, such as at a specific junction or associated with access.</p>
Public Transport Delay	<p>A significant impact on journeys by bus, rail, underground and light rail is defined as:</p> <p>CT2a - Changes in a majority of representative journey times by rail, Underground or light rail of more than 20 per cent lasting for more than four weeks in any 12-month period.</p> <p>Or CT2b - Temporary changes in journey distances by bus for more than four weeks in any 12-month period, of more than 400 m in the GLA area and 1 km elsewhere, where diversions apply.</p> <p>Or CT2c - A temporary net increase of more than 30 per cent, for more than four weeks in any 12-month period, in lorries or total traffic on a route running along a bus route, or a net increase of more than 30 per cent in total traffic on a route intersecting a bus route.</p> <p>Or CT2D - A significant delay, disruption, overcrowding or other impact affecting the public transport network over a wide area for a period of more than five days.</p>
Disruption to Interchange	<p>A significant impact on interchange is defined as:</p> <p>CT3a - A material change in the vicinity of stations and worksites for over four weeks in any 12-month period to public transport interchange such as:</p> <ul style="list-style-type: none"> ▪ Bus facilities and operation (e.g. material loss of or relocation of bus stops, passenger waiting facilities, bus stands or operator facilities); or ▪ Taxi facilities and operations (e.g. material loss of or relocation of taxi stands, passenger waiting facilities or operator facilities); or ▪ “kiss-and-ride” facilities or operations (e.g. material loss or relocation of dropping off areas).
Parking and Loading	<p>A significant impact on parking and loading is defined as:</p> <p>On-Street Facilities</p> <p>CT4a - On-street facilities – Loss for more than four weeks in any 12-month period of:</p> <ul style="list-style-type: none"> ▪ One or more on-street loading bays; or ▪ One or more on-street parking bays for a specific user or vehicle, including disabled persons, buses, taxis, doctors, ambulances and police vehicles; or ▪ Five or more on-street bays for residents and businesses; or ▪ Five or more on-street pedal or motor cycle spaces; or ▪ 20 or more general parking bays or the equivalent length of unrestricted kerbside space; and ▪ The bays or spaces area reasonably well used. <p>Public Off-Street Parking</p>

Impact	Significant Effects Criteria
	<p>CT4b - Public off-street facilities – Loss for more than four weeks in any 12-month period of:</p> <ul style="list-style-type: none"> 30 or more public off-street car parking spaces; or 20 per cent of the capacity of the car parks if the number of spaces lost is less than 30; or Loss of any public off-street spaces for disabled persons, buses, taxis, doctors, ambulances or police vehicles; Loss of any public off-street loading bays or facilities; and The spaces are reasonably well used and, for ordinary parking spaces, replacement facilities are more than 5 minutes' walk away. <p>Private Parking</p> <p>CT4c - Private parking – a material traffic or transport impact due to a loss of private off-street parking or loading facilities for more than four weeks in any 12-month period.</p> <p>Note: the socio-economic consultant will report any significant socio-economic impacts or impacts of particular importance of loss of private parking or loading facilities.</p>
Vulnerable Road User Delay and Loss of Amenity	<p>A significant impact on vulnerable road users (pedestrians, cyclists, mobility impaired persons and equestrians) is defined as:</p> <p>CT5a - There will be a temporary increase of more than 30 per cent in the total traffic flow, or the number of lorries, or more than four weeks in any 12-month period; and</p> <ul style="list-style-type: none"> The increase is more than 40 movements a day; and There will be over 100 two-way movements of cyclists or pedestrians per 12-hour average weekday; and <p>Note: the vulnerability of the users is 'high' (e.g. there are no physically segregated facilities for cyclists, or there is no footway or an inadequate footway or crossing facilities for pedestrians).</p> <p>Or CT5b - A temporary maximum increase, for more than four weeks in any 12-month period, in pedestrian journey length along a road or other public right of way than:</p> <ul style="list-style-type: none"> 250m on a route carrying more than 200 pedestrians a day; or 500m on a route carrying more than 100 pedestrians a day; or 1km on a route carrying more than 50 pedestrians a day; or 2km on any other route. <p>Or CT5c - A temporary maximum increase in journey length, for cyclists or equestrians along a road or other public right of way, for more than four weeks in any 12-month period, of more than:</p> <ul style="list-style-type: none"> 1.5km on a route carrying more than 100 cyclists a day; or 3km on a route carrying more than 50 cyclists a day; or 6km on any other route.

Impact	Significant Effects Criteria
	<p>Or CT5d - A significant problem is forecast such as at a specific crossing, associated with footway or footpath overcrowding or with access to or between stations or bus stops, or to premises.</p> <p>Or CT5e - A temporary increase of more than 30 per cent in lorries or total traffic on a route intersecting a bridleway or near an equestrian centre, for more than four weeks in any 12-month period.</p>
Accidents and Safety	<p>Significant impacts on accidents and safety is defined as:</p> <p>CT6 - Those junctions that have experienced more than ten personal injury accidents in the five-year period 2015 to 2019 for which data is available: or</p> <ul style="list-style-type: none"> Links for which data is available that have experienced on average more than 10 personal injury accidents per 100m length in the five-year period 2015 to 2019; and The junctions or links would be subject to a net increase of 10 per cent or more in total traffic flow during construction for a period exceeding four weeks in any 12-month period.
Waterways	<p>A significant impact on waterways or waterway users is defined as:</p> <p>CT7 - Loss of, or prevention of access to, moorings or waterside or water-borne facilities or closure of a route with a diversion distance of more than 1000m, for a period of more than five days, considering the level of use and local circumstances.</p> <p>Note: impacts on waterside pedestrians, cyclists, mobility impaired persons and equestrians are assessed in relation to the vulnerable road user and criteria.</p>

15.3.6. A summary of the permanent significant effects criteria extracted has been identified in Table 15-2.

Table 15-2 – Significance of Permanent Transport Impacts Assessment Criteria

Impact	Significant Effects Criteria
Traffic Levels and Delays to Vehicle Occupants	<p>A significant impact in traffic levels and driver and vehicle passenger delay is defined as:</p> <p>OT1a - A 10 per cent increase in morning peak hour two-way traffic levels on the adjoining highway and exceeding the highway capacity on non-congested links.</p> <p>Or OT1b - Traffic to or from the station development exceeds 5 per cent of the morning peak hour two-way traffic flow on the adjoining highway where traffic congestion exists or will exist, or in another sensitive area (defined as schools, hospitals or other community facilities).</p> <p>Or OT1c - Increased traffic levels that exceed 30 per cent of the off-peak-hour two-way traffic on the adjoining highway in congested or non-congested conditions.</p> <p>Or OT1d - A 5 per cent decrease in morning peak-hour modelled traffic link speeds (over future baseline flows) for congested areas (defined as junction approaches running at an average of 85 per cent of capacity during the peak hour) on an individual highway link.</p> <p>Or OT1e - A 10 per cent decrease in morning peak-hour modelled traffic link speeds in non-congested areas.</p>

	<p>Or OT1f - A 30 per cent decrease in off-peak modelled traffic link speeds in congested or non-congested areas.</p> <p>Or OT1g - There will be a permanent increase in journey length of 1250m.</p>
Public Transport	<p>A significant impact on journeys by bus is defined as:</p> <p>OT2a - A 20 per cent change in journey times (an increase or decrease) on bus links.</p> <p>Or OT2b - A permanent change in journey distance of more than 400m.</p> <p>A comparison of public transport journey times without Crossrail (by any or all modes) with the proposed Crossrail journey time has been assessed. A significant impact is defined as:</p> <p>OT2c - A change (an increase or decrease) in representative journey times of more than 10 per cent.</p>
Pedestrian Delay and Loss of Amenity	<p>A significant impact is defined as:</p> <p>OT3a - A predicted permanent increase of more than 10 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> ▪ The increase will be more than 40 vehicle movements a day; and ▪ There will be over 100 two-way movements of pedestrians per 12-hour average weekday; and ▪ The vulnerability of the pedestrian is 'high'. <p>Or OT3b - A predicted permanent increase of more than 30 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> ▪ The increase will be more than 40 vehicle movements a day; and ▪ There will be between 50 and 100 two-way movements of pedestrians per 12-hour average weekday; and ▪ The vulnerability of the pedestrian is 'high'. <p>Or OT3c - A predicted permanent increase of more than 30 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> ▪ The increase will be more than 40 vehicle movements a day; and ▪ There will be over 100 two-way movements of pedestrians per 12-hour average weekday; and ▪ The vulnerability of the pedestrian is 'moderate'. <p>Or OT3d - A predicted permanent increase in journey length of more than 250m for pedestrians; and</p> <ul style="list-style-type: none"> ▪ There will be over 100 two-way movements of pedestrians per 12-hour average weekday. <p>Or OT3e - A predicted permanent increase in journey length of more than 500m for pedestrians; and</p> <ul style="list-style-type: none"> ▪ There will be between 50 and 100 two-way movements of pedestrians per 12-hour average weekday. <p>Or noOT3f - A predicted permanent increase in journey length of more than 1000m for pedestrians; and</p> <ul style="list-style-type: none"> ▪ There will be less than 50 two-way movements of pedestrians per 12-hour average weekday.

	Note: high vulnerability is, for example, no or inadequate footway or crossing facilities for pedestrians.
Cyclist Delay and Loss of Amenity	<p>A significant impact is defined as:</p> <p>OT4a - A predicted permanent increase of more than 10 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> The increase will be more than 40 vehicle movements a day; and There will be over 100 two-way movements of cyclists per 12-hour average weekday; and The vulnerability of the cyclist is 'high'. <p>Or OT4b - A predicted permanent increase of more than 30 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> The increase will be more than 40 vehicle movements a day; and There will be between 50 and 100 two-way movements of cyclists per 12-hour average weekday; and The vulnerability of the cyclist is 'high'. <p>Or OT4c - A predicted permanent increase of more than 30 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> The increase will be more than 40 vehicle movements a day; and There will be over 100 two-way movements of cyclists per 12-hour average weekday; and The vulnerability of the cyclist is 'moderate'. <p>Note: moderate vulnerability is, for example, limited physically segregated facilities for cyclists.</p> <p>Or OT4d - A predicted permanent increase in journey length of more than 750m for cyclists; and</p> <ul style="list-style-type: none"> There will be over 100 two-way movements of cyclists per 12-hour average weekday. <p>Or OT4e - A predicted permanent increase in journey length of more than 1250m for cyclists; and</p> <ul style="list-style-type: none"> There will be less than 100 two-way movements of cyclists per 12-hour average weekday. <p>Note: high vulnerability is, for example, no physically segregated facilities for cyclists.</p>
Station and Interchange Impacts	<p>A significant impact on station interchange is defined as:</p> <p>OT5a - Impacts that may be caused by additional Crossrail passengers arriving and departing at stations have been assessed using professional judgement, taking account of:</p> <ul style="list-style-type: none"> Local transport conditions at each station; or Forecast additional Crossrail passengers; or The resulting increase in passengers arriving and departing on foot, by bicycle, by car and by bus and taxi.

	Impacts that it is considered will not be able to be mitigated by local improvement measures are reported as significant impacts.
Parking and Loading	<p>A significant impact on parking and loading is defined as:</p> <p>OT6a - A loss of special-use on-street or off-street spaces, including spaces for disabled persons, buses, taxis, doctors, ambulances, police vehicles and car club bays.</p> <p>Or OT6b - Any predicted increase in on-street parking demand in the vicinity of the station.</p> <p>Or OT6c - A loss of private car parking.</p> <p>Or OT6d - Any loss of off-street station car parking.</p>
Waterways	<p>A significant impact on waterways or waterway users is defined as:</p> <p>OT7 - Permanent loss of, or prevention of access to, moorings or waterside or water-borne facilities or closure of a route with a diversion distance of more than 1000m, considering the level of use and local circumstances.</p> <p>Note: impacts on waterside pedestrians, cyclists, mobility impaired persons and equestrians are assessed in relation to the vulnerable road user criteria.</p>
Accidents and Safety	<p>A significant impact on accidents and safety is defined as:</p> <p>OT8 - Those junctions that have experienced more than ten personal injury accidents in the five-year period 2015 to 2019 for which data is available: or</p> <ul style="list-style-type: none"> Links for which data is available that have experienced on average more than 10 personal injury accidents per 100m length in the five-year period 2015 to 2019; and The junctions or links would be subject to a net increase of 10 per cent or more in the total 12-hour weekday traffic flow.

- 15.3.7. While generally a quantitative analysis will be used to undertake these assessments, for some criteria, given data availability, a more qualitative approach and professional judgement will be used where appropriate.

15.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

Spatial Scope of Assessment

- 15.4.1. The spatial scope will include:

- Walking and cycling routes within the vicinity of the Site;
- Public transport services;
- Transport interchange arrangements in the vicinity of the Site; and
- The local highway network.

- 15.4.2. This will consider the study area identified in **Section 13.1**.

Temporal Scope of Assessment

- 15.4.3. The temporal scope will consider a realistic worst-case assessment in terms of traffic and transport impacts both during the construction and operational phases of the Proposed Development. This will constitute the period in which the highest levels of trips are expected to be generated by the site.

- 15.4.4. The Crossrail ES Guidance (2009) identifies that construction impacts should be assessed against the baseline conditions that are predicted to occur at the time of the OSD construction.
- 15.4.5. Subject to planning approval, it is currently anticipated that construction of the Site would commence in 2021 and be complete by 2025. With cognisance of the proposed construction programme (in preparation), the assessment will identify the peak traffic and transport impacts during construction and operation of the OSD.
- 15.4.6. It is understood through discussions with the Crossrail Traffic Manager that the construction of Woolwich Crossrail Station is now largely complete and therefore construction traffic flows associated with Crossrail are minimal. No consideration will therefore be given to an overlap of Crossrail construction works as it considered this would not have a material impact on the baseline traffic flows.
- 15.4.7. The operational assessment will consider the impact of trips to and from the Proposed Development in the anticipated projected opening year of 2025. It is proposed that no future year projection assessment beyond the scheme opening year will be considered and is therefore scoped out. There is no formal requirement for this identified in either Crossrail ES Guidance (2009) or the Institute of Environmental Management and Assessment (IEMA) Guidance (1993).
- 15.4.8. For the purposes of forecasting future baseline conditions, TEMPRO (Trip End Model Presentation Programme) growth factors will initially be used to forecast background traffic growth in Greenwich over the period 2019 to 2021 for the construction assessment and over the period 2019 to 2025 for the operational assessment. Consideration will be given to the growth rates obtained through this methodology against identified committed and cumulative schemes to ensure that the forecast growth is reflective of anticipated future conditions. As such, allowance for cumulative development will be included within the baselines for assessment and a separate cumulative impact analysis is not proposed to be undertaken.
- 15.4.9. As previously noted, the Crossrail ES Guidance (2009) additionally identifies that operational impacts should be assessed against 'pre-Crossrail' conditions. An assessment of the operational impacts against a 2009 'pre-Crossrail' situation will therefore be included. This approach has also been agreed with the Crossrail Traffic Manager.
- 15.4.10. A summary of the proposed temporal scope of assessment is provided in Table 15-3.

Table 15-3 – Temporal Scope Approach

Assessment Type	Temporal Scope	Impacts
Construction	2021 – Assumed Worst Case Construction Year*	Temporary
Operational	2009 – 'pre-Crossrail' Conditions 2025 – Assumed Opening Year	Permanent

*Year to be determined

Potential Impacts

- 15.4.11. The Crossrail ES methodology sets out detailed criteria used for the identification and assessment of potentially significant impacts. This includes impacts on vulnerable road users (pedestrians,

cyclists, mobility impaired persons and equestrians), road traffic, public transport and interchange, parking and loading and accidents and safety.

15.4.12. Potential temporary impacts during construction can result from:

- Construction traffic, particularly from lorries using routes to and from worksites and disposal sites for excavated material; and
- Changes in the road network or footpaths to accommodate construction traffic and accesses.

15.4.13. Potential temporary impacts during construction may include:

- Changes in traffic and lorry flows on routes;
- Temporary road closures, diversions and improvements;
- Changes in journey times and distances, and loss of amenity, for vulnerable road users.
- Changes to interchange;
- Changes in road and parking layouts, including loss of parking and loading facilities; and
- Changes in the numbers of road accidents.

15.4.14. Potential permanent impacts during operation can result from:

- Changes in traffic and lorry flows on routes;
- Permanent road closures, diversions and improvements;
- Changes in journey times and distances, and loss of amenity, for vulnerable road users.
- Changes to interchange;
- Changes in road and parking layouts, including loss of parking and loading facilities; and
- Changes in the numbers of road accidents

LIKELY SIGNIFICANT EFFECTS

15.4.15. The assessment will consider the significant effects in detail, however, it is predicted that the Proposed Development would not have a significant transport impact given it would be a generally car free development and would have the highest PTAL rating possible and therefore a very low vehicle trip generation.

15.4.16. The construction and operation of the OSD has the potential to affect vulnerable road users including pedestrians, cyclists, public transport users and road users. In addition, the development may affect parking, loading, access and drop-off arrangements. The following potential impacts will be considered in the ES Transport Chapter.

Table 15-4 – Summary of Potential Significant Effects

Impact	Phase	Receptor	Justification
CT1 and OT1	Temporary and Permanent	Traffic Level and Delay to Vehicle Occupants	Change in number of vehicle trips impacting on delay
CT2 and OT2	Temporary and Permanent	Public Transport Delay	Change in number of vehicle trips impacting on delay
CT3 and OT5	Temporary and Permanent	Disruption to Interchange	Potential change in public transport provision temporarily to aid

Impact	Phase	Receptor	Justification
			construction or increase in passenger numbers during construction and / or operation
CT4 and OT6	Temporary and Permanent	Parking and Loading	Potential impacts on parking or loading based on construction or development proposals
CT5 and OT3 / OT4	Temporary and Permanent	Vulnerable Road User Delay and Loss of Amenity	Change in number of vehicle trips impacting on vulnerable road users
CT6 and OT8	Temporary and Permanent	Accidents and Safety	Change in number of vehicle trips

INSIGNIFICANT EFFECTS

15.4.17. The following criteria (Table 15-5) have been scoped out as they are not anticipated to experience any significant environmental effects given the Site's location relative to the nearest waterways.

Table 15-5 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
CT7 and OT7	Temporary and Permanent	Waterways	No impact on waterways anticipated

15.5. MITIGATION

15.5.1. There are several potential likely mitigation measures which will be incorporated into the design and management of the Proposed Development. Embedded measures which it is reasonable to assume will be provided include:

- Car Free Development which limits operational parking to disabled people only in accordance with the Draft London Plan (2019);
- Incorporation of Electric Vehicle charging provision for disabled parking in accordance with the Draft London Plan (2019);
- Incorporation of cycle parking provision in accordance with the Draft London Plan (2019); and
- Other Site access design improvements to prioritise sustainable travel.

15.5.2. Other mitigation which will likely be secured by condition comprise:

- Outline Construction Logistics Plan;
- Draft Delivery and Servicing Plan;
- Framework Travel Plan; and
- Draft Car Park Management Plan.

15.5.3. In addition, if significant transport capacity or environmental effects are identified, additional mitigation may be considered, including junction improvements, off-site pedestrian and cycle route improvements and contributions to off-site strategic highways or public transport schemes. The

scale of any such mitigation would be proportionate to the relevant impact of the proposed development. This will be reviewed as part of the Active Travel Zone Assessment included as part of the Healthy Streets Transport Assessment.

15.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 15.6.1. As noted above, the ongoing site design process will consider ways to promote sustainable travel and maximise active modes over general car trips.

15.7. ASSESSMENT METHODOLOGY

- 15.7.1. The proposed methods for prediction and evaluation of impact on people travelling by the various modes are based on those specified in the Crossrail Environmental Statement Guidance (2009). The magnitude of each impact and its significance are assessed in accordance with the significance criteria set out in Volume 8a of Crossrail ES (2005).
- 15.7.2. During the assessment of impacts, reference will also be made to the Armourers Court Transport Assessment.
- 15.7.3. The assessment of significance, receptors and impacts has been identified earlier in this scoping report in Section 15.3.

15.8. LIMITATIONS AND ASSUMPTIONS

- 15.8.1. Given the limited availability of traffic data, traffic data from 2009 will be used as the '*pre-Crossrail*' baseline conditions. There were only two counters located on Plumstead Road (A206) east and west of Arsenal Way.
- 15.8.2. It is proposed that new Automatic Traffic Count and Classified Link Count traffic surveys will be undertaken at locations shown in the Figure 15-2. The current aim is to collect this data in November 2019.
- 15.8.3. For the purposes of forecasting future baseline conditions, initially TEMPRO growth factors will be used to forecast background traffic growth in Greenwich over the period 2019 to 2021 for the construction assessment and over the period 2019 to 2025 for the operational assessment. These growth factors will be included in the Transport Assessment prepared for the Proposed Development.
- 15.8.4. The quantity of materials will be outlined in the Construction Traffic Management Plan and will inform the likely construction trip generation. It is assumed that construction of the Woolwich Crossrail station will end prior to construction of the Armourers Court site, and therefore there will be no overlap of construction trips.
- 15.8.5. The operational trip generation for the Proposed Development will be assessed using trip rates derived from the TRICS database and will be outlined in the Transport Assessment.

16. CLIMATE CHANGE

16.1. STUDY AREA

- 16.1.1. The climate change chapter of the scoping report identifies the outcomes of likely significant environmental effects which could arise from the Armourers Court site. With an expected 515 residential units and additional non-residential floor space in the form of five buildings surrounding a central landscaped podium, the management of Greenhouse Gas (GHG) emissions should be closely monitored. The Climate Change Act 2008 sets targets for the UK to reduce its CO₂ emissions to net zero by 2050 (against a 1990 baseline), this also requires a Climate Change Risk Assessment to be used to calculate the risks from the impact of climate change in the UK. Due to this legislation, a climate change assessment to quantify the amount of GHGs is likely to arise. As well as national legislation being taken into consideration, the local council requirements for GHG emissions need to be adhered to as well.

16.2. BASELINE CONDITIONS

- 16.2.1. To ensure that the reporting of GHG emissions is accurate, a baseline measurement will need to be taken in order to provide a reference point against which the impact of the proposed development can be compared. If site data is available from the proposed Armourers Court location, then this can be used to calculate the baseline conditions. If no site data is available, then the emissions will have to be calculated based upon typical energy use and general industry values.

16.3. IDENTIFICATION OF SENSITIVE RECEPTORS

- 16.3.1. The sensitive receptors which are identified for this site includes the London Borough of Greenwich and the wider UK GHG emissions. Any and all GHG emissions are considered to be highly sensitive, as any GHG emissions at the site will count towards the UK's climate budget and have a further effect on the global climate.

16.4. SCOPE OF ASSESSMENT

LIKELY SIGNIFICANT EFFECTS

- 16.4.1. The GHG emissions during the demolition/construction and operational phases of the proposed development are considered to be the most significant effects and are summarised below.

Table 16-1 – Summary of Likely Significant Effects

Impact	Phase	Receptor	Justification
Embodied Carbon	Demolition and Construction Stage	London Borough of Greenwich and wider UK GHG emissions	Large increase in GHG emissions through carbon generated during manufacturing
Construction Transport	Demolition and Construction Stage	London Borough of Greenwich and wider UK GHG emissions	Large increase in GHGs through the transportation of material
Building Energy Use	Operational Stage	London Borough of Greenwich and wider UK GHG emissions	Large increases in GHG emissions through carbon being generated whilst the asset is in use

Operational Transport	Operational Stage	London Borough of Greenwich and wider UK GHG emissions	Large increases in GHG from an increase in vehicles passing through the area during the operational use of the development
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INSIGNIFICANT EFFECTS

- 16.4.2. Any GHGs which are likely to represent less than the >1% threshold set out by PAS 2050: 'Specification for the assessment of the life cycle GHG emissions of good and services' criteria are considered to be insignificant effects, and are summarised below:

Table 16-2 – Summary of Likely Insignificant Effects

Impact	Phase	Receptor	Justification
Project Design	Design Stage	London Borough of Greenwich and wider UK GHG emissions	Likely to represent less than the >1% threshold set out by PAS 2050
Distribution (including transport of materials at manufacturer/supplier and storage)	Demolition and Construction Stage	London Borough of Greenwich and wider UK GHG emissions	Likely to represent less than the >1% threshold set out by PAS 2050
Energy used on site from electricity use, generators, machinery etc	Demolition and Construction Stage	London Borough of Greenwich and wider UK GHG emissions	Likely to represent less than the >1% threshold set out by PAS 2050
Refurbishment and Demolition	End-of-use Stage	London Borough of Greenwich and wider UK GHG emissions	Likely to represent less than the >1% threshold set out by PAS 2050

16.5. MITIGATION

- 16.5.1. **Embodied Carbon:** Opportunities to reduce embodied carbon will need to be identified at all stages of the assets life cycle. As the majority of the emissions associated with this stage are related to the product and use stage and therefore, the raw material supply, transport and manufacturing selection is an important element of mitigation. Consideration should also be given to robustness and component durability. The selection of material could consider less energy intensive alternatives such as timber framed buildings instead of steel and the use of local suppliers. The minimisation of packaging and wasted materials will also reduce embodied carbon associate with the project.
- 16.5.2. **Operational Carbon:** There are mitigation measures which can be taken in order to reduce the amount of operational carbon which is attributed to the development. The development will need to follow local legislation in regard to design and heating, ventilation and air conditioning (HVAC) but has the opportunity to be designed achieve optimum energy performance levels. The developments can integrate new green technologies which are viable for the project to further reduce carbon levels through clever design and future proofing the development, e.g. electric charging points for vehicles.

16.6. OPPORTUNITIES FOR ENHANCING THE ENVIRONMENT

- 16.6.1. Opportunities to enhance the environment may present themselves after a more detailed ES report is completed.

16.7. ASSESSMENT METHODOLOGY

- 16.7.1. The assessment methodology for the Climate Change ES Chapter will encompass several different legislations and calculations to achieve the best possible practice. This will include definition of the legislative context (Climate Change Act, Building Regulations etc) and of the (national and local) planning policy and guidance/best practice from IEMA. Current best practice is reflected in IEMA's (2017) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance and builds on IEMA's previous guide on Climate Change Resilience and Adaptation.
- 16.7.2. The IEMA Assessing Greenhouse Gas Emissions and Evaluating their Significance (2017) guide will be followed. This will entail:
- Undertaking a GHG assessment by:
 - Developing a GHG emission baseline to provide a reference point against which the impact of the new development can be compared.
 - Modelling future GHG emissions based on design documentation, including emissions from regulated and unregulated sources and transport. This will require agreement from the design team as to a typical lifespan for the project to allow temporal factors to be applied to our analysis such as predicted UK grid decarbonisation projections.
 - Providing commentary on any significant emissions against sectoral, local and national carbon budgets or targets.
 - Issuing a draft climate change ES chapter for review and comment
- 16.7.3. There are likely to be moderate to minor significant impacts from this development in terms of GHG emissions, mainly due to the size of the development (515 units and additional non-residential floorspace).

16.8. LIMITATIONS AND ASSUMPTIONS

- 16.8.1. For the climate change chapter to be effectively written, data will have to be collected from the Energy Statement to establish the operation carbon emissions from the buildings. Likewise, data from the transport consultant (or air quality consultant) and an idea of the construction methodology and materials.
- 16.8.2. The chapter will focus on the calculation of GHG emissions. Having assumed that the consideration of climate change resilience and future adaptation would be considered within the front end of the ES with a high level qualitative assessment undertaken within each individual technical chapter to determine if future climate projects would change either the sensitivity of the receptor or the magnitude of change. Where relevant, it is understood that detailed calculations/assessment will be undertaken and reported in the technical chapter (e.g. flood risk).
- 16.8.3. Due to the outline nature of the planning applications, the modelling of GHG emissions is considered to be indicative.

- 16.8.4. The predicted decarbonisation of the grid has not been considered and as such this will likely be an overestimation of the actual emissions from the Proposed Development due to the current uncertainty around this element and difficulties in obtaining credible data.

17. CUMULATIVE EFFECTS

17.1. ASSESSMENT METHODOLOGY

- 17.1.1. The EIA Regulations require the likely significant cumulative environmental effects of a development to be considered. The following types of cumulative effects will be considered in ES:
- In-combination Effects: The effects of the interaction of the Proposed Development with other projects ('committed developments') affecting the same receptors. A committed development is defined as a development for which planning consent has been granted or a foreseeable development currently undergoing a planning determination; and
 - Effect Interactions: The effects of the interaction of multiple environmental effects from the Proposed Development on the same affected receptor.
- 17.1.2. There is no single widely accepted published methodology for the assessment of cumulative effects. However, several best practice guidance documents are available, including those published by the Department of Communities and Local Government and the European Commission. These will be referred to during the completion of the Cumulative Effects assessments in the ES.
- 17.1.3. The assessment of cumulative effects will be divided into two separate assessments in accordance with the types of cumulative effects to be considered, namely:
- An assessment of In-Combination Effects; and
 - An assessment of Effect Interactions.

IN-COMBINATION ASSESSMENT

- 17.1.4. The assessment of In-Combination effects will be entirely desk based and the following approach has been determined as an appropriate methodology.
- 17.1.5. A list of committed developments produced by conducting a desk study of planning documents and applications, and relevant development frameworks and policies in the area of the Proposed Development is provided in Table 17-1. An initial list has been presented in this EIA Scoping Report for consultation with RBG. With a final list intended to be agreed through consultation with RBG, and assessed in the ES. This will be limited to a maximum of ten committed developments. The potential for an in-combination effect, and subsequent classification of the development as a 'committed development' has been determined based on the criteria below:
- The nature and scale of the development (and the likelihood of the development to result in a heightened effect compared to the Proposed Development in isolation);
 - The proximity of the development to the Proposed Development;
 - The likelihood of the development to result in similar activities (e.g. construction activities) acting on the same environmental receptors as the Proposed Development; and
 - The potential for the development to have an overlapping construction phase with the Proposed Development, and the temporal extent of these overlapping phases.
- 17.1.6. Any development currently under construction that is expected to be completed before the construction phase of the Proposed Development will be excluded from the assessment.
- 17.1.7. Once the list of committed developments is established an assessment of the level of in-combination effects will be carried out on a case by case basis. The assessment will be based on the information

available for each committed development, with assumptions towards a worst-case scenario and professional judgement being used when information is not available.

- 17.1.8. Effects will be classified by technical topic, with each committed development being assessed individually. For the purposes of the assessment, any in-combination effect of Moderate or higher will be considered a significant effect.

EFFECT INTERACTION ASSESSMENT

- 17.1.9. There is no established EIA methodology for assessing and quantifying the effects of multiple individual impacts on the same receptor or resource. The assessment will be entirely desk based and the following approach has been determined as an appropriate methodology.
- 17.1.10. The reported residual effects from each technical chapter on receptors and resources will be assessed in the effect interaction assessment. Any residual effect of minor or above will be considered as it will have the potential to result in an effect interaction. The first stage of the assessment will identify which of these receptors and resources see more than one residual effect on them. This will identify a list of 'Common Receptors' to be taken forward for assessment. All receptors and resources that are not identified as a Common Receptor will be scoped out at this stage.
- 17.1.11. The residual effects on each common receptor will be classified by each technical topic and collated in two matrices (one for construction effects and one for operation effects). The residual effects will then be assessed for their potential to result in an effect interaction. This effect interaction will be classified in accordance with the significance methodology outlined in Section 3. The classification of any effect interactions will be based on consultation with technical specialists from each relevant technical topic.
- 17.1.12. For the purposes of the assessment, any Effect Interaction of Moderate or higher will be classified as a significant effect.

STUDY AREA

- 17.1.13. The study area for the In-Combination Assessment will be based on consideration of the likely significant effects that could reasonably arise from the Committed Developments that are considered alongside the Proposed Development. These likely effects will be determined in consultation with the technical specialist for each corresponding topic.
- 17.1.14. The study area for the Effect Interaction Assessment will be consistent with the study areas defined for each technical topic (see sections 5-16).

COMMITTED DEVELOPMENTS

An initial review of the RBG Planning Register for applications approved within 3 years of the anticipated construction start (March 2021) of the Proposed Scheme has identified the following developments of interest, further information is outlined in Table 17-1. As part of the Scoping Opinion provided by RBG, RBG are welcome to comment on whether they find the list below acceptable. The search has been limited to within 1km of the Proposed Scheme, excluding the area on the north side of the River Thames. The location of these relative to the Proposed Scheme are

shown in



17.1.15. Figure 17-1.

Table 17-1 – Committed Developments

Development Address	ID	Distance from Site	Description of Development	Application Reference
Building 11, Major Draper Street, Royal Arsenal, Woolwich, SE18	1	Directly adjacent (north-west)	Change of use and alteration of two Grade II Listed Buildings to provide mixed use development comprising 146 residential units with refuse/recycling and cycle parking, 2150 sqm commercial use and a public square with vehicle access and drop off, and landscaping.	18/0326/NM

Development Address	ID	Distance from Site	Description of Development	Application Reference
The Waterfront Masterplan (Royal Arsenal Riverside Waterfront Masterplan) Land off Beresford Street/Woolwich High Street, Woolwich, SE18	2	0.2km west	Phased, mixed use development comprising 2,032 units and 2,442 (GEA) sqm of non-residential floor space (A1/A2/A3/A4/B1/D1 Use), access, landscaping, public accessible open space, car and cycle parking provision and refuse and recycling storage areas.	16/3025/MA (and amendments)
Land bound by Beresford and Macbean Street, Woolwich, SE18 6BG	3	0.3 km west	Comprehensive mixed-use redevelopment of the site comprising the demolition of the existing buildings and structures on site and the provision of five buildings of 6, 12, 19, 20 and 22 storeys comprising 642 residential units (Use Class C3 use); a roof top public viewing gallery; 2944 sqm GEA of flexible commercial floorspace (Class A1/A2/A3/A4/B1/D1/D2 and Sui Generis) at ground and mezzanine level; new market storage facility (Sui Generis); new public realm with hard and soft landscaping, highway works, car parking and cycle parking, access and servicing arrangements; plant and associated works.	19/2498/F
36-38 Artillery Place, Woolwich, London, SE18 4AB	4	1 km south-west	Demolition of the existing buildings and erection of two 6-storey buildings to provide 65 residential flats (25x1-bed, 20x2-bed and 20x3-bed) with associated landscaping, amenity space, cycle parking, refuse and recycling storage, and the provision of six on street disabled car parking spaces.	17/2546/F (and amendments)
Crossrail, Units 1 and 2, The I O Centre, Skeffington Street, Woolwich, SE18 6SR	5	Within the site boundary	Crossrail Woolwich Station	18/4392/G (and amendments)
Riverside House (East and West), Woolwich High Street, Woolwich, SE18 6BU	6	0.5 km north-west	Change of use from Office (Class B1a) to Residential (Class C3) forming 199 residential units	18/4120/PN2
33-37 Hare Street, Woolwich, SE18 6NE	7	0.7 km north-west	Retention of the Hare Street facade and main frame with remainder of the property demolished; reconstruction of the building; installation of new shopfronts, change of use from retail at first and second floors to residential and the construction of a second floor rear extension for the creation of 9 self-contained flats comprising 4 x 2-bed and 5 x 1-bed units and refurbishment of ground and basement retail space including rear refuse area	14/1678/F (and amendments)

Development Address	ID	Distance from Site	Description of Development	Application Reference
Callis Yard, Bunton Street, Woolwich, SE18	8	0.6km north-west	Partial demolition of existing buildings and redevelopment of the site to provide 152 residential dwellings (comprising 57 x 1 beds, 80 x 2 beds, and 15 x 3 bed accommodation), together with indoor children's play centre, ancillary gym, and associated landscaping and car parking.	14/1355/F (and amendments)
Spray Street Quarter, Woolwich, SE18	9	Adjacent (south-west)	Demolition of existing buildings and the construction of a mixed use development comprising 742 residential dwellings (class C3), 6,000 sqm of retail floorspace (classes A1/A2/A3), 3,500 sqm of leisure space including a cinema (class D2), 650 sqm of a nursery (class D1), 1,650 sqm of business floorspace (class B1), new public square and new public realm with hard and soft landscaping, highway works, parking, access and servicing arrangements, plant, infrastructure and associated works	18/0126/F

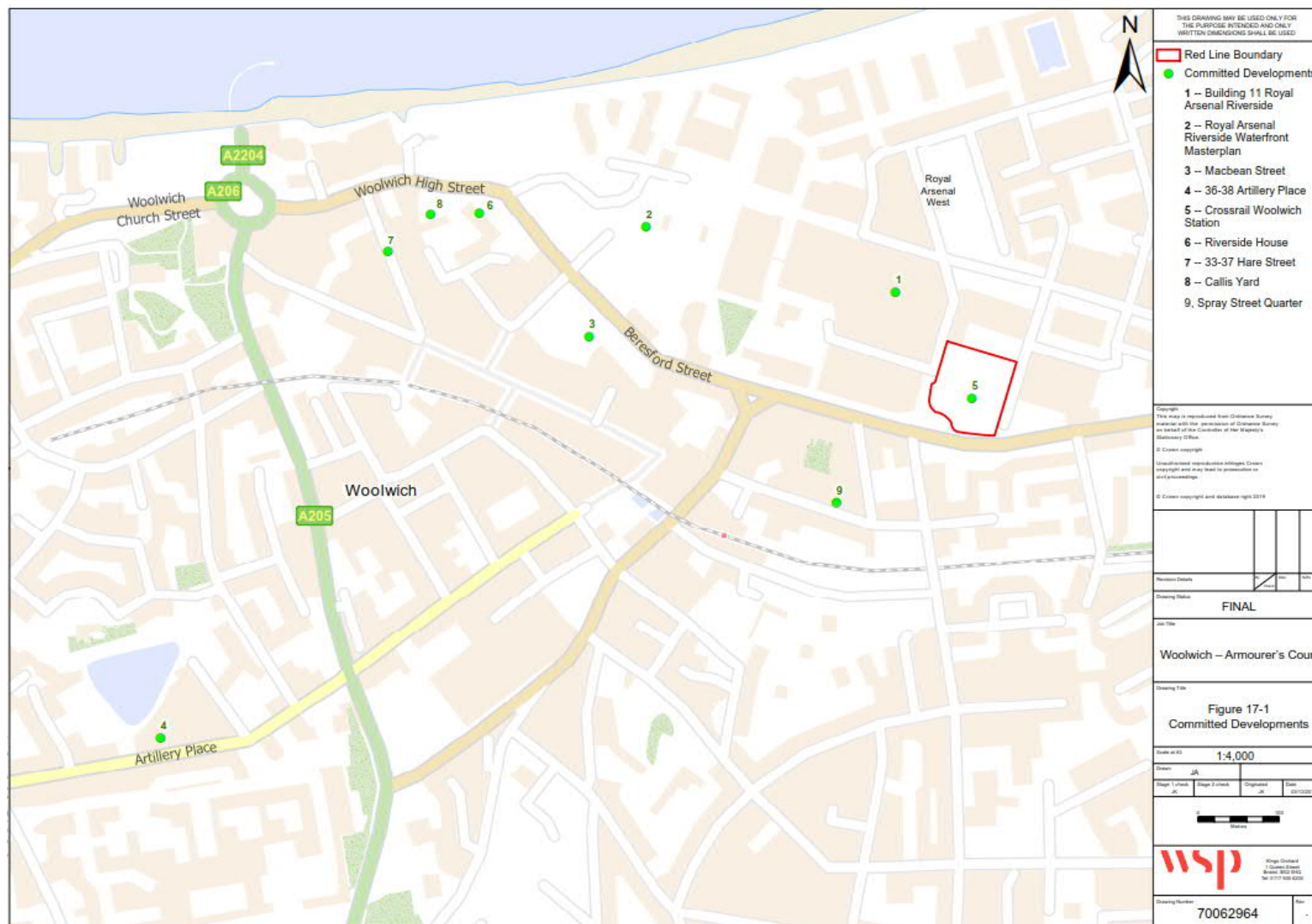


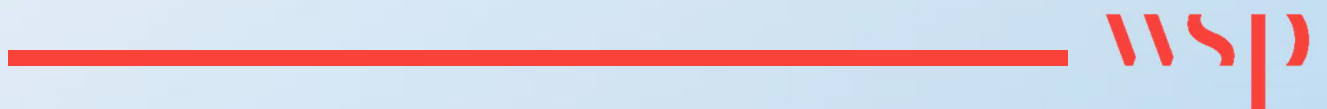
Figure 17-1 - Committed Developments within 1km of the Proposed Scheme

17.2. LIMITATIONS AND ASSUMPTIONS

- In the assessment of effect interactions there is an assumption that mitigation measures outlined in the respective chapters will be fully incorporated to mitigate the corresponding adverse effects resulting from the Proposed Scheme;
- The assessment of in-combination effects will be limited to publicly available information at the time of writing and information provided by RBG;
- For the purposes of the in-combination effects, professional judgement and a 'worst case scenario' will be used where there is a lack of certainty about a committed development in consultation with the relevant technical specialist;
- In the absence of sufficient information, it will be assumed that the applicant for a committed development will implement standard best practice mitigation measures to reduce any residual environmental effects; and
- The assessments will be entirely desk based, not site visits will be undertaken to inform the assessment.

Appendix A

PROPOSED STRUCTURE OF THE
ENVIRONMENTAL STATEMENT



The structure proposed for the ES is in line with Schedule 4 of the EIA Regulations and relevant good practice guidance.

Volume 1 – Environmental Statement

Front End

Chapter 1: Introduction

Chapter 2: The Proposed Development

Chapter 3: Consideration of Alternatives

Chapter 4: Approach to the EIA

Technical Chapters

Each technical chapter will be structured as follows:

- Introduction;
- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions
- Sensitive Receptors
- Insignificant Effects;
- Assessment of Effects, Mitigation and Residual Effects;
- Limitations and Assumptions;
- Summary; and
- References

Concluding Chapters

Chapter X: Cumulative Effects

Chapter X: Summary

Volume 2 – Technical Appendices

Technical Reports and Documents associated with the technical chapters. For example, Preliminary Ecological Appraisal and Construction Environmental Management Plan.

Volume 3 Townscape and Visual Impact Assessment

The Townscape and Visual Impact Assessment will be separated from the Volume 1 ES and be presented in its own Volume.

Volume 4 – Non-Technical Summary

A concise summary of the ES that provides a description of the EIA process and its findings. This is presented in a manner that is both appealing to read and easily interpreted by the general public.

Appendix B

ARCHAEOLOGY PLANS








Archaeological Investigations at The Royal Arsenal, Woolwich. Crossrail Station Box

Interim Statement

Document History:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
1.0	7.2.2012	Dan Sykes	David Score	R Brown	For Information
					
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Figure 2: Site plan

Plate 1: The Royal Arsenal, Woolwich with Site in foreground (Copyright English Heritage)

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Plate 3: Floor surfaces within Officers' Quarters (Structure 174)

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Plate 6: Base of Octagonal Water Tower 334

Plate 7: Recording of furnace/hearth features within Structure 282

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SUMMARY

From 20th September to 16th December 2011 Oxford Archaeology undertook a watching brief on the diversion of utilities and a targeted watching brief (strip, map and sample excavation) on the site of a new Station Box for Crossrail at The Royal Arsenal, Woolwich. The work was commissioned by Berkeley Homes Plc.

The remains of a series of buildings relating to the historic development of the site as The Royal Arsenal were recorded across the area. These remnants of buildings for the most part consisted of foundations, structures and subterranean services that had survived previous remediation and demolition episodes on the site. Towards the western end of the site intact floor surfaces and internal features of a range of buildings labelled as 'Officers' Quarters'/'Official Residences' on historic maps (1749-1930s) were revealed. The intact internal floor surfaces of this semi-basemented building survived as they were considerably lower than the ground floor levels of surrounding structures where more significant truncation had occurred. This residential area was bordered to the east and south by a curtain wall. The lower level of the construction of these buildings may be due to the presence of an ancient palaeochannel, which underlies them and crosses the site from south to north in this location. The approximate extent and upper levels of this feature were investigated and it will be the subject of further work during bulk excavation of the site in 2012.

Moving across the site to the east, the footings of a 'Pattern Room' building and substantial associated drainage culverts and tanks as well as the base of a Water Tower and the remains of Police Barracks were recorded. These structures can be identified on historic maps dating from the 19th century.

At the eastern extent of the site two further historic buildings were recorded, both retaining elements relating to industrial processes. To the north the southernmost parts of Gunnery Terrace were investigated and to the south, a similarly northwest-southeast orientated building of unknown function present on the site from approximately 1845 until the 1930s was recorded.

The natural gravel was revealed extensively across the site but it had been truncated by the activity in the post medieval period and no evidence for earlier archaeological deposits was observed.

1 INTRODUCTION

1.1 Scope of work

- 1.1.1 From 20th September to 16th December 2011 Oxford Archaeology (OA) undertook a general watching brief on the diversion of utilities and a targeted watching brief (strip, map and sample excavation) on the site of a new Station Box for Crossrail at The Royal Arsenal, Woolwich. The work was commissioned by Berkeley Homes Plc.
- 1.1.2 The proposals comprised a station box (approximately 14–16m deep x 22–27m wide and 256m long internally) and shafts at both ends to ground level. The station box is being constructed using diaphragm walls and piling. Significant ground reduction adjacent to the box and de-watering of the site will also be required in order to enable the construction. It should be noted that when heights on this project are given as Tunnel Datum (ATD) these equate to Ordnance Datum +100.
- 1.1.3 Historic building recording of structures on the site (Gunnery Terrace) which have been demolished was undertaken by Museum of London Archaeology (MOLA). OA were tasked with carrying out a general watching brief on the diversion of utilities and a targeted watching brief (strip, map and record) on the stripping and bulk excavation of the main area.
- 1.1.4 Details of the project, background, outline methodologies and scopes of work are contained in *Woolwich Station. Site-Specific Archaeological Written Scheme of Investigation* (SSWSI document ref.: CR-PN-GRE-EN-SP-00001 version 7) (MOLA 2011). In response to the SSWSI OA produced a *Site Specific Method Statement for Archaeological Fieldwork* (OA 2011) providing information on OA site-specific methodologies and practices and company procedures to be employed on the project.
- 1.1.5 This report is an Interim Statement in line with Crossrail specifications and is intended to be a brief statement outlining the work undertaken and a summary of the results.

1.2 Location, geology and topography

- 1.2.1 The Woolwich Station site is located immediately north of Plumstead Road and extends in an east west direction across Arsenal Way, in the London Borough of Greenwich. The area is crossed by Arsenal Way and Cornwallis Road and includes remains of the Woolwich Arsenal, which is currently in the process of regeneration. The site is located 220m north of the existing Woolwich Arsenal Station, which is located on the Southeastern mainline service to Gravesend and Dartford; and on the Docklands Light Railway (DLR) service from Woolwich Arsenal to Bank. The site is located c 400m south of the River Thames (Fig.1 Plate1).
- 1.2.2 Historically the site has been in a military area since the 16th-century, armaments manufacture and associated logistical facilities had extended onto the site by the early 18th-century and the first barracks were built in 1719. By the 19th-century the site had been entirely covered by military and industrial buildings associated with the Royal Arsenal. The former Royal Arsenal is now being regenerated with housing and other amenities.

- 1.2.3 Woolwich lies on a promontory of bedrock (Thanet Beds) protruding into the floodplain (alluvium). This higher and dryer ground would have made the area attractive for settlement throughout prehistoric and historic times. The site is situated on river terrace sand and gravel which has been truncated by post medieval and modern activity and overlain by deposits of made ground and demolition material. The ground level slopes very gently down from 108.8m Above Tunnel Datum (ATD) in the west to 107.5m ATD in the east.

1.3 Archaeological background

- 1.3.1 The archaeological and historical background to the site, past archaeological investigations and potential and relevant background documents are outlined in the SSWSI and are not reproduced here.

2 INVESTIGATION METHODOLOGY

- 2.1.1 This section sets out the specific methods which were applied during the archaeological works.
- 2.1.2 Specific methods for the excavation, specific health and safety issues, programme and lines of communication were discussed and agreed, and generally working relations established between Berkeley Homes, O'Keefe Construction and OA, at the start of the works.
- 2.1.3 The programme for excavation works was led by O'Keefe Construction who conducted the ground works on the site. The main excavation area was divided into 20m square boxes forming a site grid. These boxes were numbered and related to the development grid and were used to reference activity and progress on the site. Progress and order of excavation were determined by various site constraints in particular the need to maintain adequate access and the procedures for dealing with spoil.
- 2.1.4 There was constant liaison and communication at a site level between OA and O'Keefe in order to facilitate the day to day site work and Berkeley Homes were kept fully informed of progress. Berkeley Homes operated a Permit to Dig system with O'Keefe and a sign off system also operated between OA and O'Keefe to monitor archaeological progress and completion on a 'box by box' basis.
- 2.1.5 Excavations started at the west end of site and worked eastwards in 20m wide strips using the grid of 20m square boxes. The excavation was conducted as a 'strip, map and record' excavation rather than full archaeological excavation, the essence of which is that deposits are investigated at a level determined by their relative nature and importance and the amount of archaeological work carried out is that which will be required to adequately understand them.
- 2.1.6 Overburden deposits were removed in stages by O'Keefe using 360° tracked excavators fitted with toothless grading buckets. Excavation proceeded in level spits determined by and supervised by OA. Machine excavation subject to archaeological monitoring proceeded until archaeological remains in the form of structures or other features were revealed or the top of natural geology was discovered, whichever was encountered first.

- 2.1.7 Any archaeological horizons or features were then cleaned as necessary to achieve clear definition of archaeological features and deposits. Spoil from around foundations and structural deposits were removed by the ground works contractor using a machine or hand tools as directed by OA.
- 2.1.8 Hand investigation, survey and recording of archaeological features was then undertaken by OA using the methodologies outlined in the SSWSI and the OA Method Statement. Investigation was at a level appropriate to the remains and was sufficient to characterise and understand them.
- 2.1.9 While any hand excavation was carried out by OA the stripping of overburden continued in subsequent 20m boxes. Stripping, bulk excavation and archaeological investigation ran concurrently.
- 2.1.10 When archaeological investigation or recording in a box had been completed an assessment was made as to whether further archaeological remains or information could be revealed at lower depth in that area. If yes, further machine excavation took place under OA supervision and the process above was repeated. This continued within a box until all archaeological remains had been dealt with at which point OA 'signed off' that box and O'Keefe proceeded to excavate to formation level.
- 2.1.11 As anticipated, in much of the site a single strip to the first significant horizon was all that was required with further observations of foundation character / depth etc being made when obstructions were removed.
- 2.1.12 The excavation formation level for this phase of works was 105m ATD which generally meant approximately 3m depth of bulk excavation from the existing ground level. Excavation edges were battered for safety where necessary. At the 105m level there were a small number of deeper foundations which were 'tested' with machine investigation sufficient to characterise them for the archaeological record.
- 2.1.13 Historic maps and a borehole survey previously undertaken had indicated the possible presence of two palaeochannels at depth running roughly north south at either end of the site. At the eastern end of the area no evidence for a channel was identified but at the western end a wide feature was recorded in the base of the excavation at the 105m ATD level. It was investigated within a pair of discreet slot trenches, excavated to a maximum depth of 1m by machine under archaeological supervision in order to determine its extent. The upper section of the channel was then archaeologically cleaned to reveal its profile and determine the nature of the deposits. For logistic and health and safety reasons the full depth of what appears to be a deep channel could not be excavated at this stage but a further targeted investigation is planned in conjunction with the bulk excavation programme during 2012.
- 2.1.14 A watching brief was also undertaken on excavations below 1m depth in a trench which extended around the eastern end of the site for the diversion of services. OA investigated and recorded any archaeological remains in this area to the same standard as the main excavation but did not supervise the machining. OA recording was undertaken within the programme and scope of the trenching.

- 2.1.15 The archaeological works were monitored by Berkeley Homes Plc, Nick Elsdon (MOLA) their Archaeological Consultant and Mark Stevenson from the Greater London Archaeology Advisory Service who advise Greenwich Borough Council on archaeological matters. Regular meetings were held on site to discuss and review findings and progress during the works.

3 AIMS AND OBJECTIVES

3.1 General

- 3.1.1 The aims and objectives of the investigations are presented in the SSWSI and are reproduced below. The overall objectives of the investigation were to identify, excavate and record any archaeological remains on the site, which would be adversely impacted by the Woolwich Station works.

3.2 Specific aims and objectives

- 3.2.1 The general watching brief had the potential to recover:
- Evidence of the construction and development of non-listed historic buildings on the site
 - Remains of previously demolished buildings associated with earlier phases of the Royal Arsenal.
- 3.2.2 The targeted watching brief during the removal of the made ground had the potential to recover:
- Remains of previously demolished buildings associated with earlier phases of the Royal Arsenal. This could include evidence of foundations and unusual practices (eg the use of former gun carriages as foundation base plates which has been noted elsewhere at the site).
 - Any post-medieval convict burials.
 - Any evidence of the post-medieval buildings on the site prior to the construction of the Arsenal.
- 3.2.3 The targeted watching brief (strip, map and record) following removal of the made ground had the potential to recover:
- Burials associated with the Roman cemetery on the Arsenal site.
 - Evidence of the former watercourse crossing the site, and whether it is natural or manmade.
 - Any evidence of outlying settlement or activity associated with the Iron Age possible oppidum or subsequent Roman occupation.
 - Any evidence of the Roman road, if it is present on the site.
 - Any evidence of the pre-Arsenal later medieval and post-medieval use of the site.

4 FINDS SUMMARY

- 4.1.1 Finds of particular note consisted of 3 naval cannon, one cannon ball and a small assemblage of pottery retrieved from the backfill of the palaeochannel. The cannon were retained on site by Berkeley Homes Plc and the remainder of the finds were removed to storage at OA offices in Oxford. It is anticipated that the cannon will be retained by Berkeley Homes and incorporated into the landscape design for the Royal Arsenal site.

- 4.1.2 The cannon (324, 325 and 326) were all 32 pounders and of sea service issue. They dated from 1834 to the late 1850s and had their muzzles truncated as part of their decommissioning from active service. Cannon 324 (Plate 8) featured a V.R. inscription uppermost = Victoria Regina (pers.comm. Paul Evans, Library and Archives: Firepower Museum).
- 4.1.3 A 24lb/12kg, 8" diameter cannon ball was retrieved from the ground reduction works around Structure 73. It was hollow with an open filler sprue and dated from c.1789-1815. (Pers. comm.-Allan Marcuson, Explosive Ordnance Supervisor: Macc International).
- 4.1.4 Pottery retrieved from backfill 242 of the Palaeochannel has been dated to 1720-1780 (Pers. Comm. J.Cotter, OA) and is consistent with the infilling of the upper levels of the palaeochannel and the subsequent construction of the Officer's Quarters in that area from 1749 onwards.

5 RESULTS

5.1 General soils and ground conditions

- 5.1.1 The main features recorded on the site are described below and illustrated on the site plan (Fig.2).
- 5.1.2 Natural river terrace mid orange sand and gravel was observed throughout the site. This was overlain by 18th and 19th century made ground deposits which in turn were overlain by 20th century demolition layers and the make up and concrete and tarmac surfaces of the modern temporary car park. The upper horizon of the natural gravel was extensively truncated by the post medieval activity and with the exception of the channel described below no earlier features pre-dating the Royal Arsenal were identified. The natural was generally approximately 1-1.5m below the current ground surface although at the western end of the site the truncation was more extensive and the natural horizon was 3-3.5m below current ground level, roughly coinciding with the 105m ATD formation level for this phase of works.

5.2 Palaeochannel

- 5.2.1 Towards the western end of the site a NE-SW aligned feature (239) was revealed cutting through the natural sand and gravel at approximately the 105 ATD formation level (Plate 2).
- 5.2.2 This roughly 40m wide feature corresponds with a channel shown on historic mapping and indications of channel deposits recorded in a borehole (WP142R) just to the north of the excavation which suggest the presence of an ancient watercourse running across the site. This area had been heavily truncated by the construction of Royal Arsenal buildings but the surviving uppermost deposits of this feature were recorded. A brick culvert in the upper fills appears to represent an attempt to contain the water from the channel prior to Arsenal related construction. A further stage of work is planned to take place during the further bulk reduction of the area in 2012 to examine earlier fills of the channel. The results of this future investigation will be reported in a further interim statement following completion of the work.
- 5.2.3 A possible second palaeochannel suggested from the results of boreholes at the eastern end of the site was not observed during the works.

5.3 Officers' Quarters (Structures 171, 174 and 176)

- 5.3.1 Situated towards the west of the site the remains of buildings referred to as 'Officers Quarters' were revealed. These buildings were remodelled and extended over a period of years following the initial construction of the complex in the mid 1700s. The buildings were aligned NE-SW and appear to have been constructed with floors at slightly lower levels than other buildings in the general area which may be a consequence of a natural depression caused by the presence of the underlying palaeochannel (239). The existing stream was culverted (117) as part of the foundation (176) construction of this building. The base of the outer walls of the foundation (119) was recorded at a depth of 1.8 metres below the formation level of the present site (105 m ATD) presumably to account for the softness of the underlying ground. The interior cross walls were of a lesser depth at 0.4m below the formation level. Pottery retrieved from the backfill of the foundation construction is of a date range 1720-1780.
- 5.3.2 The building was recorded in two separate stages of excavation as it was revealed by the site strip. The southern part is referred to as Structure 174 with the northern revealed area being Structure 171 (Plates 3 and 4). The building continued beyond the limit of excavation to the north.
- 5.3.3 Structure 174 was recorded as being 10m in width NW-SE, directly over the footprint of foundation 119 and for the most part was constructed of red brick with a lime mortar bonding. The average level of the revealed walls and floors was between 105.6 and 105.76m ATD. All interior partition walls ran parallel or at right angles with the outer walls except dog-legged wall 17 which may have served as a stairwell. The floor surfaces were probably all originally of yellow Flemish brick, laid on edge, aligned with the outer walls (floors 14, 19, 20, 24 and 26) or in a herringbone pattern (16) or as gullies (15 and 25). At a later date these floors had mainly been overlain or replaced with concrete screed floors or concrete floor tiles.
- 5.3.4 On the eastern side two probable thresholds were observed constructed of granite block (7) and Greensand block (13), although no external yard surfaces were evident relating to these features.
- 5.3.5 A 5m wide external yard area was formed to the west of Structure 174 between its outer westernmost wall (36) and the eastern extent of a further block in the complex, Structure 328. This yard featured a mixture of cobbled and flag-stoned surfaces on either side (46, 47 and 48) which sloped towards a central gully. In common with the inside of the building the surfaces had been patched with and in some places overlain by concrete screed. At the northern extent of the yard a rectangular coal store was observed with a brick floor (44) with a threshold leading into the western side of Structure 174.
- 5.3.6 The northern area of the Officers' Quarters (Structure 171) showed more evidence of remodelling of the building over time. Mixtures of floor surfaces, often within the same room, were observed: Flemish brick (172), possibly original, granite setts (131, 132 and 133), flagstones (128 and 147), 'chocolate block' concrete tiles and patches and whole floors of concrete screed. Three hearth/fireplaces were observed (134, 145 and 152) as were three toilet cubicles (137, 148 and 161).

- 5.3.7 The northern extent of the building (171) was 7.5m wider in plan to the west than the central/southern extent (174). It seems likely that this is a result of extensions being made to the original footprint over time, although interpreting the progression of walls or even the original layout is complicated by the fact that the main load-bearing walls (124, 126, 127, 130, 151 and 167) differ from both each other, in terms of brick size and colour and bonding mortars, and from the underlying foundation (176).
- 5.3.8 A quadrangle formed by walls 60, 69 and 78 and on the east side 55, 60 and 66 was recorded as Structure 328 and is shown as a yard-like area on James' plan of 1860-63. The rectangular building within its north eastern corner (67) is clearly visible on the historic plan as are those to the south (Structure 177) and north (Structure 178).
- 5.3.9 Structure 180 in the north-western corner of the current site comprised a basemented and flagstone floored room (90) accessed by a stairwell at its northern edge. A small building (Structure 179) lay immediately to the east of Structure 180 and was not visible on the historic map progressions and yet appeared to be constructed of broadly contemporary materials with later additions.
- 5.3.10 To the east of the area of 'Official Residences' formed by the complex of structures described above Wall 51 ran across site and returned at its southern end towards the south-west forming an eastern perimeter to the domestic ranges. Wall 51 was buttressed and stepped on its eastern side and faced towards the Residences to the west. It was surmounted by later Wall 52.

5.4 Pattern Room, Water Tower and Police Barracks (Structures 73, 190, 334 and 331)

- 5.4.1 In the central area of the site a number of structures which could be recognised on historic mapping were recorded. Structure 73 ('Pattern Room'), orientated NW-SE, measured 68m in length by 18m in width and consisted of a stepped brick foundation laid on a concrete footing. No interior walls or floors survived previous site remediation. The northern side of this building was abutted by Structure 181, a likely 20th century addition which consisted of a concrete floored sub-basement room accessed by a stairwell at its eastern side.
- 5.4.2 A similarly aligned Structure (190), to the east of Structure 73, can be seen as a later unattached addition to it and probably performed a similar function.
- 5.4.3 A series of culverts ran on the north side of Structures 73 and 190 and linked with two large brick-built settling tanks, (183 and 186). Both tanks measured 16 x 3m and featured vaulted roofs with access hatches. They were approximately 2m deep (Plate 5).
- 5.4.4 Immediately to the east of Structure 190 the remains of an octagonal Water Tower were revealed (Structure 334). This measured 10.6m in diameter and consisted of 2 concentric octagonal yellow brick walls overlying a concrete footing (Plate 6).
- 5.4.5 To the south of Structure 190 brick Structure 331 was constructed of red/yellow bricks on a concrete base. Walls 199 and 200 appear to form the footprint of the northern wing of the 'Police Barracks' as depicted on the 1860-63 historic plan with Wall 193 fitting the alignment of the northern wall of the main building.

5.5 Southern extent of Gunnery Terrace (Structures 332 and 333)

- 5.5.1 Structure 332 comprised the remains of a building of uncertain function located to the south of Gunnery Terrace. Two walls greater than 60m in length and 8m apart on a NW-SE alignment were recorded. Neither the western nor the eastern extent of the building could be established: The western extent had been truncated by a large NW-SE aligned sewer pipe trench of probable late 20th century date with the eastern extent continuing beyond the eastern site boundary.
- 5.5.2 A roughly 'T'-shaped structure between the walls, measuring 4.5 x 5.1m consisted of yellow brick walls surrounding a concrete floor (275) which was covered in metal (Fe) working debris. Apart from a patch of concrete relating to a service pipe (268) no other internal features remained between the walls but the southern wall was abutted on its southern side by a series of brick-built hearths (269, 270, 271 and 278) which contained charcoal/ash and a similar hearth-like feature (272) stood alone 5m to the south. It is probable therefore that this area was also internal to the overall structure.
- 5.5.3 Structure 333 to the north of Structure 332 consisted of a large rectangular building (Structure 282) with a later extension (297) abutting its south-western corner. Structure 333 represents the southern extent of Gunnery Terrace.
- 5.5.4 The bases of several walls representing earlier phases of Gunnery Terrace were recorded within the footprint of Structure 333. All were aligned NE-SW or SE-NW.
- 5.5.5 A series of furnace/hearth structures (283 - 286, 302, 315 and 316) (Plate 7) were recorded along the southern wall of Structure 282. These were all similar in form, having an apsidal northern end and a sloping stoke-hole to the east and measured 2 x 1.5m in plan. All contained a black clinker-like deposit. Structure 313, partially revealed beneath later concrete and Structure 293, partially exposed at the northern limit of excavation, are likely to have been similar features. A larger furnace-like construction (Structure 317) was also partially uncovered in the south-western corner of the building. A series of concrete, probable machine bases, some displaying fixing bolts were recorded. The most interesting of these contained a row of 3 naval cannon, aligned NW-SE. The Cannon (324 (Plate 8), 325 and 326) had been set vertically within a 4m deep block of concrete with their muzzles uppermost and level with each other.
- 5.5.6 The southern extension to the building (297) contained several concrete machine bases and an alignment of 5 hearths which abutted the inner face of the southern wall. Hearths 303 - 307 were constructed on concrete bases with yellow bricks that were blackened internally.

5.6 Utilities trench

- 5.6.1 A utilities trench encircled the eastern portion of the site, in a 'U'-shape, diverting services from Arsenal Way to the north, around the Station Box and then back to Arsenal Way at the junction with Plumstead Road to the south. The northern run of the trench revealed a series of brick structures beneath the extant concrete floor surface of Gunnery Terrace., including a large, east-west aligned flue (215). In the north side of the trench a series of NW-SE walls and buttresses with elements of remodelling formed an earlier internal partition wall to Gunnery Terrace.

- 5.6.2 In the eastern and southern areas of the utilities trench fairly modern make-up deposits overlaid a continuation of wall 260, the building to the south of Gunnery Terrace. A feature (252) with silt-rich fills was initially thought to be a ditch/channel but is now thought to be a discreet pit, possibly a gravel quarry, as it was not observed continuing into the main excavation area immediately to the west.

6 REPORTING

- 6.1.1 This report is an Interim Statement in line with Crossrail specifications and is intended to be a brief statement outlining the work undertaken and a summary of the results. Summaries have also been prepared and will be submitted to London Archaeologist, Museum of London and other appropriate journals.
- 6.1.2 It has been agreed by Crossrail, Berkeley Homes and English Heritage that further post excavation work, analysis and publication which may be appropriate for this site will be included in the overarching framework (EH 2004) which exists to take the accumulated archaeological investigations undertaken at the Royal Arsenal forward to publication.

7 CONCLUSION

- 7.1.1 The archaeological investigation established that the site area had been subject to extensive disturbance and truncation relating to the construction of buildings forming part of the Royal Arsenal. With the possible exception of an ancient palaeochannel, which will be subject to further investigation, any deposits or features which might have been present from earlier phases of activity have been removed. The buildings of the Royal Arsenal have in turn been subject to demolition and remediation and have survived to varying degrees. The lower lying floors and surfaces of the Officers' Quarters complex at the western end of site showing the best levels of preservation. Evidence for both the domestic life of the Arsenal and its industrial function as exhibited in the hearths and furnaces recorded in the remains of the southern extent of Gunnery Terrace has been collected. Many of the structures revealed can be traced on historic maps of the site dating from 1749-1930 and the archive will add to the wealth of historic information collected from the wider, extensive redevelopment of the site.

APPENDIX 1 ARCHAEOLOGICAL CONTEXT INVENTORY

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
1	Wall	2	0.46	3	Yellow/Pink Brick 210x102-105 x60mm (8¼x4-4½x2⅜") Off-white Lime Mortar	E-W aligned Wall at northern edge of Cellar 327 (continuation of 92).	180
2	Wall	1.5	0.2	3.2	Yellow/Pink Brick 210x105x64mm (8¼x4½x2½") White Lime Mortar	E-W aligned Wall of Cellar 327, western continuation of Wall 2 and 92?	180
3	Wall		0.46	1	Red Brick 215x100x60mm (8½x4x2⅜") White Lime Mortar	Stairwell Wall at north of Cellar 327.	180
4	Steps	0.45	0.3	1	Green Sand Block 1000x300x450mm (39⅜x11¾x17¾")	Staircase into Cellar 327	180
5	Wall	0.3	0.23	2.07	Red/Orange/ Yellow Frogged Brick 230x116x70mm (9x4¼x2¾") Portland-rich Mortar	NE-SW external Wall. On eastern edge of structure. Butting Wall 6 along western edge.	174
6	Wall	0.12	0.17	2.64	Granite Sets 300-360x170-180x 90-120mm (11¾-14x6¾-7x 3½-4¾") Portland-rich Mortar	NE-SW Wall. Internal face of Wall 5.	174
7	Block	0.2	0.35	2.59	Granite Block 2590x355x200mm (103x14x8") Portland-rich Mortar	NE-SW aligned threshold	174
8	Floor		3.08	8.97	Granite Setts 205x95x?mm (8x3¾x?) Portland-rich Mortar	Floor Surface with a T-shaped concrete lined central aperture of unknown function	174
9	Post	0.45			330mm (13") Diameter	Timber Post	174
10	Wall		1.8	2.18	Red/Yellow Brick 220x100x?mm (8⅝x4x?) Lime Mortar	External chimney base?	174
11	Wall	0.32	0.12	3.49	Red/Yellow Brick 220x90x70mm (8⅝x3½x2¾") Lime Mortar	NE-SW Wall butted by chimney base 10	174

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
12	Wall	0.44	0.34	4.18	Red Brick 230x100x80mm (9x4x3 $\frac{1}{8}$ "") Lime Mortar	NE-SW Wall at east of structure	174
13	Block	0.2	0.39	1.42	Green Sand Block 1420x390x200mm (56x15 $\frac{1}{4}$ x8") Lime Mortar	Threshold on the eastern edge of the structure	174
14	Floor		3	5.24	Yellow Flemish Brick 150x70x40mm (6x2 $\frac{3}{4}$ x1 $\frac{1}{2}$ "")	Bricks laid NE-SW	174
15	Gully		0.29	5.27	Yellow Flemish Brick 160x70x40mm (6 $\frac{1}{4}$ x2 $\frac{3}{4}$ x1 $\frac{1}{2}$ "")	NW-SE Floor Gully	174
16	Floor		1.7	5.29	Yellow Flemish Brick 160x70x40mm (6 $\frac{1}{4}$ x2 $\frac{3}{4}$ x1 $\frac{1}{2}$ "")	Herringbone Pattern within single brick edging	174
17	Wall		0.32	4.29	Orange/Red/ Yellow Brick 220x110x60mm (8 $\frac{5}{8}$ x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") Hard white Mortar	Dog Legged Wall, possibly part of stairwell, leading to doorway at western end of Wall 30	174
18	Wall	0.34	0.68	5.18	Red Brick 230x95x60mm (9x3 $\frac{3}{4}$ x2 $\frac{1}{2}$ "") Compact Lime Mortar	NE-SW Wall, part of outer eastern wall of structure	174
19	Floor		1.16	1.35	Yellow Flemish Brick 160x70x40mm (6 $\frac{1}{4}$ x2 $\frac{3}{4}$ x1 $\frac{1}{2}$ "")	Herringbone Pattern, butting Wall 23	174
20	Floor		0.98	1.3	Yellow Flemish Brick 155x70x40mm (6 $\frac{1}{8}$ x2 $\frac{3}{4}$ x1 $\frac{1}{2}$ "") 230x80x70mm (9x3 $\frac{1}{4}$ x2 $\frac{3}{4}$ "")	NE-SW aligned Flemish Bricks bordered by larger bricks at western edge	174
21	Wall	0.48	0.6	2.7	Red Brick 223x100x70mm (8 $\frac{3}{4}$ x4x2 $\frac{3}{4}$ "") Compact Lime Mortar	NE-SW Wall, part of eastern exterior edge. Continuation of Wall 18	174
22	Wall	0.15	0.45	2.52	Red Brick 165x100x70mm (6 $\frac{1}{2}$ x4x2 $\frac{3}{4}$ "") Compact Lime Mortar	NW-SE Wall, possible insertion between Walls 18 and 21	174
23	Wall		0.22	1.65	Red Brick 203x?x56mm (8x?x2 $\frac{1}{4}$ "") Compact Lime	NE-SW Wall, internal partition wall of structure	174

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Mortar		
24	Floor		1.32	5.18	Yellow/Red Brick 230x70x70mm (9x2 ³ / ₄ "") Compact Lime Mortar	Bricks laid on edge NE-SW	174
25	Gully		0.25	4.69	Yellow Flemish Brick 150x70x40mm (6x2 ³ / ₄ x1 ¹ / ₂ "")	NW-SE Floor Gully, incorporating drain with Iron Screen on top between floors 24 and 26/164	174
26	Floor		3.36	4.43	Yellow Flemish Brick 160x70x40mm (6 ¹ / ₄ x2 ³ / ₄ x1 ¹ / ₂ "") Compact Lime Mortar	Bricks laid on edge NE-SW. Same as 164	174
27	Wall		0.3	4	Purple/Orange Unfrosted Brick (Unable to Measure)	NW-SE Wall. Internal partition within structure	174
28	Wall		0.58	2.92	Red Brick (Unable to Measure)	NE-SW Wall. Internal partition wall within structure	174
29	Floor		1.15	2.6	Frosted Bricks 235x110x60mm (9 ¹ / ₄ x4 ¹ / ₄ x2 ³ / ₈ "")	Bottom of Stairwell formed by Wall 17	174
30	Wall		0.36	5.9	Pink/Red Brick 224x102x60mm (8 ⁷ / ₈ x4x2 ³ / ₈ "") Hard Mid Cream Lime Mortar	NW-SE Wall. Internal partition wall with a 1.2m wide doorway at western end	174
31	Wall		0.28	5.34	Pink/Red Brick 224x102x60mm (8 ⁷ / ₈ x4x2 ³ / ₈ "") Hard Mid Cream Lime Mortar	NE-SW Wall. Internal partition wall. Appears to butt Wall 35 at southern end	174
32	Hearth		0.35	0.45	Pink/Red Brick 224x102x60mm (8 ⁷ / ₈ x4x2 ³ / ₈ "") Hard Mid Cream Lime Mortar	Wall stubs on western edge of Wall 31. Possibly forming base of hearth	174
33	Wall		0.22	1.75	Yellow/Purple/ Pink Brick 120x110x60mm (4 ³ / ₄ x4 ¹ / ₄ x2 ³ / ₈ "") Hard Grey-White Mortar	NE-SW Wall. Short stretch wall possibly related to Hearth 32	174
34	Wall		0.23	6.42	Yellow Frosted Brick 220x107x60mm	NE-SW Wall. Internal partition of structure. Parallel to Wall 31.	174

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					(8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ " Grey Friable Mortar	Butts Wall 35 at southern end	
35	Wall		0.36	9.1	Purple/Orange Brick 224x102x60mm (8 ⁷ / ₈ x4x2 ³ / ₈ " Hard Mid Cream Lime Mortar	NW-SE Wall. Internal dividing wall. Butting Wall 36 to the West and Wall 12 to the East	174
36	Wall		0.52	18.04	Orange/Red/ Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ " Hard white Mortar	NE-SW Wall. Original external western wall of structure. Corresponds with original foundation footing	174
37	Wall		0.38	3.09	Pink/Yellow/Red/ Orange Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ " Cream Lime Mortar	NW-SE Wall. Internal partition wall towards the south of the structure	174
38	Wall		0.33	6.32	Mid Purple Brick 215x100x60mm (8 ¹ / ₂ x4x2 ³ / ₈ " Cream Lime Mortar	NW-SE Wall. Continues to the west as Wall 37. Internal partition wall	174
39	Wall		0.5	3.94	Pink/Red Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ " Off White Lime Mortar	NE-SW Wall. Underlying Floor 31 and a concrete floor to the east	174
40	Wall	0.07	0.33	1.5	Pink/Red Brick 210x70x70mm (8 ¹ / ₄ x2 ³ / ₄ x2 ³ / ₄ " Off White Lime Mortar	E-W Wall. Truncated to the east. Probably forming internal partition of structure	174
41	Floor				Red Brick 225x110x65mm (8 ⁷ / ₈ x 4 ¹ / ₄ x 2 ¹ / ₂ " Off White Lime Mortar	Fragmented Brick Surface.	174
42	Wall		5.1	8.76	Red Brick 210x100x50mm (8 ¹ / ₄ x4x2") Lime Mortar	Original western wall of structure. The same as Wall 163	174
43	Wall		0.4	1.51	Yellow/Red Brick 210x100x60mm (8 ¹ / ₄ x2x2 ³ / ₈ " Lime Mortar	NW-SE Wall. External to Structure 174 on the west side. Dividing Wall between Floor 44 to the north and 46/47/48 to the south. Continues to the west as Wall 45	175
44	Floor		3	5	Yellow Brick 220x60x60mm	Brick Surface. Floor of coal cellar overlain by	175

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					(8 ⁵ / ₈ x2 ³ / ₈ x2 ³ / ₈ ")	layer of in situ coal	
45			0.4	2	Yellow/Red Brick 210x100x60mm (8 ¹ / ₄ x2x2 ³ / ₈ ") Lime Mortar	NW-SE Wall. Forming northern limit of yard area. Butts Wall 50. Continues to the east as Wall 43	175
46	Floor		2.08	2.45	Flagstone 600-740x450mm Granite Setts ?	Flagstone/Granite Sett Surface. Forming part of yard surface to west of Structure 174. Sloping towards yard gully to the east	175
47	Floor		2.4	15.07	Granite Setts ?	Granite Sett Surface. Forming part of yard surface to west of Structure 174. Sloping towards yard gully to the east	175
48	Floor		2.25	10	Granite Setts Random Sized Portland-rich Mortar	Granite Sett Surface. Area of yard to the north was covered in concrete. Forming part of yard surface to west of Structure 174. Both portions slope towards central gully to the west.	175
49	Floor		1.38	4.57	Yellow Flemish Brick 160x70x45mm (6 ¹ / ₂ x2 ³ / ₄ x1 ³ / ₄ ")	Flemish Brick Surface. Internal floor structure formed by Walls 54 and 57	175
50	Wall		0.34	9.23	Red/Pink Brick 215x130x60mm (8 ¹ / ₂ x5 ¹ / ₈ x2 ³ / ₈ ") Hard Lime Mortar	NE-SW Wall. Parallel to Walls 42 and 163. Forms western wall of coal cellar (Floor 44). Probably western extension to Structure 171/174. Probably continues to north as Wall 130 and south as Wall 55/56	328
51	Wall	1.58	0.93	21.67	Yellow/Red Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Soft Lime Mortar	NE-SW/NW-SE Wall. Overlain by Wall 52. Buttress on eastern edge. Delineates area of Officers Quarters to the north and west (Building 16)	175
52	Wall		0.82	18.02	Orange/Red Brick 220x105x70mm (8 ⁵ / ₈ x4 ¹ / ₈ x2 ³ / ₄ ")	NE-SW Wall. Repair/rebuild of Wall 51. Earlier wall has	175

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Portland-rich Mortar	been re-patched with this later brick work and surmounted with new wall	
53	Void	Void	Void	Void	Void	Void	Void
54	Wall		0.3	8.35 NW - SE	Pink/Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Hard White Lime Mortar	Wall enclosing Flemish Brick Floor 49. Same as 57	175
55	Wall	0.8	0.45	10.83	Red Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Off White Lime Mortar	NE-SW Substantial Wall. Forms part of eastern wall of Structure 328. Continuation of 50 and 56 to the north. Forms western edge of outer yard to the west of Structure 174	328
56	Wall	0.16	0.39	1.6	Yellow/Red Frogged and Unfrogged Brick 220x95x50mm (8 ⁵ / ₈ x3 ³ / ₄ x2") Portland-rich Mortar	NE-SW Wall. Rebuilt portion of wall between Wall 50 and 55	328
57	Wall				Pink/Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Hard White Lime Mortar	Wall enclosing Flemish Brick Floor 49. Same As 54	175
58	Wall		0.26	1.81	Yellow/Red Brick 220x100x55mm (8 ⁵ / ₈ x4x2 ¹ / ₈ ") Lime Mortar	NE-SW Wall. Spur wall for a doorway. Connects Wall 60 to the north , Walls 54 and 57 to the south	177/328
59	Floor		1.53	2.3	Yellow/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ ") Unmortared	Brick Surface. Possible cellar?	177/328
60	Wall		0.33-0.45	23.42	Yellow/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ ") Off White Lime Mortar	NW-SE Wall. Main southern wall of structure	177/328
61	Wall	0.25	0.22	2.46	Yellow/Red Brick 230x110x60mm (9x4 ¹ / ₄ x2 ³ / ₈ ") Off White Lime Mortar	NE-SW Wall. Encloses the room containing Floor 59 with 58 to the east and 60 to the north	177/328
62	Wall		0.23	1.2	Yellow/Red Brick 230x110x60mm (9x4 ¹ / ₄ x2 ³ / ₈ ")	NW-SW Wall. Short length of wall bonded to the west side of Wall 61	177/328

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Off White Lime Mortar		
63	Service	0.14	0.4	11.98	Red Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Off White Lime Mortar	NW-SE Culvert/Drain. Parallel to and to the north of Wall 60	328
64	Wall		0.4	1.3	Red Brick 240x110x70mm (9 ¹ / ₂ x4 ¹ / ₄ x2 ³ / ₄ ") Hard Off White Lime Mortar	NE-SW Wall. Additional wall built to house water pipe	328
65	Service		0.7	2.4	Red/Purple Brick 210x100x70mm (8 ¹ / ₄ x4x2 ³ / ₄ ") Beige Lime Mortar	Culvert recorded at western edge of L.O.E. Block 16	328
66	Service		0.29-0.85	4.4	Yellow/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ ") Off White Lime Mortar	Snaking Drain within structure	328
67	Wall		0.26-0.60	7.06 NW-SE 2.55 NE-SW	Yellow/Red Brick 220x120x70mm (8 ⁵ / ₈ x4 ³ / ₄ x2 ³ / ₄ ") Lime Mortar	Rectangular internal partition in NE corner of structure	178/328
68			0.33	0.51	Yellow/Red Brick 220x120x70mm (8 ⁵ / ₈ x4 ³ / ₄ x2 ³ / ₄ ") Lime Mortar	Internal partition within room formed by Wall 67	178/328
69	Wall	2	0.28-0.8	31.24	Yellow/Red Brick 220x110x70mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₄ ") White Wash (on southern face)	NW-SE Wall. Coursing of wall 10-20° from horizontal with scars of former partitions visible on northern face	178/328
70	Wall	1	0.32	3.39	Yellow Brick 220x100x70mm (8 ⁵ / ₈ x4x2 ³ / ₄ ") Portland-rich Mortar	NE-SW Wall. Fairly modern brick wall with return to NW as Wall 76	178
71	Wall		0.36	7.72+ 2.38+ 10.37	Yellow Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ ") Unpointed White Lime Mortar	Dog-legged Wall. North of and parallel to Structure 328	178
72	Brick Pads	0.3	0.23	0.34	Red Brick 220x110x70mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₄ ") Off White Lime Mortar	Foundation Pads. Use unknown	328
73	Struct		17.9	68.94	Yellow Brick 230x70x100mm	Large rectangular building. Building 15:	184

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					(9x2¾x4") Hard Off White Lime Mortar	Pattern Room and Stores. Appearing in map regressions 1867-1952. Stepped foundation sat on concrete footing	
74	Floor	0.07	1.86	1.93	"Chocolate Block" 100x100x70mm (4x4x2¾") Portland-rich Mortar	Blocked floor between Walls 28 and 30	174
75	Wall	0.09	0.5	0.75	Red Brick 220x110x60mm (8⅝x4¼x2⅜") Hard White Lime Mortar	Wall Foundation?	328
76	Wall		0.26	5.67	Yellow Brick 230x110x70mm (9x4¼x2¾") Portland-rich Mortar	NW-SE Wall. Western return of Wall 70	178
77	Wall		1.14	1.76	Yellow/Orange Frogged Brick 220x110x60mm (8⅝x4¼x2⅜") Hard White Lime Mortar	Small internal partition/alcove	178/328
78	Wall		0.45	4.04	Orange/Red Brick Degraded	NE-SW Wall. Forming western external wall of structure	178/328
79	Service		0.47	2.97	Pinkish/Yellow Frogged Brick 210x110x60 (8¼x4¼x2⅜") Friable Cream Lime Mortar	NW-SE probable Drain butting north side of Wall 69	178
80	Wall		0.25	1.8	Yellow Frogged Brick 220x110x? (8⅝x4¼x?) Yellowish Lime Mortar	NW-SE Wall. Partition wall?	178
81	Wall	0.25	0.33-0.56	176+ 2.18+ 1.44	Yellow Frogged Brick 210x110x60mm (8¼x4¼x2⅜") Cream Lime Mortar	Internal L-Shaped partition	178
82	Structure		2.5	3.5	Brown/Red Brick 220x110x60mm (8⅝x4¼x2⅜") Off White Lime Mortar	Walls forming room encasing Floor 83	178

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
83	Floor		1.78	2.92	Yellow Frogged Brick 220x90x60mm (8 ⁵ / ₈ x3 ¹ / ₂ x2 ³ / ₈ ") Unbonded	Brick Surface encased by Wall 82	178
84	Wall	0.63	0.3	3.87	Yellow Frogged Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Lime Mortar	NE-SW Wall. Bonded to Wall 112 at northern limit	178
85	Wall	0.18	0.56	2.73	Orange/Purple Frogged Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Hard White Lime Mortar	NE-SW Wall. Continuing alignment of Wall 78 to the south	178
86	Wall	0.16	0.8	6.1	Orange/Purple Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") White Lime Mortar	NE-SW Wall. Wall heading north on the western edge of Wall 69. Faced by Wall 113 to western edge	178
87	Service		1.6	1.95	Red/Pink Frogged Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Portland-rich Mortar	Man Hole	
88	Footing	0.13	0.63	2.01	Purple Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Yellowish Lime Mortar	Foundation	180
89	Walls		0.70-0.98	4.96-5.75	Purple Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Yellowish Lime Mortar	Internal Partition Walls. Part of Structure 180	180
90	Floor		6.72	7.63	Flagstone ≤870x640x40mm	Flagstone Surface within Possible Kitchen 327.	180
91	Wall		0.24	3.9	Yellow/Red Brick 230x110x70mm (9x4 ¹ / ₄ x2 ³ / ₄ ") Lime Mortar	NW-SE Wall. Internal dividing wall. Room blackened through use	178/180
92	Wall		0.21-0.72	4.30+6.6	Yellow/Red Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Off White Lime Mortar	Wall of Possible Kitchen 327, part of Structure 180	180
93	Hearth		0.63	1.13	Sandstone/Red/Yellow Brick	Fireplace set within Wall 108. Consisting of	180

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					230x120x80mm (9x4 ³ / ₈ x3 ¹ / ₈ ")	Sandstone hearth overlain/replaced by later bricks.	
94		0.06	0.65	1.5	Flagstone 1500x650x60mm	Flagstone fronting Hearth 93	180
95	Hearth	0.25	0.7	2.5	Yellow/Red Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Off White Lime Mortar	Fireplace set within Wall 89	180
96	Slab	0.09	0.45	0.62	Purbeck Marble? 620x450x90mm	Purbeck Marble? Slab of unknown use. Butts southern side of Drain 97	
97	Service		1.05	1.3	Yellow Frogged Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ ") Hard Grey White Lime Mortar	Drain/Manhole	
98	Wall		0.40-0.9	9.09	Orange/Pink/Red Brick 230x100x60mm (9x4x2 ³ / ₈ ") Off White Lime Mortar	NE-SW Wall. Western wall of Structure 179. May have linked to Wall 85 to the south	179
99	Service		0.4	1.42	Yellow/Red Brick 150x100x60mm (6x4x2 ³ / ₈ ") Grey White Lime Mortar	Curving Drain	178
100	Floor		0.72	1.84	Yellow/Red/Purple Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Beige White Lime Mortar	Brick Surface with concrete resurfacing. Presence of coal dust indicates use as coal store in both phases of use.	179
101	Floor		2.58	2.62	Yellow/Red/Purple Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ ") Beige White Lime Mortar	Floor of a probable coal store	179
102	Walls		0.27-0.46	3.16+3.4	Red Brick 230x100x60mm (9x4x2 ³ / ₈ ") Off White Lime Mortar	Outer wall surrounding Floor 101. Probable coal store combined with Wall 98	179
103	Wall		0.42+0.	1.68+1.4	Orange/Red Brick	Fairly modern wall with	179

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
			58	2	230x100x80mm (9x4x3 $\frac{1}{8}$ "") Portland-rich Mortar	Portland-rich renders on internal faces	
104	Wall	1.3	0.39	6.23	Orange/Red Brick 230x100x60mm (9x4x2 $\frac{3}{8}$ "") Off White Lime Mortar	NW-SE Wall. Southern wall of structure	179
105	Service		0.3	1.12	Yellow Brick 220x100x60mm (8 $\frac{5}{8}$ x4x2 $\frac{3}{8}$ "") Off White Lime Mortar	Remains of Drain?	179
106	Wall	0.6	0.66	3.16	Purple Brick 220x110x60mm (8 $\frac{5}{8}$ x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") Hard Lime Mortar	NE-SW Wall. Eastern element of structure	179
107	Service	0.5	1.4	2	Yellow Brick 220x110x60mm (8 $\frac{5}{8}$ x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") Portland-rich Mortar	Fairly modern culvert that appears to truncate south east corner of Structure 179	
108	Wall		0.5-0.6	4.75+ 4.85	Purple/Orange Brick 220x110x60mm (8 $\frac{5}{8}$ x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") Yellowish Lime Mortar	Part of structure. Incorporating Fireplace 93	180
109	Floor		1.12	2.24	Soft Yellowish Mortar	Lime mortar surface	180
110	Wall		0.23	1.87	Brown/Purple Brick 220x100x65mm (8 $\frac{5}{8}$ x4x2 $\frac{1}{2}$ "") Off White Lime Mortar	NW-SE Wall. Partition wall	180
111	Wall		0.23	3.45	Purple Brick 220x100x60mm (8 $\frac{5}{8}$ x4x2 $\frac{3}{8}$ "") Yellow Lime Mortar	NW-SE Wall. Partition wall	180
112	Wall	0.9	0.36	7.57	Purple/Yellow Frogged Brick 230x100x60mm (9x4x2 $\frac{3}{8}$ "") Cream Lime Mortar	NW-SE Wall. Northern most wall of structure	178
113	Wall		0.23	5.27	Yellow Frogged Brick 220x110x60mm (8 $\frac{5}{8}$ x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") Yellowish Lime Mortar	NE-SW Wall	178

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
114	Service		0.4-0.89	13.73	Yellow/Red Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Off White Lime Mortar	NW-SE Culvert. Truncating structure	176
115	Struct		1.88	2.05	Yellow Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Portland-rich Mortar	Aperture and Floor	176
116	Walls		1.17	2.67	Yellow/Pink/Brown Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") White Lime Mortar	Probable chimney base	176
117	Service		0.92	1.2	Yellow/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Grey Lime Mortar	Main NE-SW Culvert/Culvert intersection	176
118	Service		0.34	0.9	Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Beige Lime Mortar	Small N-S Culvert	176
119	Walls		10.59	21.35	Orange/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Hard Lime Mortar	Foundation Walls of southern portion of Building 16 . Circa 1845?	176
120	Wall	1.2	0.47	4.06	Purple/Orange/Red Frosted Brick 210x110x60mm (8 ¹ / ₄ x4 ¹ / ₄ x2 ³ / ₈ "") Grey White Lime Mortar	NW-SE Wall at northern edge of Block 44	
121	Walls		1.92	3.36	Orange/Red Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ "") Grey Lime Mortar	Rectangular Brick Structure at northern edge of Block 44	
122	Struct		1.54 Exter Diam 1.10 Intern Diam		Red Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈ "") Grey White Lime Mortar	Well	
123	Wall	0.4	0.55	2.06	Orange/Purple/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Unpointed Beige Lime Mortar	N-S Wall abutted by Well 122	
124	Wall	0.4	0.6	5.81	Orange/Purple/	NW-SE Wall	171

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Red Brick 230x110x65mm (9x4¼x2½") Whiteish Lime Mortar		
125	Wall	0.2	0.45	2.84	Yellow/Red Brick 223x110x60mm (8¾x4¼x2¾") Beige White Lime Mortar	NE-SW Wall	171
126	Wall	0.6	0.35	4.9	Yellow/Red Brick 210x110x60mm (8¼x4¼x2¾") Beige White Lime Mortar	NW-SE Wall. Continuation of Wall 124	171
127	Wall		0.5	7.22+0.85	Yellow/Red Brick 220x100x70mm (8⅝x4x2¾") Creamy White Lime Mortar	NW-SE Wall	171
128	Floor		0.95	1.6		Flagstone Surface	171
129	Walls		1.08	1.84	Yellow/Purple/Red Brick 220x110x60mm (8⅝x4¼x2¾") Off White Lime Mortar	Fire surround	171
130	Walls		5.64	8.53+4.57	Yellow/Red Brick 220x110x65mm (8⅝x4¼x2½") Creamy White Lime Mortar	Inner room of structure. With entrance in NW corner and rendered inner face	171
131	Floor		2.05	6.58	Granite Sett 170x120x?mm (6¾x4¾x?)	Granite Sett Surface. Partially overlain by concrete. Between Walls 126 and 160	171
132	Floor		0.86	2.9	Granite Sett 190x120x?mm (7½x4¾x?)	Granite Sett Surface. Partially overlain by concrete. Between Walls 130 and 160	171
133	Floor		0.13	0.75	Granite Sett 180x130x145mm (7⅞x5⅞x5¾")	Granite Sett Surface north of Fireplace 134	171
134	Walls	0.15	0.72	1.22	Yellow/Red Brick 230x110x70mm (9x4¼x2¾") Lime Mortar	Fire surround butting Wall 135	171
135	Wall	0.31	0.23	10.86	Yellow Brick 230x115x70mm (9x4½x2¾")	NE-SW Wall at western edge of structure	171

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Lime Mortar		
136	Wall	0.31	0.46	3.25	Red Brick 230x100x70mm (9x4x2 ³ / ₄) Lime Mortar	NW-SE Wall parallel to and south of Wall 124	171
137	Wall		1.2	3.75	Yellow Frogged Brick 230x110x70mm (9x4 ¹ / ₄ x2 ³ / ₄) Beige White Lime Mortar	Toilet Block	171
138	Wall		0.37	0.96	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x4 ¹ / ₈ x2 ³ / ₄) Grey White Lime Mortar	NE-SW Wall. Internal partition wall	171
139	Service	0.7	0.37	1.92	Yellow/Red Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂) Lime Mortar	Curvilinear Drain	171
140	Floor		3.16	3.93	"Chocolate Block" 100x100x70mm (4x4x2 ³ / ₄) Portland-rich Mortar	Blocked floor sloping to drain. Partially overlain with concrete	171
141	Wall		0.46	4.2	Orange/Purple/Red/ Yellow Brick 210x100x60mm (8 ¹ / ₄ x4x2 ³ / ₈) Beige Lime Mortar	NW-SE Internal Wall	171
142	Wall	0.1	2.15	2.24	Yellow/Red Brick 215x100x60mm (8 ¹ / ₂ x4x2 ³ / ₈) Creamy White Lime Mortar	One course of NE-SW Partition Wall	171
143	Wall	0.06	0.22	0.6	Yellow Brick 220x100x60mm (8 ⁵ / ₈ x4x2 ³ / ₈) Portland-rich Mortar	Small NE-SW Partition Wall	171
144	Wall		0.23	1	Yellow Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂) Portland-rich Mortar	Small NW-SE Internal Partition Wall	171
145	Floor	0.07	0.82	1.28	Yellow/Red Brick 230x110x70mm (9x4 ¹ / ₄ x2 ³ / ₄) Unmortared	Fireplace	171
146	Floor		2.31	4.46	Concrete	Concrete Surface	171
147	Floor		5.06	5.87	Flagstone	Surface	171
148	Floor		1.06	1.39	Concrete	Surface of toilet cubicle	171

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
149	Wall		0.27	2.47+4.07	Yellow/Red Brick 210x100x65mm (8¼x4x2½") Creamy White Lime Mortar	L-Shaped Internal Partition Wall	171
150	Wall		0.28	8.87	Yellow/Red Brick 210x105x65mm (8¼x4½x2½") Lime Mortar	NW-SE Internal Partition Wall	171
151	Wall		7.9	14.08	Orange/Red/Purple Brick 220x100x60mm (8⅝x4x2⅜") Creamy White Lime Mortar	Load Bearing Wall	171
152	Floor	0.01	0.5	0.98	Black/Yellow Tiles 150x100x75mm (5⅞x4x3") Red Brick 105x105x10mm (4⅛x4¼x⅜")	Probable Hearth	171
153	Floor		4.07+4.97	5.5	Concrete	Concrete Surface	171
154	Floor		0.77	1.61	Concrete	Concrete Surface	171
155	Floor		1.5	6.8	Concrete	Concrete Surface	171
156	Floor		3.25	6.4	Concrete	Concrete Surface	171
157	Floor		3.11	5.42	Concrete	Concrete Surface	171
158	Floor		3.04	4.57	Concrete	Concrete Surface	171
159	Floor		0.38	1.3	Yellow Tile 150x80x10mm (5⅞x3⅛x⅜") Grouted	Remnants of Tiled Surface. Overlaying Floor 156	171
160	Wall		1.02	5.05	Yellow Sand Ashlar Block 1012x320x?mm (39¾x12½x?) Yellow/Purple Frosted Brick 220x110x60mm (8⅝x4¼x2⅜") Creamy Lime Mortar	Possibly earlier entrance way/portico to Building 16?	171
161	Floor		0.95	1.55	Concrete	Concrete Surface	171
162	Wall	0.6	0.35	2	Yellow/Red Brick 220x100x60mm (8⅝x4x2⅜") Lime Mortar	NE-SW Wall at the north of the structure	171
163	Wall		5.1	8.76	Red Brick 210x100x50mm (8¼x4x2")	Original western wall of structure. The same as Wall 42	174

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Lime Mortar		
164	Floor		3.36	4.43	Yellow Flemish Brick 160x70x40mm (6¼x2¾x1½") Compact Lime Mortar	Bricks laid on edge NE-SW. Same as 26	171
165	Wall		0.22	1.6	Purple/Yellow Brick 220x110x60mm (8⅝x4¼x2⅜") Cream Lime Mortar	NE-SW Internal Partition Wall	174
166	Wall		0.23	1.63	Yellow/Red Frogged Brick 220x110x60mm (8⅝x4¼x2⅜") Yellow Lime Mortar	NW-SE Internal Partition Wall	171
167	Wall		0.49	5.71	Sandstone Blocks 1270x450x40mm (50x17¾x1½") Yellow/Red Brick 220x100x65mm (8⅝x4x2½") Creamy White Lime Mortar	NE-SW Wall. External eastern edge of structure with sandstone detailing	171
168	Floor		2.45	7.88	Tarmac?	Tarmac like Surface	171
169	Floor		0.9	1.26	Yellow/Red Brick 215x100x60mm (8½x4x2⅜") Unmortared	Brick Surface	171
170	Floor	0.1	0.7	2.1	Granite Setts 280x130x100mm (11x5⅛x4") Unmortared	Granite Sett Surface	171
171	Group					Northern part of Building 16. Incorporates 124 - 172	
172	Floor		3.91	5.12	Yellow/Red Flemish Brick 150x70x40mm (5⅞x2¾x1½") Grey Lime Mortar	Flemish Brick Surface sloping towards drain in the NW	171
173	Wall	0.18	0.45	1.8	Yellow/Red/Purple Frogged Brick No dimensions Off White Lime Mortar	NE-SW Wall. Internal partition wall of structure	328
174	Group					Southern upper portion of Building 16. Observed in Blocks 15 and 16. Incorporates 5 – 42, 163/165	

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
175	Group					Number allocated to coal store and yard area to the west of Group 174. Incorporates 43 - 57	
176	Group					Lower level of foundations and culverts of Group 174. Incorporates 114-119/233-238. Circa 1818?	
177	Group					Collection of Walls etc to the south of Group 328. Incorporates 58 - 62	
178	Group					E-W Orientated series of Walls etc at north of Group 328. Incorporates 67 - 71/76 - 86/91/99/112-113. Poss 75	
179	Group					Group of structures in Blocks 43 and 44. Incorporates 98/100 - 105	
180	Group					Associated structures in the NW corner of site, Block 44. Incorporates 1-5/88 - 95/108 - 111	
181	Walls		3.53	8.25+ 9.47	Red Froged Brick 225x110x70mm (8 ⁵ / ₈ x 4 ¹ / ₈ x 2 ³ / ₄ ") Portland-rich Mortar	Fairly modern, semi-basemented room abutting north side of Structure 73	184
182	Floor		3	8.64	Concrete	Concrete Surface	184
183	Service			62.12	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x 4 ¹ / ₈ x 2 ³ / ₄ ") Grey Lime Mortar	Settling tank?	184
184	Group					Group given to Structures 73/181 - 183	
185	Service		0.63	3.66	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x 4 ¹ / ₈ x 2 ³ / ₄ ") Grey White Lime Mortar	NE-SW Culvert	
186	Service		3.47	16	Red/Purple Froged Brick 220x105x70mm (8 ⁵ / ₈ x 4 ¹ / ₈ x 2 ³ / ₄ ") Grey White Lime	Settling tank?	

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Mortar		
187	Service		0.97	5.95	Yellow/Red/Purple Frogged Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Grey White Lime Mortar	Curvilinear Culvert	
188	Service		0.41	1.39	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x4 ¹ / ₈ x2 ³ / ₄ ") Grey White Lime Mortar	Culvert	
189	Service		0.61	8.4	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x4 ¹ / ₈ x2 ³ / ₄ ") Grey White Lime Mortar	N-S Culvert	
190			7.92+8.27	34.81	Yellow Frogged Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ ") Yellow Grey Lime Mortar	Eastern most of Buildings numbered as '15'. Pattern room and stores within WSI	
191	Service		0.91	5.06	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x4 ¹ / ₈ x2 ³ / ₄ ") Grey White Lime Mortar	N-S Culvert going into 186	
192	Service		0.76+0.98	6.42	Yellow/Red Brick 220x105x70mm (8 ⁵ / ₈ x4 ¹ / ₈ x2 ³ / ₄ ") Grey White Lime Mortar	NE- SW Culvert going into 186	
193	Wall	0.3	0.56	12.62	Yellow/Orange/Red Brick 230x110x65mm (9x4 ¹ / ₄ x2 ¹ / ₂ ") Cream Lime Mortar	E-W main Wall	331
194	Wall	0.08	0.25	1.98	Yellow/Red Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ ") Cream Lime Mortar	E-W Partition Wall. Possibly later addition	331
195	Wall	0.15	0.48	0.48	Yellow Brick 240x100x65mm (9 ¹ / ₂ x4x2 ¹ / ₂ ") White Lime Mortar	N-S Wall	331
196	Wall	0.28	0.68	2.1	Yellow/Red/Purple 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ ") Cream Lime Mortar	N-S Wall	331

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
197	Service		0.46	15	Red Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") White Lime Mortar	NW-SE Culvert	331
198	Service	0.38	0.44	4.7	Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Grey White Lime Mortar	Drain	331
199	Wall	0.18	0.24	1.45	Yellow Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Cream Lime Mortar	E-W Wall. Possibly associated with surrounding drains	331
200	Wall	0.19	0.45	2.1	Yellow/Red Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Grey White Lime Mortar	E-W Wall	331
201	Walls		0.24	0.92+ 1.24	Yellow Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Grey White Lime Mortar	L-Shaped Wall. Possibly formed part of drain/manhole	331
202	Wall	0.28	0.42	2.75	Yellow/Orange Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") White Lime Mortar	N-S Wall. Internal Partition Wall	331
203	Wall	0.16	0.43	2.2	Yellow/Red Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Cream White Lime Mortar	N-S Wall. Internal Partition Wall	331
204	Wall	0.18	0.23	2.07	Yellow/Purple/ Orange Brick 230x110x70mm (9x4 ¹ / ₄ x2 ³ / ₄ "") Cream Lime Mortar	E-W Wall. Abutting Wall 196 at eastern end	331
205	Floor	0.23	0.35	2.2	Granite Setts 220-230x170- 220x120mm (8 ⁵ / ₈ -9x6 ³ / ₄ -8 ⁵ / ₈ x4 ³ / ₄ "") Unmortared	Granite Setts, originally part of a larger surface	Utilities Trench
206	Wall	0.23	0.14	7	Yellow/Red Brick 210x?x70mm (8 ¹ / ₄ x?x2 ³ / ₄ "") Cream Lime Mortar	NW-SE Wall	Utilities Trench
207	Wall	0.23	0.24	2	Orange/Yellow Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Grey White Lime	Curvilinear Brick Wall	Utilities Trench

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Mortar		
208	Wall	0.21	0.17	2	Orange/Yellow Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Cream Grey Lime Mortar	NW-SE Wall. Continuation of Wall 206?	Utilities Trench
209	Wall	0.18	0.22	2.6	Yellow/Red Brick 210x100x65mm (8 ¹ / ₄ x4x2 ¹ / ₂ "") Grey White Lime Mortar	NW-SE Wall. Short length of partition wall?	Utilities Trench
210	Tank	0.3	1.05	2.15	Cast Iron	Water Tank	Utilities Trench
211	Wall	0.48	0.44	2.1	Orange/Yellow Brick 220x110x70mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₄ "") Yellow/Cream Lime Mortar	NW-SE Partition Wall	Utilities Trench
212	Wall	0.66	0.52	1.15	Yellow Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Grey White Lime Mortar	NW-SE Wall	Utilities Trench
213	Wall	0.3	0.8	0.8	Yellow/Red/Purple Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Cream Lime Mortar	NW-SE Wall	Utilities Trench
214	Wall	0.55	0.23	6.3	Yellow/Orange Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Cream Brown Lime Mortar	NW-SE Wall. Possible continuation of Wall 212	Utilities Trench
215	Service	0.3	1.5	6.9	Yellow/Orange Brick 220-240x100-120x55-65mm (8 ⁵ / ₈ -9 ¹ / ₂ x4-4 ³ / ₄ x2 ¹ / ₄ -2 ¹ / ₂ "") Brown White Lime Mortar	NE-SW Flue	Utilities Trench
216	Wall	0.7	0.46	2.9	Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Cream Portland-rich Mortar	NW-SE Wall/Buttress?	Utilities Trench
217	Wall	0.7	1.2	2.2	Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Grey Portland-rich Mortar	NE-SW Buttress/Wall?	Utilities Trench

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
218	Wall	0.45	0.4+0.91	4.64	Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Grey Cream Portland-rich Mortar	NW-SE Wall	Utilities Trench
219	Wall	0.6	0.22	3.05	Pink/Red Brick 205x102x60mm (8x4x2 ³ / ₈ "") Grey Portland-rich Mortar	NW-SE Wall	Utilities Trench
220	Wall		0.52	2.12	Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Grey Cream Portland-rich Mortar	NW-SE Wall	Utilities Trench
221	Wall		0.26	1.09	Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Grey Cream Portland-rich Mortar	NW-SE Wall	Utilities Trench
222	Wall		0.62-0.88	1.7	Yellow Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Grey Cream Portland-rich Mortar	NW-SW Wall	Utilities Trench
223	Service	0.15	0.98	1.2	Yellow/Red Frogged Brick 238x110x70mm (9 ¹ / ₂ x4 ¹ / ₄ x2 ³ / ₄ "") Portland-rich Mortar	Manhole	Utilities Trench
224	Service	0.15	1.23	1.3	Yellow/Red Frogged Brick 222x110x70mm (8 ³ / ₄ x4 ¹ / ₄ x2 ³ / ₄ "") Portland-rich Mortar	Manhole	Utilities Trench
225	Wall	0.88	0.21	0.12	Yellow Frogged Brick 216x102x70mm (8 ¹ / ₂ x4x2 ³ / ₄ "") Portland-rich Mortar	NE-SW Wall	Utilities Trench
226	Wall	0.6	0.46	9.37	Yellow Frogged Brick 238x110x70mm (9 ¹ / ₂ x4 ¹ / ₄ x2 ³ / ₄ "") Lime Mortar	NW-SE Wall	Utilities Trench
227	Wall	0.52	0.23-0.96	7.36+12.18	Yellow Frogged Brick 238x110x70mm (9 ¹ / ₂ x4 ¹ / ₄ x2 ³ / ₄ "")	NW-SE Wall. Wall abutted on south face by Wall 228	Utilities Trench

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Lime Mortar		
228	Wall	0.43	1.16	1.32+ 10.19	Red Frogged Brick 222x102x65mm (8 ³ / ₄ x4x2 ¹ / ₂ "") Portland-rich Mortar	NW-SE Wall. Butts the south side of Wall 227	Utilities Trench
229	Wall		0.23	0.58+ 1.33	Yellow/Purple Brick 220x100x65mm (8 ⁵ / ₈ x4x2 ¹ / ₂ "") Cream Lime Mortar	L-Shaped Wall	331
230	Wall	0.69	0.1	8.37	Beige Frogged Brick 216x102x70mm (8 ¹ / ₂ x4x2 ³ / ₄ "") Portland-rich Mortar	NW-SW Wall	Utilities Trench
231	Wall	0.56	0.42- 0.62	1.32+ 3.51	Yellow Brick 230x110x70mm (9x4 ¹ / ₄ x2 ³ / ₄ "") Compact Lime Mortar	L-Shaped Wall	Utilities Trench
232	Service	0.41	0.91	3.64	Yellow Frogged Brick 240x110x70mm (9 ¹ / ₂ x4 ¹ / ₄ x2 ³ / ₄ "")	NW-SE Culvert. Eastern edge butts Wall 231	Utilities Trench
233	Walls		4.7	10.4	Orange/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Lime Mortar	Outer eastern wall of foundations to Building 16 . Extant on 1818 plan, extended by 1860-3 plan. Officers Quarters	176
234	Wall		0.58	1.9	Purple/Red Brick 220x110x65mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ¹ / ₂ "") Lime Mortar	NE-SW Wall. Western wall of foundations to Building 16 .	176
235	Wall		1.6	2.15	Yellow/Orange Brick 210x110x?m (8 ¹ / ₄ x4 ¹ / ₄ x?"") White Lime Mortar	Square structure abutting Wall 233	176
236	Floor		0.61	0.88	Yellow Frogged Brick 220x110x60mm (8 ⁵ / ₈ x4 ¹ / ₄ x2 ³ / ₈ "") Portland-rich Mortar	Surface within Wall 235	176
237	Service		0.62	1.2	Yellow/Pink/Purple Brick Not Recorded White Lime Mortar	E-W Culvert bonded with Wall 235	176
238	Wall		0.46	0.95	Yellow/Red/Purple Brick 210x80x65mm (8 ¹ / ₄ x3 ¹ / ₈ x2 ¹ / ₂ "") Lime Mortar	NE-SW Wall	176

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
239	Cut	>0.7	>2.6	>3.14		Eastern Edge of Paleochannel. Filled By 249	
240	Cut	>0.4	>2.6	>10.9		Western Unseen Edge of Paleochannel. Filled by 242 - 248/279-281	
241	Fill	>0.5				Fill of 240. Dirty natural with occasional CBM fragments. No finds	
242	Fill	>0.2				Fill of 240. Ash like backfill deposit. Pot, bone, flint and CBM retrieved	
243	Fill	>0.5				Fill of 240. Loose gravel backfill. No finds	
244	Fill	>0.4				Fill of 240. Silt, sand backfill deposit. No finds	
245	Fill	>0.08				Fill of 240. Silt, sand backfill deposit. No finds	
246	Fill	>0.5				Fill of 240. Orange/brown sand gravel. No finds	
247	Fill	>0.4				Fill of 240. Brown/yellow sand gravel. No finds	
248	Fill	>0.06				Fill of 240. Brown humic silt. No finds	
249	Fill	>0.7				Fill of 239. Dark brown silty sand. No finds	
250	Layer	0.24				Gravel Deposit Above 249. No finds	
251	Wall	0.53	0.48	57.81	Red Brick 228x114x70mm (9x4½x2¾") Lime Mortar	NW-SE Wall. Northern exterior wall of structure	332
252	Cut	0.88	14.69	2		Cut of Possible River Channel Filled By 253 - 258	Utilities Trench
253	Fill	0.47	3.39	2		Fill of 252. Mid blue grey, sandy clay. No finds	Utilities Trench
254	Fill	0.22	1.65	2		Fill of 252. Grey/yellow gravel. No finds	Utilities Trench
255	Fill	0.36	1.7	2		Fill of 252. Dark organic sand/gravel. No finds	Utilities Trench
256	Fill	0.52	3.51	2		Fill of 252. Dark orange brown, sandy silt. No finds	Utilities Trench
257	Fill	0.35	4.18	2		Fill of 252. Dark blue	Utilities

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
						grey, sandy silt. No finds	Trench
258	Fill	0.78	9.4	2		Fill of 252. Blue gray, sandy silt. No finds	Utilities Trench
259	Timber	0.12	0.14	0.9	Timber	Timber Beams	Utilities Trench
260	Wall	0.5	0.46	60.72	Red Brick 216x122x70mm (8½x4¾x2¾") Lime Mortar	NW-SE Wall. Southern exterior wall of structure	332
261	Layer	0.54	2	75.93		Backfill. No finds	Utilities Trench
262	Wall	0.31	0.74	2	Yellow/Red Brick 228x102x70mm (9x4x2¾") Portland-rich Mortar	NW-SE Wall	Utilities Trench
263	Wall	0.16	0.33		Yellow/Orange/ Pink Brick 215x?x56mm (8½x?x2¼") White Lime Mortar	Wall Foundation in utility trench	Utilities Trench
264	Wall	0.46	0.34		Yellow/Orange/ Pink Froged Brick 210x110x60mm (8¼x4¼x2⅜") White Lime	Wall in utility trench	Utilities Trench
265	Flue		0.5 Exter Diam 0.25 Inter Diam	2	Yellow/Purple Brick 210x110x60mm (8¼x4¼x2⅜") Lime Mortar	Probable Flue. Some evidence of internal scorching. Filled with 266	Utilities Trench
266	Fill	0.25	0.25	2		Fill of 265. Soot like deposit . No finds	Utilities Trench
267	Slab	0.12	0.3	1.41	Concrete	Concrete Slab	332
268	Surface	0.16	2.77	3.66	Cracked Brick Various Sizes No mortar	Cracked Brick Surface that butted Wall 251	332
269	Struct	0.7	0.79	0.96	Yellow Froged Brick 241x102x70mm (9½x4x2¾") Mid Brown Lime Mortar	Hearth? Butting southern face of Wall 260. Charcoal like fill	332
270	Struct	0.16	0.82	1.55	Yellow/Red Brick 248x110x67mm (9¾x4¼x2⅝") Mid Brown Lime Mortar	Consists of two rectangular Hearth? Structures. Butting southern face of Wall 260. Charcoal like fill	332

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
271	Struct	0.39	1.31	0.75	Yellow/Red Brick 228x80x67mm (9x3 ¹ / ₈ x2 ⁵ / ₈ ") Mid Brown Lime Mortar	Consists of two rectangular Hearths? Structures. Butting southern face of Wall 260. Charcoal like fill	332
272	Struct	0.15	0.58	0.7	Yellow Frogged Brick 235x110x70mm (9 ¹ / ₄ x4 ¹ / ₄ x2 ³ / ₄ ") Mid Brown Lime Mortar	Hearth?	332
273	Wall	0.4	0.38	3	Yellow Brick 235x108x70mm (9 ¹ / ₄ x4 ¹ / ₄ x2 ³ / ₄ ") Lime Mortar	NW-SE Wall. Buttes southern edge of Wall 274	332
274	Walls	0.32	4.49	4.73	Yellow/Red Brick 235x108x70mm (9 ¹ / ₄ x4 ¹ / ₄ x2 ³ / ₄ ") Lime Mortar	Metal working? structure	332
275	Floor		2.42	3.92	Concrete	Concrete Surface within Wall 274 and Wall 277	332
276	Wall	0.3	0.37	1	Yellow Frogged Brick 248x114x67mm (9 ³ / ₄ x4 ¹ / ₂ x2 ⁵ / ₈ ") Lime Mortar	NW-SE Wall. Butting southern edge of Wall 274	332
277	Wall	0.16	0.34+ 0.52	2.3	Yellow/Red Brick 228x102x70mm (9x4x2 ³ / ₄ ") Portland-rich Mortar	Internal Partition Wall within Wall 274	332
278	Struct				Yellow/Red Frogged Brick 234x105x?mm (9 ¹ / ₄ x4 ¹ / ₈ x?) Mid Brown Lime Mortar	Probable hearth abutting southern face of Wall 260. Charcoal like fill	332
279	Fill					Fill of 240. Brown/yellow sand gravel. No finds	
280	Fill					Fill of 240. Firm grey/brown silt, sand.	
281	Fill	>0.5				Fill of 240. Compact blue/grey, clay silt with gravel inclusions.	
282	Wall	0.6	0.58- 0.92	6.86+ 64.17	Yellow/Red Frogged Brick 228x110x70mm (9x4 ¹ / ₄ x2 ³ / ₄ ") Lime Mortar	Exterior southern wall of structure. Northern most of Building 11 structures	333
283	Hearth	0.47	1.9	2.03	Yellow/Red Brick	Industrial	333

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					228x110x70mm (9x4¼x2¾") Lime Mortar	Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	
284	Hearth	0.16	1.9	2.03	Yellow/Red Brick 228x110x70mm (9x4¼x2¾") Lime Mortar	Industrial Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	333
285	Hearth	0.55	1.9	2.03	Yellow/Red Brick 228x110x70mm (9x4¼x2¾") Lime Mortar	Industrial Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	333
286	Hearth	0.38	1.9	2.03	Yellow/Red Brick 228x110x70mm (9x4¼x2¾") Lime Mortar	Industrial Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	333
287	Wall	0.11	1.72	2.3	Red Engineering Brick 220x110x70mm (8⅝x4¼x2¾") Lime Mortar	Rectangular Cell surrounding Concrete Floor 288	333
288	Floor		1.23	1.85	Concrete	Concrete Surface within Rectangular Cell 287	333
289	Wall	0.15	1.72	2.3	Red Engineering Brick 220x110x70mm (8⅝x4¼x2¾") Lime Mortar	Rectangular Cell surrounding Concrete Floor 288	333
290	Floor		1.28	1.85	Concrete	Concrete Surface within Rectangular Cell 287	333
291	Wall	0.45	0.56	0.56	Yellow/Red Brick 216x102x70mm (8½x4x2¾") Lime Mortar	Foundation/Buttress?	333
292	Wall	0.27	0.23	2.22	Red Brick 228x102x70mm (9x4x2¾") Lime Mortar	NE-SW Wall. Springing arch wall running north from 291	333
293	Hearth	0.08	0.58	1.2	Yellow/Red Brick 228x102x70mm (9x4x2¾") Mid Brown Lime Mortar	Brick Hearth	333

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
294	Wall	0.3	0.48	0.48	Red Brick 210x102x70mm (8¼x4x2¾") Lime Mortar	NE-SW Wall	333
295	Wall	0.1	0.52	0.6	Red Brick 210x102x70mm (8¼x4x2¾") Lime Mortar	Brick Wall Foundation	333
296	Wall	0.28	0.7	0.78	Yellow/Red Brick 216x102x70mm (8½x4x2¾") Lime Mortar	NE-SW Wall abutting 287	333
297	Wall	0.9	0.72-0.92	39.1	Yellow Frogged Brick 228x108x70mm (9x4¼x2¾") Portland-rich Mortar	Large Exterior Wall of presumed engine room abutting SW Wall 282. So probable extension of Building 11 as seen on Plan dated 1867. Room formed by wall contains engine bases and a series of hearths along inner face	333
298	Block	0.38	0.48	3.36	Marble/Granite?	Marble/Granite? Block Forming probable threshold for doorway into structure	333
299	Wall	0.48	0.56	3.22	Yellow/Red Brick 228x102x70mm (9x4x2¾") Lime Mortar	NW-SE Wall abutted and extended by Wall 300 on western edge. Encompasses by building extension 297	333
300	Wall	0.4	0.66	4.05	Yellow/Red Brick 235x102x65mm (9¼x4x2½") White Lime Mortar	NW-SE Wall extension to the west of Wall 299. Encompasses by building extension 297	333
301	Wall	0.46	0.38	1.06	Red Brick 228x108x70mm (9x4¼x2¾") Lime Mortar	NW-SE Wall abutted on western edge by Wall 308	333
302	Hearth	0.62	1.9	2.03	Yellow/Red Brick 228x110x70mm (9x4¼x2¾") Lime Mortar	Industrial Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	333
303	Hearth	0.64	0.08	1.66	Yellow Brick 207-228 x108x70mm (8½-9x4¼x2¾") Portland-rich Mortar	Hearth butting the inner face of Wall 297	333

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
304	Hearth	0.51	0.08	1.58	Yellow/Red Brick 228x108x70mm (9x4¼x2¾") Portland-rich Mortar	Hearth butting the inner face of Wall 297	333
305	Hearth	0.52	0.08	1.1	Yellow/Red Brick 228x108x70mm (9x4¼x2¾") Portland-rich Mortar	Hearth butting the inner face of Wall 297	333
306	Hearth	0.51	0.08	1.67	Yellow/Red Brick 228x108x70mm (9x4¼x2¾") Portland-rich Mortar	Hearth butting the inner face of Wall 297	333
307	Hearth	0.67	0.08	1.68	Yellow/Red Brick 228x108x70mm (9x4¼x2¾") Portland-rich Mortar	Hearth butting the inner face of Wall 297	333
308	Wall	0.54	0.44	0.47	Yellow/Red Brick 216x102x70mm (8½x4x2¾") Mixture of Portland-rich and Lime Mortar	NW-SE Wall abutting western edge of Wall 301	333
309	Hearth	0.6	0.94	1.74	Yellow Brick 228x102x70mm (9x4x2¾") Portland-rich Mortar	Hearth abutting southern side of Wall 282 within structure formed by Wall 297	333
310	Plate	13mm	0.78	1.55	Steel/Wrought Iron	Manhole/inspection chamber? Over NW-SE aligned ceramic pipe running along inner face of Wall 282	333
311	Wall	0.5	0.6	2.42	Yellow/Red Frogged Brick 228x110x70mm (9x4¼x2¾") Portland-rich Mortar	NW-SE Wall within 282. May have formed southern portion of a hearth. Same construction as 312	333
312	Wall	0.36	0.6	2.42	Yellow/Red Frogged Brick 228x110x70mm (9x4¼x2¾") Portland-rich Mortar	NW-SE Wall within 282. May have formed southern portion of a hearth. Same construction as 311	333
313	Hearth	0.17	0.98	1.6	Yellow/Red Frogged Brick 228x102x70mm (9x4x2¾") Portland-rich Mortar	Possible Remains of an Industrial Hearth/Furnace?. Brick dimensions and mortar differ from known hearths	333
314	Wall	0.15			Yellow/Red Frogged Brick 228x102x70mm (9x4¼x2¾")	Series of Walls that have been encased in concrete. Interior wall of unknown function	333

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
					Portland-rich Mortar		
315	Hearth	0.28	1.9	2.03	Yellow/Red Brick 228x110x70mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{4}$ ") Lime Mortar	Industrial Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	333
316	Hearth	0.4	1.9	2.03	Yellow/Red Brick 228x110x70mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{4}$ ") Lime Mortar	Industrial Hearth/Furnace? Structures feature apsidal north wall and stoking? chute on eastern side	333
317	Wall	0.15	0.7		Yellow/Red Frogged Brick 228x102x70mm (9x4x2 $\frac{3}{4}$ ") Lime Mortar	Internal Dividing Walls in SW corner of building formed by Wall 282	333
318	Wall	0.07	0.23	0.82	Yellow Frogged Brick 228x102x70mm (9x4x2 $\frac{3}{4}$ ") Lime Mortar	NW-SE Wall. Internal partition wall within 282	333
319	Wall	0.15	0.23	0.78	Yellow Frogged Brick 228x102x70mm (9x4x2 $\frac{3}{4}$ ") Lime Mortar	NE-SW Wall. Internal partition wall within 282	333
320	Hearth?	0.15	1.2	2.1	Yellow Frogged Brick 228x102x70mm (9x4x2 $\frac{3}{4}$ ") Lime Mortar	Possible Hearth/Fireplace. Internal face of the bricks are scorched	333
321	Service	0.56	0.78	1.64	Yellow Frogged Brick 228x102x70mm (9x4x2 $\frac{3}{4}$ ") Portland-rich Mortar	Manhole structure incorporating Plate 210	333
322	Wall	0.34	0.45	0.47	Yellow Bricks 208x102x70mm (8 $\frac{1}{4}$ x4x2 $\frac{3}{4}$ ") Lime Mortar	Foundation/Buttress? Similar to 291. Abutted by Wall 323 to the north and south	333
323	Wall	0.2	0.23	2.3	Red Brick 228x102x70mm (9x4x2 $\frac{3}{4}$ ") Lime Mortar	NE-SW Wall abutting 322. Similar to 292	333
324	Cannon				Cast Iron 2972mm (117")	Cannon used as stanchion/machine base. Navy 32lb cannon	333

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
						1834 to late 1850s. Victoria Regina crest on upper face. Vent hole blocked. Muzzle cut off in decommissioning	
325	Cannon				Cast Iron 2645mm (104½")	Cannon used as stanchion/machine base. Navy 32lb cannon 1834 to late 1850s. Vent hole open. Muzzle cut off in decommissioning	333
326	Cannon				Cast Iron 2640mm (104")	Cannon used as stanchion/machine base. Navy 32lb cannon 1834 to late 1850s. Vent hole open. Muzzle cut off in decommissioning	333
327	Group					Part of structure 180. Possible kitchen area	
328	Group					Building in SW corner of site in Block 16 of unknown function. Incorporates 50/55/56/58-69/72/75/77/78/173	
329	Drain?		0.78	0.93	Yellow/Red Frogged Brick 230x105x65mm (9x4⅞x2½") Unmortared	Drain/Manhole structure abutting north side of Wall 251	332
330	Hearth		0.52	0.92	Yellow Frogged Brick 230x105x65mm (9x4⅞x2½") Mid Brown Lime Mortar	Hearth base abutting southern face of Wall 260 near the eastern limit of site. Truncated at south. Charcoal/coal ash fill	332
331	Group					Building 12/13. Works departments offices/police quarters. In Blocks 5, 6 and 23. Incorporates 193 – 204/229	
332	Group					NW-SE aligned building. Between Building 11 in WSI map. Present in Blocks 27-29. Incorporates 251/260/267-278 329/330	
333	Group					NW-SE aligned building.	

Context	Type	Depth (m)	Width (m)	Length (m)	Building Material	Comments	Part of Structure
						Numbered as northernmost of Buildings 11 on WSI. Although appears to be machine rooms rather than sheds or barracks. Contains machine bases and hearths/furnaces. Incorporates 282-326	
334	Struct	0.3	6.43	10.65	Yellow/Red Frogged Brick 228x108x60mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") White Lime Mortar	Octagonal Water Tower, 1860-1863, shown as OA 90 in DBA. Consists of three separate walls:335,336,337	
335	Wall	0.15	0.86	0.86	Yellow/Red Frogged Brick 228x108x60mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") White Lime Mortar	Central wall of structure	334
336	Wall	0.26	0.57-0.75	4.57	Yellow/Red Frogged Brick 228x108x60mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") White Lime Mortar	Inner octagonal wall of structure	334
337	Wall	0.3	0.72-1.2	10.65	Yellow/Red Frogged Brick 228x108x60mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") White Lime Mortar	Outer octagonal wall of structure	334
338	Service	0.08	1.84-2.17	2.27-2.87	Yellow/Red Frogged Brick 228x108x70mm (9x4 $\frac{1}{4}$ x2 $\frac{3}{4}$ "")	Manhole ? structure	
339	Service	0.07	0.77	1.82	Yellow/Red Frogged Brick 228x105x60mm (9x4 $\frac{1}{8}$ x2 $\frac{3}{8}$ "") Light Brown Lime Mortar	Manhole?	
340	Wall	0.5	0.56	8(NE-SW) 4(NW-SE)	Red Brick 220-225 x108x60mm (8 $\frac{3}{4}$ x4 $\frac{1}{4}$ x2 $\frac{3}{8}$ "") Whitish Lime Mortar	South Eastern quarter of 174/176. (Building 16), officers quarters	174/176

APPENDIX 2 REFERENCES

EH	2004	Royal Arsenal, Woolwich, Greenwich. Post-fieldwork reporting structure.
MOLA	2011	Crossrail Ltd. Woolwich Station – Site Specific Archaeological Written Scheme of Investigation
OA	2011	The Royal Arsenal, Woolwich. Crossrail Station Box - Site Specific Method Statement for Archaeological Fieldwork

APPENDIX 3 SUMMARY OF SITE DETAILS

Client name: Berkeley Homes Plc

Site name: The Royal Arsenal, Woolwich. Crossrail Station Box

Site code: RAW11

Grid reference: TQ 439 790

Type of investigation: Watching Brief / Strip, Map and Sample Excavation

Date and duration of project: 20th September - 16th December 2011. 13 weeks

Location of archive: The archive is currently held at OA, Janus House, Osney Mead, Oxford, OX2 0ES, and will be deposited with the Museum of London in due course.

APPENDIX 4 OASIS DATA COLLECTION FORM: ENGLAND

OASIS DATA COLLECTION FORM: England

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OASIS ID: oxfordar1-119006

Project details

Project name	Archaeological Investigations at The Royal Arsenal Woolwich. Crossrail Station Box Interim Statement
Short description of the project	During September to December 2011 Oxford Archaeology (OA) carried out a targetted watching brief and strip, map and record exercise on the excavation of a station box for a Crossrail connection at The Royal Arsenal Woolwich on behalf of Berkeley Homes plc. The remains of several buildings related to the historic development of the site as The Royal Arsenal were recorded. In addition the course of a Palaeochannel was located beneath the Officers Quarters at the western end of the site.
Project dates	Start: 20-09-2011 End: 16-12-2011
Previous/future work	Yes / Yes
Any associated project reference codes	RAW 11 - Sitecode
Any associated project reference codes	RAW 11 - Museum accession ID
Type of project	Recording project
Site status	Conservation Area
Current Land use	Other 13 - Waste ground
Monument type	PALAEOCHANNEL Palaeolithic

Monument type FOUNDATIONS Modern

Significant Finds CANNON Modern

Significant Finds CANNON BALL Modern

Significant Finds POTTERY Modern

Investigation type 'Part Excavation','Watching Brief'

Prompt Planning condition

Project location

Country England

Site location GREATER LONDON GREENWICH WOOLWICH The Royal Arsenal

Study area 1.20 Hectares

Site coordinates TQ 439 790 51.4911028413 0.07300483213140 51 29 27 N 000 04 22 E Point

Project creators

Name of Organisation Oxford Archaeology

Project brief originator MOLAA

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Project director/manager D. Score

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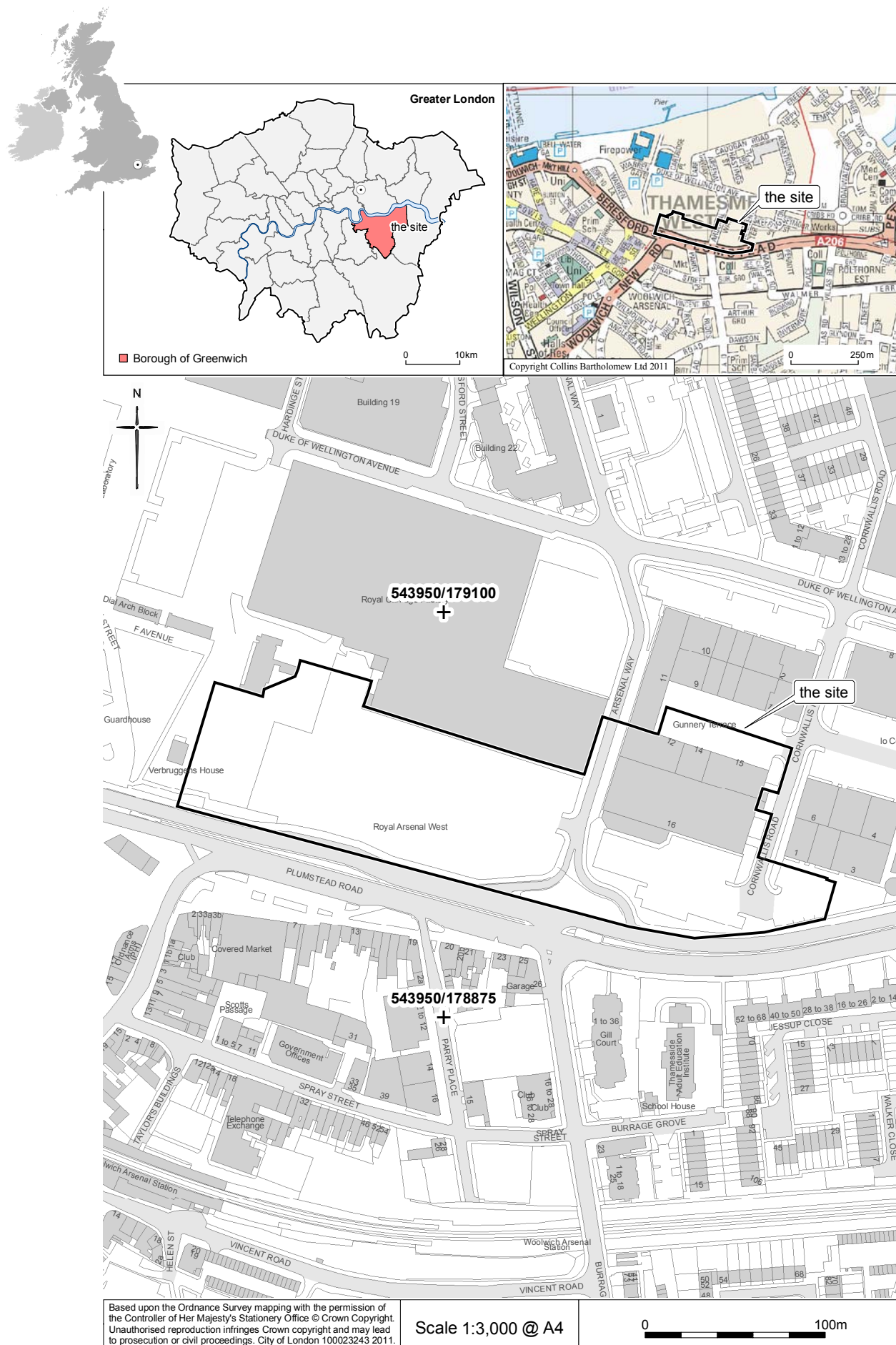


Figure 1: Site location (from SSWSI, MOLA 2011)

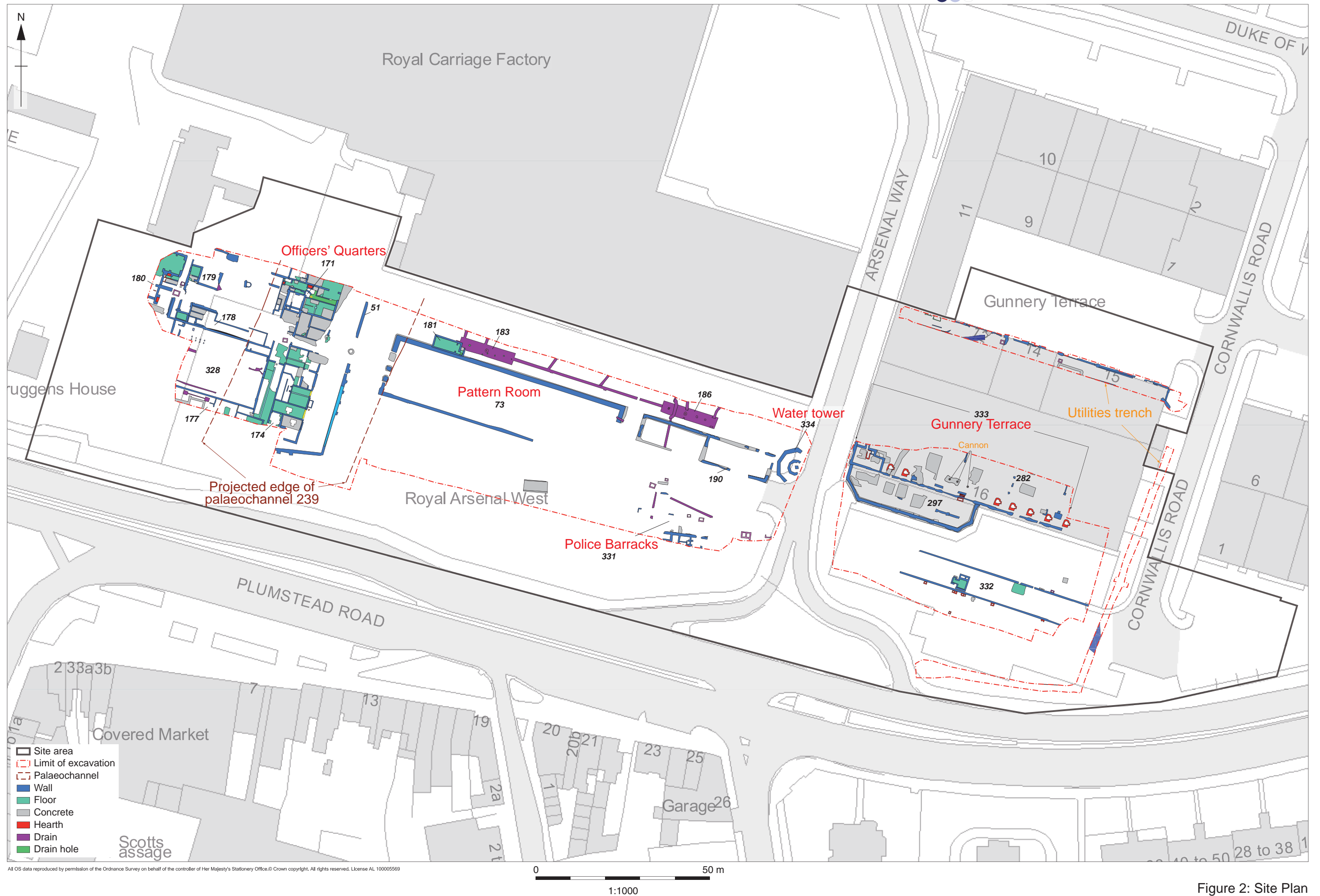


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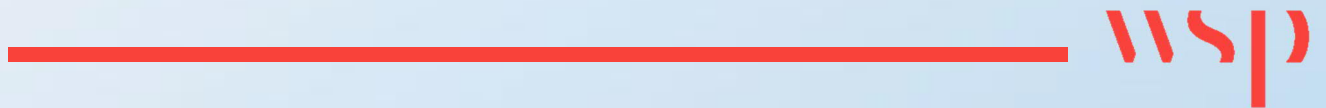
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Appendix C

PRELIMINARY ECOLOGICAL APPRAISAL





Connected Living London

ARMOURER'S COURT

PRELIMINARY ECOLOGICAL APPRAISAL



Connected Living London

ARMOURER' S COURT

PRELIMINARY ECOLOGICAL APPRAISAL

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ARMOURER' S COURT

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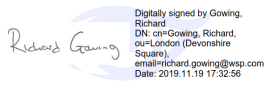
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APPENDICES

APPENDIX A

RELEVANT LEGISLATION AND PLANNING POLICY

APPENDIX B

PHOTOGRAPHS



EXECUTIVE SUMMARY

WSP was commissioned by Connected Living London to undertake a Preliminary Ecological Appraisal (PEA) of the Crossrail Over-station development (hereafter referred to as “the Site”). The PEA is to inform Environmental Impact Assessment (EIA) Scoping of the Proposed Development for ecology

The Site is situated 250m north-east of Woolwich Arsenal Docklands Light Rail (DLR) and National Rail Station and is located approximately 400m south of the River Thames. The Site is bounded by the Plumstead Road (A206) to the south, and buildings from the industrial state to the north, east and west.

The Proposed Development is for a principally residential development with non-residential ground floor space.

Habitats recorded on Site are of negligible ecological value and do not have the potential to support legally protected species. Further survey of ecological resources is not required if construction the Proposed Development occurs within two years of this survey.

No significant effects are predicted on designated nature conservation sites in the Desk Study Area as no direct or indirect impact pathways exist.

Recommendations, which are informed by guidance in the Royal Borough of Greenwich Local Plan, are made for opportunities for ecological enhancement, including the incorporation of biodiverse roofs and the installation of bat and bird boxes

1. INTRODUCTION

1.1. BACKGROUND

- 1.1.1. WSP was commissioned by Connected Living London in October 2019 to undertake a Preliminary Ecological Appraisal (PEA) of the Crossrail Over-station development ('the Site').
- 1.1.2. The Site is situated 250m north-east of Woolwich Arsenal Docklands Light Rail (DLR) and National Rail Station and is located approximately 400m south of the River Thames. The Site is bounded by the Plumstead Road (A206) to the south, and buildings from the industrial state to the north, east and west.
- 1.1.3. The Proposed Development is for a principally residential development with non-residential ground floor space. Development of the Site is expected to provide approximately 500 residential units and additional non-residential floor space in the form of five buildings surrounding a central landscaped podium.

1.2. SCOPE OF REPORT

- 1.2.1. The study set out to:
 - Provide baseline ecological information about the Site and a surrounding study area with particular reference to whether legally protected and/or notable sites, species or habitats are present or likely to be present;
 - Provide recommendations to enable compliance with relevant nature conservation legislation and planning policy; and
 - Where appropriate, to identify the need for avoidance, mitigation, compensation or enhancement measures and/or further ecological surveys.

1.3. RELEVANT LEGISLATION AND POLICY

- 1.3.1. This appraisal has been undertaken with reference to the following relevant nature conservation legislation, planning policy and the UK Biodiversity Framework from which the protection of sites, habitats and species is derived in England, additional details are presented in Appendix A.
 - The Conservation of Habitats and Species Regulations 2017 (as amended) (Habitats Regulations);
 - The Wildlife and Countryside Act 1981 (as amended) (WCA);
 - Countryside Rights of Way Act 2000;
 - The Natural Environment and Rural Communities (NERC) Act 2006 (England);
 - The Protection of Badgers Act 1992;
 - The Wild Mammals (Protection) Act 1996;
 - The UK Post-2010 Biodiversity Framework (2011-2020) (JNCC and DEFRA, 2012);
 - Biodiversity 2020: A strategy for England's wildlife and ecosystem services (DEFRA, 2011);

- UK Biodiversity Action Plan (UKBAP)¹; and
- The National Planning Policy Framework (NPPF) 2019 (Ministry of Housing Communities & Local Government, February 2019).

¹ The UK BAP has now been replaced by the UK Post-2010 Biodiversity Framework, however, it contains useful information on how to characterise important species assemblages and habitats which is still relevant.

2. METHODS

2.1. OVERVIEW

- 2.1.1. This appraisal has been prepared with reference to current good practice guidance published by the Chartered Institute for Ecology and Environmental Management (CIEEM, 2016), and Joint Nature Conservation Committee (JNCC, 2010); and guidance contained in the British Standard - Code of Practice for Biodiversity and Development BS42020:2013 (British Standards Institute (2013)).
- 2.1.2. This PEA is based on the following data sources:
- An ecological desk study; and
 - A habitat survey.

2.2. DESK STUDY

- 2.2.1. A Desk Study was undertaken on 17 October 2019 to review existing ecological baseline information available in the public domain and to obtain information held by relevant third parties. For the purpose of the Desk Study exercise, records were collated within 2km around the Site. This approach is consistent with current good practice guidance published by the CIEEM, 2013 and 2015. To provide the baseline data for the ecological desk study, the following information was requested from Greenspace Information for Greater London (GiGL):
- Records of legally protected and notable species within 2km of the Site; and
 - Records of non-statutory sites designated for nature conservation value within 2km of the Site.
- 2.2.2. Freely downloadable datasets (available from Natural England) were consulted for information regarding the presence of statutory designated habitats² within 2km of the Site. This search was extended to 10km for Natura 2000 sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) of European importance and internationally designated Ramsar sites.
- 2.2.3. Freely downloadable datasets (available from Natural England) were consulted for information regarding Habitats of Principal Importance (HPI)³ and woodland listed on the Ancient Woodland Inventory⁴ within 2km.
- 2.2.4. Open-source 1:25,000 Ordnance Survey mapping was used to identify any mapped water bodies and watercourses within 500m of the Site.
- 2.2.5. The findings of the Desk Study are provided in Section 3 of this report.

² Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) and Local Nature Reserves (LNR).

³ Mapped locations of HPI are usually not available, but HPI aligns in the most part with UKBAP habitats. Inventories of UKBAP habitat have been prepared by a variety of organisations and at a national (Natural England priority habitat inventory) and local scale (e.g. by local records centres). In some instances these are primarily based on aerial photograph analysis rather than field survey.

⁴ The ancient woodland inventory in England lists areas over two hectares in size which have been continuously wooded since at least 1600.

- 2.2.6. The Desk Study was carried out by an ecologist who has completed numerous ecological desk studies in urban and rural environments.

2.3. HABITAT SURVEY

- 2.3.1. A Phase 1 habitat survey of the Site was carried out on 17 October 2019 in moderate rain but with good visibility. The survey covered the entire Site including boundary features. The Phase 1 habitat survey was carried out by an ecologist with experience of sites containing similar habitat types and holding a Field Identification Skills Certificate Level 3 which is the standard recommended by the Botanical Society of Britain and Ireland for undertaking Phase 1 habitat surveys.
- 2.3.2. Habitats were described and mapped following the standard Phase 1 habitat survey methodology (JNCC, 2010). Phase 1 habitat survey is a standard technique for classifying and mapping British habitats. The dominant plant species are recorded and habitats are classified according to their vegetation types. Where appropriate consideration was given to whether habitats qualify, or could qualify, as HPI following habitat descriptions published by the Joint Nature Conservation Committee (JNCC, 2008).
- 2.3.3. A list of plant species was compiled (Appendix C), with relative plant species abundance estimated using the DAFOR scale⁵. The scientific names for plant species follow those in the New Flora of the British Isles 4th Edition (Stace, 2019) and are listed in Appendix C.
- 2.3.4. Habitats were marked in the field on a paper base map and subsequently digitised using a Geographical Information System (GIS).
- 2.3.5. Data collected as part of this Phase 1 habitat survey is suitable for use in retrospective biodiversity unit calculations, if required.

2.4. PROTECTED SPECIES ASSESSMENT

- 2.4.1. The suitability of the Site to support legally protected and notable species was assessed using the Desk Study results combined with field observations during the habitat survey. The assessment of habitat suitability for protected and notable species was based on professional experience and judgement. This was supplemented by standard sources of guidance on habitat suitability assessment for key faunal groups including: birds (Gilbert et al, 1998 and Bibby et al, 2000), great crested newt (Gent and Gibson, 2003 and English Nature, 2001); reptiles (Froglife, 1999 and Gent and Gibson, 2003); bats (Collins, 2016 and Mitchell-Jones, 2004); and invertebrates (Drake *et al*, 2007 and Kirby, P, 2001).

2.5. NOTES AND LIMITATIONS

- 2.5.1. The following limitations apply to this assessment:

⁵ The DAFOR scale has been used to estimate the frequency and cover of the different plant species as follows: Dominant (D) - >75% cover, Abundant (A) – 51-75% cover, Frequent (F) – 26-50% cover, Occasional (O) – 11-25% cover, Rare (R) – 1-10% cover., The term 'Locally' (L) is also used where the frequency and distribution of a species are patchy and 'Edge' (E) is also used where a species only occurs on the edge of a habitat type.

- Ecological survey data is typically valid for two years unless otherwise specified, for example if conditions are likely to change more quickly due to ecological processes or anticipated changes in management.
- Records held by local biological record centres and local recording groups are generally collected on a voluntary basis; therefore, the absence of records does not demonstrate the absence of species, it may simply indicate a gap in recording coverage.
- The survey was not completed during the optimal survey season for Phase 1 habitat survey, generally accepted to be from April-September (inclusive). Botanical surveys are seasonally limited, and throughout the spring and summer period certain species will be more or less evident at different times (i.e. depending on the flowering season). However due to the lack of semi-natural habitats on Site the vegetation present was limited to ruderal species occurring at a low density and as such the survey is considered representative.
- The extended Phase 1 habitat map (Figure 1) has been reproduced from field notes and plans. Whilst this provides a sufficient level of detail to fulfil the requirements of a PEA, the maps are not intended to provide exact locations of key habitats.

3. RESULTS

3.1. DESIGNATED SITES

STATUTORY SITES

- 3.1.1. The Desk Study identified one statutory nature conservation site within 2km of the Site boundary, and one site of European importance within 10km of the Site boundary. These sites are described in Table 1 and 2.

Table 1 - Statutory designated sites of European or International importance

Site Name	Designation	Size (ha)	Approximate Distance and orientation from Site	Description
Epping Forest	SAC	1630.74	10km north	Epping Forest is 10km north, north west from the Site and is notified for broadleaved, beech <i>Fagus sylvatica</i> woodland. It is important for a range of rare species, including the moss <i>Zygodon forsteri</i> . The Site is also supports a range of fungi and dead-wood invertebrates including stag beetle <i>Lucanus cervus</i>

Table 2 - Statutory designated sites of local to national importance

Site Name	Designation	Size (ha)	Approximate Distance and orientation from Site	Description
Maryon Wilson Park and Gilbert's Pit LNR	LNR	17.52	2km south-west	Maryon Park and Gilbert's Pit LNR is 2km south west of the Site. It contains acid grassland which supports an assemblage of burrowing bees and wasps in addition to gorse <i>Ulex</i> sp. and broom <i>Cytisus scoparius</i> scrub and secondary woodland. A small stream and associated areas of wet grassland support a number of locally rare plants, including bristle club-rush <i>Isolepis setacea</i> and bog stitchwort <i>Stellaria alsine</i> , both are noted by the citation to be rare in London.

NON-STATUTORY SITES

- 3.1.2. The Desk Study identified 16 non-statutory nature conservation sites within 2km of the Site. Non-statutory sites within the Desk Study area are classified as of Metropolitan, Borough or Local

Importance (SMI, SBI and SLI respectively). A description of SMIs within the Desk Study area and SBI and SLI within 500m of the Site is provided in Table 3 below.

Table 3 - Non-statutory designated sites

Site Name	Designation	Size (ha)	Distance and orientation from Site	Description
River Thames and tidal tributaries	SMI	2311.29	400m north	The River Thames and the tidal sections of creeks and rivers which flow into it comprise, mud-flats, shingle beach, inter-tidal vegetation, islands and river channel itself. The site is of particular importance for wildfowl and wading birds. The river walls also provide important feeding areas for black redstart. The Thames is extremely important for fish, with over 100 species now present. Barking Creek supports extensive reed beds. Further downstream are small areas of saltmarsh, a very rare habitat in London.
Plumstead Railway Cutting	SBI	2.2	190m south-east	A fairly wide railway cutting with sycamore woodland, scrub of bramble <i>Rubus fruticosus agg.</i> , regenerating elm <i>Ulmus sp.</i> and Duke of Argyll's teaplane <i>Lycium barbarum</i> and grassland dominated by false oat-grass <i>Arrhenatherum elatius</i> . There are also patches of bracken <i>Pteridium aquilinum</i> and tall herbs, mainly Canadian goldenrod <i>Solidago canadensis</i> . The cutting supports good populations of common birds, butterflies and other animals. This is part of an important green corridor, linking to The Ridgeway.
Anglesea Road Open Space & School Wildlife Garden	SLI	0.37	480m south-west	This small wooded open space with adjacent school nature garden contains a range of habitats, including a pond and associated marshy area, wildflower meadow and scrub. It is well used for environmental education.

OTHER HABITATS OF CONSERVATION IMPORTANCE

- 3.1.3. No HPI or ancient woodland are present within the Site boundary. The following HPI are present within 2km of the Site.

Table 4 - Habitats of Principal Importance

Habitats of Principal Importance	Distribution
Coastal saltmarsh	A small area (0.02ha) of habitat is present on the south bank of the River Thames adjacent to Gallions Reach development, 1.9km north-east of the Site.
Intertidal Mudflats	Intertidal mudflats line both sides of the Thames, covering a total area of 31.04ha within the Desk Study area. The nearest area of mud flat is 0.4km north of the Site.
Good quality semi-improved grassland	Greater London Authority (GLA) survey in 2002 identified 4.1ha of ' <i>possible dry acid grassland</i> ' with eight acid grassland indicator species recorded, within Charlton Cemetery (1.9km south-west of the Site).
Good quality semi-improved grassland	GLA survey in 2002 identified, ' <i>herb-rich neutral grassland</i> ' adjacent to White Hart Lane and South of Nathan Way (0.9km east of the Site). Seven indicator species for lowland meadow habitat were recorded.
Deciduous woodland	Areas of deciduous woodland are distributed throughout the Desk Study area. The nearest of which is 0.4ha adjacent to Anglesey Road (0.5km south-west of the Site).
Wood-pasture and Parkland	41.5 ha of wood-pasture and parkland is present within Plumstead Common and Woolwich Common, which are 0.8 km south-east and 1.6km south-east of the Site respectively.

3.2. HABITAT SURVEY

OVERVIEW

- 3.2.1. Three Phase 1 habitat types were identified: Buildings (J3.6) were mapped in the north and south of the Site; the remainder of the Site comprised hardstanding and/or compacted aggregate hardcore (mapped as bare ground J4). Habitats on Site are mapped on Figure 1 and are listed in Table 5 along with areas in hectares. A description of the dominant and notable species, the composition and management of each habitat is provided below, with photographs in Appendix B. Alpha-numeric codes used in this section cross-refer to the JNCC Phase 1 habitat survey classification (JNCC, 2010). The order of the habitat descriptions below is that of the Phase 1 habitat survey manual and is not an indication of importance.

Table 5 - Phase 1 habitat Areas

Phase 1 Habitat	Area (ha)
Buildings J3.6	0.25
Bare ground J4	0.19
Hardstanding	0.38
TOTAL	0.82

BUILDINGS – J3.6

- 3.2.2. Two buildings are present within the Site. In the north of the Site is a two-story temporary site office, constructed from portable cabin units. In the south of the Site is the 'Station Box', a flat-roofed building constructed from brick and steel louvres slats, which houses infrastructure associated with the Elizabeth Line (Crossrail).

BARE GROUND– J4

- 3.2.3. An area of compacted aggregate hardcore is located to the south of the Site. The vegetation present is sparse and comprises buddleia (*Buddleja Davidii*), Shepherd's purse (*Capsella bursa-pastoris*), prickly lettuce (*Lactuca serriola*) and a single plant of bird's-foot trefoil (*Lotus corniculatus*).
- 3.2.4. The following criteria are required to be met for a site to fit the definition of the HPI open mosaic on previously developed land:

- Criterion 1

The site is at least 0.25ha in size. This minimum size may be part of a much larger site containing other habitats or developed land.

- Criterion 2

Known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added.

- Criterion 3

The site contains some vegetation. This will comprise early successional communities consisting mainly of stress tolerant species (e.g. indicative of low nutrient status or drought). Early successional communities are composed of:

- a) annuals; or
- b) mosses/liverworts; or
- c) lichens; or
- d) ruderals; or
- e) inundation species; or

- f) open grassland; or
- g) flower-rich grassland; or
- h) heathland.

- Criterion 4

The site contains unvegetated, loose bare substrate and pools may be present.

- Criterion 5

The site shows spatial variation, forming a mosaic of one or more of the early successional communities plus bare substrate, within 0.25ha.

- 3.2.5. The previously developed habitat present on Site lacks spatial variation as required by Criterion 5 and the bare substrate is highly compacted as opposed to loose as described in Criterion 4. As such the habitat is not attributable to the HPI.

HARDSTANDING

Much of the Site is concrete slab hardstanding, which is free of cracks and supports no vegetation.

3.3. PROTECTED AND NOTABLE SPECIES ASSESSMENT

- 3.3.1. The suitability of the Site to support legally protected and notable species has been assessed using the results of the Desk Study combined with observations made during the survey of habitats within and immediately surrounding the Site. Desk Study records have only been considered if they are from the last 10 years and if they relate to species that may be supported by habitats at the Site. Habitats present within the Desk Study Area may be suitable for the following species; further consideration is given below to the likelihood for these species to be present within the Site:

- Amphibians (including great crested newt);
- Bats;
- Badger;
- Birds;
- Hazel dormouse;
- Reptiles; and
- Terrestrial invertebrates.

AMPHIBIANS (INCLUDING GREAT CRESTED NEWTS)

- 3.3.2. No waterbodies or habitat suitable to support amphibians is present on Site. The nearest waterbody is a water feature within the Royal Arsenal Woolwich development on Cadogan Road, 320m to the north. All waterbodies in the Desk Study area are separated from the Site by large areas of hardstanding, built development and busy urban roads.

BATS

- 3.3.3. No records of bat roosts were returned from within the Desk Study Area. Seventy-four records of bats foraging or flying were returned. These records comprised seven species of bat: common pipistrelle *Pipistrellus pipistrellus*; soprano pipistrelle *Pipistrellus pygmaeus*; Nathusius' pipistrelle *Pipistrellus nathusii*; noctule *Nyctalus noctula*; Leisler's bat *Nyctalus leisleri*; and serotine *Eptesicus serotinus*. The closest records to the Site were of common pipistrelle and noctule, all of which were

recorded approximately 63m west of the Site boundary. These were also the most recent records, dated 20 June 2018.

- 3.3.4. There are two buildings within the Site, a newly constructed station infrastructure building and a temporary Site office. Both buildings have negligible suitability to support roosting bats, due to their recent construction and lack of cavities, fissures or points of access for bats. Additionally, there are no trees on Site which provide roosting habitat for bats. The lack of natural or semi-natural habitat will limit invertebrate numbers and as such the bat foraging resource on Site is negligible.

BADGER

- 3.3.5. There is no natural or semi-natural habitat within the Site within which badgers might forage. The entire Site and immediate surroundings comprise hardstanding, or compacted hardcore, preventing the construction of setts.

BIRDS

- 3.3.6. There is no suitable vegetation on Site within which birds might nest. The lack of natural or semi-natural habitat will limit invertebrate numbers and as such the foraging resource for birds offered by the habitat on Site is negligible. One record of black redstart *Pheonicurus ochurus*, from 2005, 276m north-east of the Site, was returned by the desk study. Black redstart is adaptable to brownfield sites, although the lack of recent records and the absence of suitable habitat means that it is highly unlikely that this species currently uses the Site.

HAZEL DORMICE

- 3.3.7. The Site has been cleared of vegetation and contains no suitable habitat to support hazel dormice.

REPTILES

- 3.3.8. The Site has been cleared of vegetation and contains no suitable habitat to support reptiles.

TERRESTRIAL INVERTEBRATES

- 3.3.9. The Site has been cleared of vegetation and is comprised entirely of hard standing. The site is generally unsuitable to support terrestrial invertebrates of ecological importance. One area of hardcore substrate is present, but this appears to have been recently created and compacted prior to surfacing and is therefore unlikely to support burrowing solitary bees, wasps or other invertebrates associated with brownfield habitats⁶.

NON-NATIVE INVASIVE PLANT SPECIES

- 3.3.10. No species listed on Schedule 9 of the Wildlife and Countryside Act were recorded within the Site. Small buddleia shrubs (under 50cm) were recorded growing at a low density at the southern side of the Site. Buddleia is listed as an invasive species on the London Invasive Species List⁷.

⁶ Buglife (2012). Creating Green roofs for Invertebrates – A best Practice Guide. Peterborough: Buglife.

⁷ London Invasive Species Initiative LISI. 2014. Species of Concern. London, London Invasive Species Initiative LISI.

4. DISCUSSION AND RECOMMENDATIONS

4.1. STATUTORY AND NON-STATUTORY DESIGNATED SITES

- 4.1.1. All designated sites in the Desk Study area are outside the Site boundary and are separated from the Site boundary by an expanse of dense, urban development, roads and areas of hardstanding. There are no direct hydrological connections between the Site and any designated sites. Air quality changes arising from construction or operation of the Proposed Development will be controlled by best practice construction measures and/or will not permeate beyond the Site boundary. In Addition, the Site does not lie within a SSSI impact risk zone⁸ for residential developments.
- 4.1.2. No significant effects are predicted on designated nature conservation sites in the Desk Study area due to the lack of any direct or indirect pathway for an impact.
- 4.1.3. The Habitats Regulations provide strict protection to sites of European and/or international importance. This includes requiring projects or plans to be screened for likely significant effects upon SPA, SAC and candidate SACs (cSACs). Guidance also requires potential SPAs (pSPAs) and Ramsars are subject to the same assessment. Therefore, due to the presence of Epping Forest SAC (approximately 10 km north of the Site) the Proposed Development must be screened by the competent authority (Royal Borough of Greenwich) to determine whether significant effects are likely to result. On the basis of evidence provided in this report it is highly unlikely that there would be any likely significant effect on this SAC as it is distant from the Site, on the opposite side of the River Thames and with many kilometres of intervening dense, urban development between Site and SAC.
- 4.1.4. The Proposed Development is likely to increase the number of residents in this part of London. No resulting significant impact is anticipated on any designated site as a result on the basis of proximity of the Site from local nature conservation sites, intervening urban development and non-designated parks and an existing baseline of high recreational use. However, at the strategic level, the local authority should consider the carrying capacity of local green infrastructure to support increased numbers of people arising from all development in this part of London.

4.2. HABITATS

- 4.2.1. The majority of the Site comprises buildings or hardstanding, though a small area of compacted aggregate with a limited flora is present. The Site does not qualify as open mosaic on previously developed land HPI⁹.

⁸ Impact Risk Zones are a GIS tool developed by Natural England to make an initial assessment of the potential risks posed by development proposals to: Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. They define zones around each site which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

⁹ Riding, A., Critchley, N., Wilson, L. and Parker, J. 2010. Definition and mapping of open mosaic habitats on previously developed land: Phase 1. Defra Research Report WC0722. London, Department for Environment Food and Rural affairs.

- 4.2.2. The habitats identified within the Phase 1 habitat survey are of negligible ecological value. No negative impacts are envisaged on any Phase 1 habitat types identified in Section 3 of this PEA as these habitats are all of low nature conservation interest.

4.3. PROTECTED AND NOTABLE SPECIES

- 4.3.1. The Site does not provide suitable habitat for the protected or notable species listed in Section 3.2.

4.4. FURTHER SURVEY REQUIREMENTS

- 4.4.1. There are no ecological constraints for which further surveys are required to ensure legal and planning policy compliance. If development of the Site were to be delayed for a period of greater than two years it may be possible for sufficient coverage of buddleia to establish to support nesting birds. In such a case a re-survey of the Site to evaluate its suitability to support nesting birds should be undertaken.

4.5. PRELIMINARY AVOIDANCE, MITIGATION AND COMPENSATION MEASURES

- 4.5.1. It is assumed that best environmental practice measures will be adhered to during the construction phase to address potential sources of water and air pollution and noise and vibration, further guidance is provided in 4.4.2. There are no significant effects requiring additional mitigation. No suitable habitat for legally protected species was identified on Site and there is no requirement to provide mitigation to comply with nature conservation legislation.

ENVIRONMENTAL BEST PRACTICE

- 4.5.2. In addition, general environmental protection measures should be implemented during the construction phase of the proposed scheme. Such measures include best environmental practice guidance outlined in the Environment Agency's Pollution Prevention Advice and Guidance (Environment Agency, 2007) and those outlined by the Construction Industry Research and Information Association guidance (CIRIA, 2015). The following minimum standards should be adhered to prevent ecological impacts beyond the Site boundary:
- Measures should be taken to prevent dust and other emissions from construction affecting land beyond the Site.
 - Chemicals and fuels should be stored in secure containers located away from watercourses or water bodies. Spill kits should be available.
 - Excavations should be covered or securely fenced (with no potential access points beneath fencing) when the Site is closed (e.g. overnight) to prevent entrapment of animals.
 - Noise and vibration should be controlled and kept to the minimum necessary.
 - Lighting used for construction should be switched-off when not in use and positioned so as not to spill on to adjacent land or retained vegetation within the Site.

4.6. ECOLOGICAL ENHANCEMENT OPPORTUNITIES

- 4.6.1. The surrounding Thames Gateway Region¹⁰ has historically contained extensive areas of open mosaic on previously developed land, much of which has subsequently been redeveloped¹¹. Maintaining the existing net extent (185ha) within the Greater London Authority area is a 'Target for 2020' within the current London Plan:
- 4.6.2. 'This target should be used to inform the redevelopment of brownfield land so that important elements of wasteland habitat are incorporated in development proposals as well as recreating the characteristics of the habitat within the design of new development and public spaces. It may be

¹⁰ The Thames Gateway Region is defined by the Department for Communities and Local Government – Thames Gateway Delivery Plan (2007) and includes the areas adjacent to the Thames estuary from Canary Wharf in London to Southend in Essex and Sittingbourne in Kent

¹¹ Robins, J., Henshall, S. and Farr, A. (2013). The state of brownfields in the Thames Gateway. Peterborough: Buglife.

possible for the Proposed Development to contribute to this conservation objective by incorporating biodiverse roofs providing vegetation and substrate that mimic brownfield habitat, for example¹².

- 4.6.3. Additionally, the National Planning Policy Framework (NPPF) (2019)¹³ states that at an overview level the ‘planning system should contribute to and enhance the national and local environment by... minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government’s commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures’
- 4.6.4. At a local level, policy E(f) of the Royal Greenwich Local plan¹⁴ requires that:
- ‘New build development proposals should be designed to incorporate living roofs or walls... The design, installation and maintenance of living roofs should be consistent with the most recent version of the GRO Green Roof Code.’*
- 4.6.5. To encourage compliance with planning policy the following measures are recommended for inclusion within the Proposed Development; where possible:
- The instillation of biodiverse roofs, these should be designed to recreate an open mosaic habitat with guidance on substrate, areas of bare aggregate habitat and appropriate native planting can be found in ‘Creating Green roofs for Invertebrates – A best Practice Guide’¹⁵.
 - Naturalistic/wildlife planting provide in formal beds, planters, hanging baskets of other measures to increase the saturation of naturalistic vegetation providing pollen and nectar sources for wildlife and places for wildlife to nest and shelter.
 - Integration of climbing plants or formal green walls into the development.
 - Integration of Sustainable Drainage Systems (SuDS) features such as kerb inlets, to allow for surface run off infiltration and to support areas of naturalistic planting as per ‘SuDS in London a guide’¹⁶.
 - Installation of nest boxes for bats/birds in areas adjacent to newly created planting.
 - Avoidance of herbicide/pesticide usage.
 - Good horticultural practice (e.g. should be utilised, including the use of peat-free composts, mulches and soil conditioners, native plants with local provenance and avoidance of the use of invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or the Invasive Alien Species (Enforcement and Permitting) Order 2019.
 - Whilst not a legal requirement existing buddleia on Site should be disposed of by chipping to avoid the further spread of this invasive species.

¹² Office of The Mayor of London (2019). The London Plan. The Spatial Development Strategy for London. London: The Greater London Authority.

¹³ Ministry of Housing, Communities and Local Government (2019). National Planning Policy Framework. London: Her Majesty’s Stationery Office.

¹⁴ Royal Borough of Greenwich (2014). The Royal Greenwich Local Plan: Core Strategy with Detailed Policies. London.

¹⁵ Buglife (2012). Creating Green roofs for Invertebrates – A best Practice Guide. Peterborough: Buglife.

¹⁶ TfL (2017). SuDS in London a guide. London: TfL

5. CONCLUSIONS

- 5.1.1. All habitats on Site are of negligible ecological value. The introduction of soft landscaping and ornamental planting will enhance the ecological value of the habitats on Site.
- 5.1.2. Due to the lack of suitable habitat within the Site, there is negligible potential for the Site to support protected species.
- 5.1.3. Consideration should be given to the Royal Borough of Greenwich local plan requirement that '*New build development proposals should be designed to incorporate living roofs or walls*'.
- 5.1.4. The incorporation of a 'biodiverse roof' would be highly likely to result in a net gain in biodiversity and would be ecologically appropriate by providing connectivity with adjacent living roofs and with remnants of open mosaic on previously developed land with the Royal Borough of Greenwich and wider Thames Gateway area.

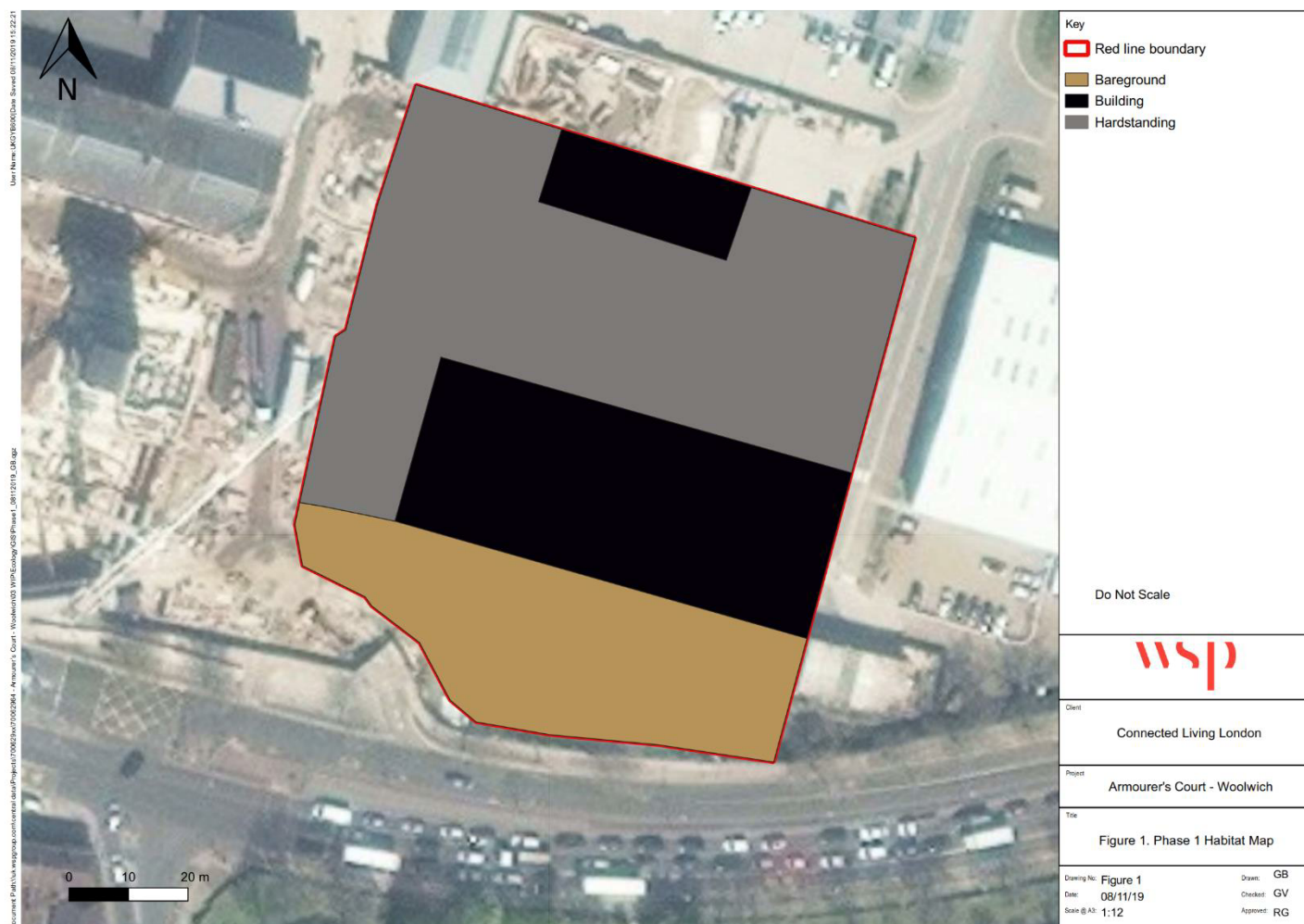
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FIGURES

Figure 1- Habitats Present Within the Site Boundary



Appendix A

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RELEVANT LEGISLATION AND PLANNING POLICY

ENGLAND & WALES LEGISLATION AND POLICY CONTEXT

This report has been compiled with reference to relevant wildlife legislation, planning policy and the UK Biodiversity Framework. An overview and context of relevant legislation is provided, with the relevant protection each species groups or species receives summarised in Table 1.

The Wildlife and Countryside Act 1981, (as amended) (WCA)

Protected birds, animals and plants are listed under Schedules 1, 5, 8 and 9 respectively of the WCA, a description of these Schedules and their meaning is provided below.

Under the WCA (England and Wales) all birds, their nests and eggs (with exception of species listed under Schedule 2) are protected by the WCA. It is an offence to:

- Intentionally kill, injure, or take any wild bird,
- Take or destroy an egg of any wild bird.
- Damage or destroy the nest of any wild bird (whilst being built, or in use). Under the WCA the clearance of vegetation within the survey area boundary, or immediately adjacent to the survey area during the bird nesting season could result in an offence occurring by the disruption or destruction of nest sites. The bird breeding season can be taken to occur between March - August inclusive, although is subject to variations based on species, geographical and seasonal factors.

Schedule 1

Birds listed under Schedule 1 of the WCA¹⁷ are afforded additional protection with regard to intentional or reckless disturbance whilst nest-building, or at a nest containing eggs or young, or disturb the dependent young of such a bird.

Schedule 5

Species listed in Schedule 5 can either be fully protected or be partially protected under Section 9, which makes it unlawful to intentionally:

- Part 1: kill, injure or take;
- Part 2: possess or control (live or dead animal, part or derivative);
- Part 4 (a): damage or destruct any structure used for shelter or protection;
- Part 4 (b): disturb them in a place of shelter or protection;
- Part 4 (c): obstruct access to place of shelter or protection;
- Part 5 (a): sell, offer for sale, possess or transport for the purpose of sale (live or dead animal, part or derivative);
- Part 5 (b): advertise for buying or selling.

Schedule 8

The Act makes it an offence (subject to exceptions) to pick, uproot, trade in, or possess (for the purposes of trade) any wild plant listed in Schedule 8, and prohibits the unauthorised intentional uprooting of such plants.

Schedule 9

Invasive species listed under Schedule 9 are prohibited from release into the wild and the Act prohibits planting or “causing to grow” in the wild of any plant species listed in Schedule 9. It should be noted that certain bird species listed on Schedule 1 of the WCA are also listed on Schedule 9 to prevent release of non-native and captive individuals, this includes barn owl, red kite, goshawk and corncrake.

Countryside Rights of Way Act 2000 (CRoW Act)

The CRoW Act has amended the WCA in England and Wales strengthening the protection afforded to Sites of Special Scientific Interest (SSSI) and the legal protection for threatened species. It adds the word ‘reckless’ to the wording of the offences listed under Section 9(4) of the WCA. This alteration makes it an offence to recklessly commit an offence, where previously an offence had to be intentional to result in a breach of legislation.

¹⁷ To view the current list of Schedule 1 listed birds visit: <http://www.legislation.gov.uk/ukpga/1981/69/schedule/1> [Accessed October 2019].

Natural Environment and Rural Communities (NERC) Act 2006

Species and Habitats of Principal Importance in England and Wales are listed under Section 41 and Section 42 respectively of the NERC Act. The Section 41 and 42 lists detail species that are of principal importance for the conservation of biodiversity in England and Wales, and should be used to guide decision-makers such as local and regional authorities when implementing their duty to have regard for the conservation of biodiversity in the exercise of their normal functions – as required under Section 40 of the NERC Act 2006.

The Environment (Wales) Act 2016

The Environment (Wales) Act 2016 (<http://www.legislation.gov.uk/anaw/2016/3/contents/enacted>) puts in place the legislation needed to plan and manage Wales' natural resources in a more proactive, sustainable and cohesive way. Section 7 replaces the duty in Section 42 of the NERC Act 2006 and it places a duty on the Welsh Ministers to publish, review and revise lists of living organisms and types of habitats which they consider are of key significance to sustain and improve biodiversity in Wales. The species and habitat lists are identical to those in Section 42 but it should be noted it is currently under review (23.03.2017).

The Protection of Badgers Act (1992)

It is an offence to wilfully take, kill, injure, possess or ill-treat a badger. Under the Act their setts are protected against intentional or reckless interference. Sett interference includes damaging or destroying a sett, obstructing access to any part of the sett, or disturbance of a badger whilst it is occupying a sett. The Act defines a badger sett as 'any structure or place, which displays signs indicating the current use by a badger' and Natural England (NE) takes this definition to include seasonally used setts that are not occupied but that show sign of recent use by badgers (Natural England, 2009¹⁸).

If impacts to badgers or their setts are unavoidable then authorised sett disturbance requires a licence.

The UK Post-2010 Biodiversity Framework (2011-2020) (JNCC and DEFRA, 2012)

This Framework lists the UK's most threatened species and habitats and sets out targets and objectives for their management and recovery. The UK Biodiversity Action Plan (BAP) process is delivered nationally, regionally and locally and should be used as a guide for decision-makers to have regards for the targets set by the framework and the goals they aim to achieve. The UK BAP has now been replaced by the UK Post-2010 Biodiversity Framework, however, it contains useful information on how to characterise important species assemblages and habitats which is still relevant (UK Post-2010 Biodiversity Framework, 2012¹⁹).

The Conservation of Habitats and Species Regulations 2017 (as amended)

The Conservation of Habitats and Species Regulations 2017 (as amended) consolidate the Conservation of Habitats and Species Regulations 2010 with subsequent amendments. The Regulations transpose Council Directive 92/43/EEC, on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive), into national law. They also transpose elements of the EU Wild Birds Directive in England and Wales. The Regulations came into force on 30th November 2017, and extend to England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters). In Scotland, the Habitats Directive is transposed through a combination of the Habitats Regulations 2010 (in relation to reserved matters) and the Conservation (Natural Habitats &c.) Regulations 1994. The Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) transpose the Habitats Directive in relation to Northern Ireland.

All species listed under Annex IV of the Habitats Directive require strict protection and are known as European Protected Species (EPS). Under Regulation 42 of the Habitats Regulations it is unlawful to:

- Deliberately kill, capture or disturb;
- Deliberately take or destroy the eggs of; and
- Damage or destroy the breeding site/resting place of any species protected under this legislation.

If the Ecologist determines that impacts to an EPS are unavoidable then the works may need to be carried out under a site specific mitigation licence from Natural England (NE) or Natural Resources Wales (NRW). Low Impact Class licences are also available in both England and Wales for bats and great crested newts. This enables Registered Low Impact Consultants to undertake certain low impact activities reducing the EPS application paperwork and process length.

¹⁸ Natural England, June 2009, Protection of Badgers Act 1992 (as amended), Guidance on 'Current Use' in the definition of a Badger Sett WMLG17, Natural England, Peterborough.

¹⁹ JNCC and Defra (on behalf of the Four Countries' Biodiversity Group), July 2012, UK Post-2010 Biodiversity Framework, Available from: http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf [October 2019].

Certain EPS are also listed under Annex II of the Habitats Directive and are afforded protection by the establishment of core areas of habitat known as Special Areas of Conservation. This means these species are a relevant consideration in a Habitats Regulations Assessment (HRA).

The Birds Directive seeks to maintain populations of all wild bird species across their natural range (Article 2). All bird species listed under Annex I²⁰ of the Birds Directive are rare or vulnerable and afforded protection by the classification of Special Protection Areas (SPAs), these are also designated under all regularly occurring migratory species, with regard to the protection of wetlands of international importance (Article 4). This means these bird species and communities are a relevant consideration in HRA.

²⁰ To view birds listed under Annex I visit: http://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/index_en.htm [accessed October 2019]

Table A:1: Key Species and National Wildlife Legislation, Policy and Biodiversity Framework Applicable in England & Wales

Species	Legislation, Planning Policy and UK Biodiversity Framework							
	Wildlife and Countryside Act 1981 (as amended), (WCA)				The Conservation of /Habitats and Species Regulations 2010 (as amended) (Habitats Regulations) - Regulation 41	Natural Environment and Rural Communities (NERC) Act 2006 / The Environment(Wales) Act (2016)	The Protection of Badgers Act 1992	The UK Post-2010 Biodiversity Framework 2011-2020 (JNCC and DEFRA, 2012)
	Schedule1	Schedule 5	Schedule 8	Schedule 9	European Protected Species (Annex IV of the EC Habitats Directive),			
Badger							✓	
Bats		✓ ²¹ (part)			✓ ²²	✓ ²³		✓ ²⁴
Hazel Dormouse		✓ 5(part)			✓	✓		✓
Otter		✓ 5(part)			✓	✓		✓
Water vole		✓ ²⁵ (full)				✓		✓
Birds	✓			✓ ²⁶		✓ ²⁷		✓ ²⁸
Reptiles		✓		✓ ⁹	✓ ³⁰	✓ ³¹		✓ ³²

²¹ These species are partially protected under section 9(4)(b), (4)(c) and (5).

²² Only Barbastelle (*Barbastella barbastellus*), Bechstein's bat (*Myotis bechsteinii*), greater horseshoe bat (*Rhinolophus ferrumequinum*) and lesser horseshoe bat (*Rhinolophus hipposideros*) are listed on Annex II of the Habitats Directive.

²³ Greater horseshoe bat, lesser horseshoe bat, Bechstein's bat, noctule (*Nyctalus noctula*), soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared bat (*Plecotus auritus*) and barbastelle are listed as Species of Principal Importance in England with the addition of common pipistrelle (*Pipistrellus pipistrellus*) in Wales listed under Section 7 of the Environment (Wales) Act (2016) <http://www.legislation.gov.uk/ukpga/2006/16/contents>.

²⁴ Barbastelle bat, Bechstein's bat, noctule, soprano pipistrelle, brown long-eared bat, greater horseshoe bat, lesser horseshoe bat are listed as UK BAP species of bat.

²⁵ Class Licences are available to Registered Consultants to intentionally disturb, damage or destroy water vole burrows or to displace water voles from their burrows in relation to a development proposal where the licensed action provides a conservation benefit for water voles. Certain displacement operations may be carried out under a Class licence by a registered person in England, however in Wales all displacement operations must be carried out under a site specific licence.

²⁶ To view plants and animals listed on Schedule 9 Part 1 visit <http://www.legislation.gov.uk/ukpga/1981/69/schedule/9> [accessed 6 April 2017]

²⁷ There are 49 species of birds listed as Species of Principal Importance in England in Section 41 of the NERC Act 2006 and 51 species in Wales under Section 7 of the Environment (Wales) Act (2016) <http://www.legislation.gov.uk/ukpga/2006/16/contents>.

²⁸ To view the current list of UK BAP priority birds visit: <http://jncc.defra.gov.uk/page-5163> [Accessed October 2019].

³⁰ Smooth snake (*Coronella austriaca*) and Sand lizard (*Lacerta agilis*) are the only reptiles to be designated as European Protected Species.

³¹ All 6 reptile species are listed as Species of Principal Importance in England listed under Section 41 of the NERC Act 2006 and 5 species, excluding smooth snake, listed under Section 7 of the Environment (Wales) Act (2016) <http://www.legislation.gov.uk/ukpga/2006/16/contents>.

³² To view the current list of UK BAP priority herptile species visit: <http://jncc.defra.gov.uk/page-5166> [Accessed October 2019].

Table A:1: Key Species and National Wildlife Legislation, Policy and Biodiversity Framework Applicable in England & Wales								
Species	Legislation, Planning Policy and UK Biodiversity Framework							
		²⁹ (part) ✓						
Amphibians		✓ ³³ (part)		✓ ³⁴	✓ ³⁵ ³⁶	✓ ³⁷		
White-clawed Crayfish		✓ ³⁸ (partial)			✓ ³⁹	✓		✓
Invertebrates		✓ ⁴⁰ (full/part)		✓	✓ ⁴¹ ⁴²	✓ ⁴³		✓ ⁴⁴

²⁹ The four common reptile species, Adder (*Vipera berus*), Grass snake (*Natrix natrix*), Common lizard (*Zootoca vivipara*) and Slow worm (*Anguis fragilis*) are offered partial protection under section 9(5). The rarer UK reptile species (Smooth snake (*Coronella austriaca*) and Sand lizard (*Lacerta agilis*)) are partially protected under section 9(4)(b) and (c) and (5).

³³ The four common reptile species, Adder (*Vipera berus*), Grass snake (*Natrix natrix*), Common lizard (*Zootoca vivipara*) and Slow worm (*Anguis fragilis*) are offered partial protection under section 9(5). The rarer UK reptile species (Smooth snake (*Coronella austriaca*) and Sand lizard (*Lacerta agilis*)) are partially protected under section 9(4)(b) and (c) and (5).

³⁴ Common frog (*Rana temporaria*), Common toad (*Bufo bufo*), Smooth newt (*Lissotriton vulgaris*) and Palmate newt (*Lissotriton helveticus*) are offered partial protection under section 9(5). Great crested newt (*Triturus cristatus*) and Natterjack toad (*Epidalea calamita*) are offered partial protection under section 9(4)(b) and (c) and (5). Pool frog (*Pelophylax lessonae*) is offered partial protection under section 9(4)(b) and (c)(1) only and with respect to England only.

³⁵ Great crested newt, Natterjack toad and Pool frog are the only amphibians to be designated European Protected Species.

³⁶ Great crested newt is the only amphibian listed on Annex II of the Habitats Directive.

³⁷ Great crested newt, Natterjack toad and Common toad are listed as Species of Principal Importance in England in Section 41 of the NERC Act 2006 and under Section 7 of the Environment (Wales) Act (2016) <http://www.legislation.gov.uk/ukpga/2006/16/contents>.

³⁸ Under the Wildlife and Countryside Act it is illegal to take or sell white clawed crayfish under the WCA. A licence is required to survey (hand net or trap) for the species. To undertake work within WCC inhabited rivers a Class Licence maybe issued by the relevant authority to move WCC away from harm prior to works. Although WCC are not protected from killing or injury Natural England state in their Class licence that due to declining numbers all efforts should be made to conserve the species.

³⁹ White clawed crayfish are listed under Annex II and V of the Habitats Directive.

⁴⁰ To view the current list of invertebrates that are protected under this Act either in part or full visit: <http://www.legislation.gov.uk/ukpga/1981/69/schedule/5> [Accessed October 2019].

⁴¹ The Large blue butterfly (*Maculinea arion*), Fisher's estuarine moth (*Gortyna borelii lunata*) and Lesser whirlpool ram's-horn snail (*Anisus vorticulus*) are the only invertebrates to be designated European Protected Species.

⁴² There are currently twelve invertebrates listed in Annex II of the Habitats Directive; White-clawed crayfish (*Austroptamobius pallipes*), Southern damselfly (*Coenagrion mercuriale*), Marsh fritillary butterfly (*Eurodryas aurinia*), Violet click beetle (*Limoniscus violaceus*), Stag beetle (*Lucanus cervus*), Freshwater pearl mussel (*Margaritifera margaritifera*), Narrow-mouthed whorl snail (*Vertigo angustior*), Round-mouthed whorl snail (*Vertigo genesii*), Geyer's whorl snail (*Vertigo geyeri*), Desmoulin's whorl snail (*Vertigo moulinsiana*), Lesser whirlpool ram's-horn snail (*Anisus vorticulus*) and Fisher's estuarine moth (*Gortyna borelii lunata*).

⁴³ There are currently 379 invertebrate species (not including marine species) listed as Species of Principal Importance in England http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0ahUKEwivvu7J9trSAhXiCsAKHX4TBGcQFggvMAM&url=http%3A%2F%2Fpublications.naturalengland.org.uk%2Ffile%2F6518755878240256&usg=AFQjCNEpiUWYuOqhVcfSDvi_3iK2TJytfQ and 188 species in Wales http://www.eryri-npa.gov.uk/_data/assets/pdf_file/0003/486156/SpeciesList.pdf listed under Section 41 of the NERC Act 2006 and listed under Section 7 of the of the Environment (Wales) Act 2016. [Accessed October 2019]

⁴⁴ To view the current list of UK BAP priority invertebrates visit: <http://jncc.defra.gov.uk/page-5169> [Accessed October 2019].

Table A:1: Key Species and National Wildlife Legislation, Policy and Biodiversity Framework Applicable in England & Wales								
Species	Legislation, Planning Policy and UK Biodiversity Framework							
Fish		✓ ⁴⁵ (full/part)		✓ ⁹	✓ 46 47 ,	✓ ⁴⁸		✓ ⁴⁹
Plants			✓ ⁵⁰	✓ ⁹	✓ 51 52 ,	✓ 53		✓ ⁵⁴

⁴⁵ To view the current list of fish either part or fully protected under the Act visit: <http://www.legislation.gov.uk/ukpga/1981/69/schedule/5> [Accessed October 2019].

⁴⁶ Sturgeon (*Acipenser sturio*) is the only fish to be designated a European Protected Species.

⁴⁷ There are eight fish species listed on Annex II of the Habitats Directive. To view the current list visit: <http://jncc.defra.gov.uk/page-1523> [Accessed October 2019].

⁴⁸ There are 35 species of fish listed as Species of Principal Importance in England listed under Section 41 of the NERC Act 2006 and 10 species in Wales listed under Section 7 of the Environment (Wales) Act 2016.

⁴⁹ To view the current list of UK BAP priority fish visit: <http://jncc.defra.gov.uk/page-5164> [Accessed October 2019].

⁵⁰ To view the current list of Schedule 8 listed plants visit: <http://www.legislation.gov.uk/ukpga/1981/69/schedule/8> [Accessed October 2019].

⁵¹ There are nine plant species designated as European Protected Species. To view the current list visit: <http://www.legislation.gov.uk/ukxi/2010/490/schedule/5/made> [Accessed October 2019].

⁵² To view the current list of plant species on Annex II of the Habitats Directive visit: <http://jncc.defra.gov.uk/page-1523> [Accessed October 2019].

⁵³ There are currently 152 vascular plants listed as Species of Principal Importance in England listed under Section 41 of the NERC Act 2006 and 77 species in Wales listed under Section 7 of the Environment (Wales) Act 2016.³¹ To view the current list of UK BAP priority plants visit: <http://jncc.defra.gov.uk/page-5171> and <http://jncc.defra.gov.uk/page-5168> [Accessed October 2019].

⁵⁴ To view the current list of UK BAP priority plants visit: <http://jncc.defra.gov.uk/page-5171> and <http://jncc.defra.gov.uk/page-5168> [Accessed October 2019].

Appendix B

PHOTOGRAPHS **wsp**

Table 6 - Photographs



Hardstanding



Temporary office building – J3.6



Bare ground - J4 and Southern elevation of 'Station box' building – J3.6



Northern elevation of 'Station box' building – J3.6



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