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INTRODUCTION
INTRODUCTION

1.1 AECOM Infrastructure and Environment UK Ltd (AECOM) have been instructed by Danescroft Land Ltd, on behalf of the group of landowners (Danescroft Land Ltd, Lindhill Properties Ltd, British Land PLC, Vastint Holding B.V, Southern Housing Group, LLDC), to undertake an assessment of ground conditions in relation to the redevelopment of the Bromley by Bow South site (herein referred to as ‘the Site’), allocated as Sub Area 4.1 of the London Legacy Development Corporation (LLDC) Local Plan 2015 to 2031 (Ref. 1).

1.2 It is the intention of the landowners to submit an illustrative masterplan to the Planning and Policy Decisions Team (PPDT) of the LLDC. This illustrative masterplan has been subject to environmental testing, and this report forms part of a series of Environmental Impact Topic Reports which have been produced to form a separate evidence base identifying any potential significant environmental effects of the operation of the maximum extents/parameters of the illustrative masterplan, and where further work might be required to support a planning application for redevelopment of the Site, or any part thereof.

1.3 Both the illustrative masterplan and Environmental Impact Topic Reports will provide the basis upon which a series of redevelopment parameters and design guidelines will be developed for the Site. These parameters and guidelines will be adopted as a Supplementary Planning Document (SPD) for the Site. Both the illustrative masterplan and Environmental Impact Topic Reports will be appended to the SPD.

1.4 The Site is approximately 6ha in size and lies between the A12 to the west, the River Lea to the east and the railway line to the south. The Bow River Village (Bromley by Bow North) development borders the Site to the north. The illustrative masterplan consists of the construction of residential, retail, workspace, education and community buildings. The Site is located with the London Borough of Tower Hamlets (LBTH) and falls under the planning jurisdiction of the LLDC.

1.5 This report presents the findings of an assessment of the likely significant effects on ground conditions as a result of the illustrative masterplan.

1.6 Consideration of effects associated with potentially contaminated soils and groundwater is made in the context of existing site conditions (i.e. baseline conditions), once the redevelopment of the Site is complete and operational. Recommendations are also made in relation to the demolition and construction phase associated with any future planning application being made for redevelopment of the Site or any part thereof.

1.7 The significance of effects is firstly assessed pre-mitigation. The requirement for any mitigation measures once the redevelopment of the Site is operational are then outlined. Following the application of the mitigation measures, the resultant residual effects are assessed in accordance with specified significance criteria.

1.8 A Landmark Envirocheck® Report (Ref. 2), which provides an account of historical and existing operations and services within 1 kilometre (km) of the Site boundary, as well as relevant environmental setting information has been reviewed as part of the baseline research during preparation of this chapter. Where appropriate, this information has been used in conjunction with this assessment.

1.9 The effects of the redevelopment of the Site on surface water and flood risk are discussed in the Water Resources, Drainage and Flood Risk Impact Topic Report.

1.10 The potential for ground conditions effect interactions and combined effects (Type 1 effects) and combined cumulative ground conditions effects (Type 2 effects) of the illustrative masterplan with other committed developments are discussed in Section 8 of this report.

Planning History

1.11 Two planning permissions have previously been granted which cover the Site in part or whole and are summarised below. Where relevant, reference is made in this report to the information within these two planning applications:
• Hybrid planning permission (with some elements approved in detail) was granted for the Tesco application PA/09/02574 by the GLA in July 2010 for a mixed-use development, including a District Centre and a superstore. The area covered by the Tesco application sits entirely within the Site.

• Hybrid planning permission (with detailed planning permission for Phase 1) was granted for the Bromley by Bow (North) planning application PA/11/02423 by the GLA in July 2012 for a residential led mixed-use development. The Bromley by Bow (North) site comprises the area directly to the north of the Site, and includes the northern most portion of the Site.
LEGISLATIVE AND PLANNING POLICY CONTEXT
LEGISLATIVE AND PLANNING POLICY CONTEXT

Introduction

2.1 This section reviews the legislative and planning policy context in relation to ground conditions and contaminated land and groundwater.

Relevant Legislation

2.2 There are five key legislative drivers for dealing with risks to human health and the environment from ground condition, namely:

- Part 2A of the Environmental Protection Act (EPA) 1990 (the Contaminated Land Regime) (Ref. 3);
- The Water Resources Act 1991 (Ref. 4) and The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 (Ref. 5);
- The Water Act 2003 (Ref. 6);
- The Building Act 1984 (Ref. 7); and
- The Building Regulations 2010 (Ref. 8).

2.3 In the UK, Part 2A of the EPA, as introduced by Section 57 of the Environment Act 1995 (Ref. 9), provides the legislative framework within which site data is to be assessed. Under Part 2A, sites are identified as 'contaminated land' if they are either causing harm, if there is a significant possibility of significant harm, or if the site is causing, or could cause, pollution of controlled waters (i.e. both surface and groundwaters).

2.4 The Water Act 2003 introduced a revision to the wording of the EPA, which requires that if a site is causing or could cause significant pollution of controlled waters it may be determined as contaminated land. Once a site is determined to be "contaminated land" then remediation is required to render significant pollutant linkages insignificant (i.e. the source-pathway-receptor relationships that are associated with significant harm to human health and/or significant pollution of controlled waters), subject to a test of reasonableness. The Water Resources Act 1991 (as amended) provides statutory protection for controlled waters (streams, rivers, canals, marine environment and groundwater) and makes it an offence to make a discharge to controlled waters without the permission or consent of the regulators of these areas.

2.5 The Building Act 1984 (Ref. 7) and the Building Regulations 2010 (Ref. 8) are the two key legislative drivers when considering structural and design aspects of a development in terms of geotechnical properties of the ground. The Regulations require that buildings are constructed so that ground movement caused by swelling, shrinkage, freezing, landslip or subsidence of the sub-soils will not impair the stability of any part of the building.

2.6 Other relevant legislation that serves as reference to this topic includes:

- Environmental Permitting (England and Wales) Regulations 2010 (Ref. 10);
- The Hazardous Waste (England and Wales) (Amendment) Regulations 2009 (Ref. 11);
- Contaminated Land (England) (Amendment) Regulations 2012 (Ref. 12);
- Environmental Damage (Prevention and Remediation) Regulations 2009 (Ref. 13); and
- The Anti-Pollution Works Regulations 1999 (Ref. 14).
National Planning Policy


2.7 The National Planning Policy Framework (NPPF) (Ref. 15) confirms that land contamination and its risk to health should be a material consideration under planning and development control. Of importance is land contamination and its risk to human health in the context of the intended end use of the site.

2.8 Section 109 of the NPPF states that: "The planning system should contribute to and enhance the natural and local environment by: …

Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and

Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

2.9 A core planning principle described in Section 11, paragraph 111 of the NPPF states that: "Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value."

2.10 In Section 11, paragraph 121 the NPPF also states that: "Planning policies and decisions should also ensure that:

The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;

After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

Adequate site investigation information, prepared by a competent person is presented."

National Planning Practice Guidance (NPPG) (2014)

2.11 The National Planning Practice Guidance (PPG) (Ref. 16) was launched on 6th March 2014 and provides a web-based resource in support of the NPPF. The PPG contains no changes relative to the NPPF or additional information that are relevant to ground conditions.

Regional Planning Policy


2.12 The London Plan (2015) (Ref. 17) sets out the spatial development strategy for Greater London. Of particular reference to ground conditions is Policy 5.21 – Contaminated Land. This policy outlines that the remediation of contaminated sites will be encouraged with the aim of bringing contaminated land into beneficial use. In addition, appropriate measures should be taken to ensure that the development of brownfield land does not result in significant harm to human health or the environment and that development does not activate or spread contamination.

Sustainable Design and Construction Supplementary Planning Guidance (2014)

2.13 The London Plan Sustainable Design and Construction Supplementary Planning Guidance (SPG) (Ref. 18) was published in April 2014. The SPG provides detailed guidance to aid implementation that cannot be covered in the London Plan. The SPG serves to update the standards that were developed for the Mayor’s SPG on Sustainable Design and Construction in 2006 (Ref. 19) with a list of ‘Mayor’s Priorities’ and best practice approaches for sustainable design and construction. ‘Mayor’s Priorities’ of relevance to the redevelopment of the Site include the following:

“Developers should set out how existing land contamination will be addressed prior to the commencement of their development. London Plan policy 3.2, 5.3, 5.21"
Potentially polluting uses are to incorporate suitable mitigation measures. London Plan policy 3.2, 5.3, 5.21”

Local Planning Policy
LLDC Local Plan 2015 to 2031

2.14 The London Legacy Development Corporation Local Plan (July 2015) (Ref. 1) sets out the strategy for the future of the area and includes the policies that will be used to direct development and determine applications for planning permission. The Legacy Corporation has a legal duty, as the Local Planning Authority for its area, to prepare and adopt a Local Plan for its area and once this has been adopted, to monitor its performance and over time review it.

2.15 There are no specific policies within this document that address land contamination or ground conditions. Site Allocation SA4.1: Bromley-by-Bow does not specifically refer to contaminated land/ground conditions.
METHODOLOGY AND IMPACT
SIGNIFICANCE CRITERIA

Introduction

3.1 This section of the report presents the following:

- Relevant standards and guidance which have been reviewed and referenced throughout preparation of this report;
- Identification of information sources which have been used throughout preparation of this assessment;
- Details of any consultation undertaken with respect to ground conditions;
- The methodology used in the assessment of ground conditions effects, including the criteria for the determination of sensitivity of receptor/importance of resource and magnitude of change from the existing or ‘baseline’ conditions;
- An explanation as to how the identification and assessment of potential ground condition effects has been reached; and
- The significance criteria and terminology for assessment of the residual effects to ground conditions.

3.2 The following sources of information have been reviewed and along with a site walkover form the basis of the assessment of likely significant effects on ground conditions:

- The 2016 Envirocheck® Report (Ref. 2);
- URS, January 2009; North Bromley-By-Bow Advice, Surveys/Studies & Due Diligence; Phase I Geoenvironmental Assessment Report, North Bromley-by-Bow, London (Ref. 20);
- GL Hearn, April 2010; Tesco Store Ltd, Bromley-by-Bow, Environmental Statement (Ref. 21);
- Alliance Planning; April 2012; Environmental Statement; Hybrid Planning Application for Mixed-use Development Comprising 741 Residential Units, Flexible Office Space, Car Dealership and a Bar/Restaurant, Associated Infrastructure and Upgrade Works to Existing Towpath Adjacent to River Lea at Hancock Road and Three Mill Lane, Bromley by Bow (PA1102423) (Ref. 22);
- Karakusevic Carson Architects (KCA) illustrative floor plans dated 29/02/2016 (KCA drawings 266-A-D-100-00, 266-A-D-100-05 and 266-A-D-100-Roof) (Ref. 23);
- The Environment Agency's "What's in my backyard" tool on-line (Ref. 24);
- British Geological Survey (BGS) Borehole Logs (Ref. 25); and
- KCA Masterplan Summary 266_REP_DD_23 (Ref. 26).

Standards and Guidance

Environment Agency Pollution Prevention Guidance Notes

3.3 The Environment Agency (EA) Pollution Prevention Guidance Notes (PPGN) provide advice on statutory responsibilities and good environmental practice. The Guidance Notes of particular relevance to the illustrative masterplan and ground conditions include:

- PPGN 1: General Guide to the Prevention of Pollution (Ref. 27), provides an introduction to the principles of pollution prevention and the Environment Agency's pollution prevention guidance note series;
- PPGN 2: Above Ground Oil Storage Tanks (Ref. 28) provides guidance to those responsible for the storage of oil on construction sites. The document provides guidance on location, bunding,
protection and operation of stored oils in addition to maintenance and brief guidance on dealing with spills;

- PPGN 5: Works in, Near or Liable to Affect Watercourses (Ref. 29) provides guidance on general precautions to take when working in the vicinity of a watercourse, along with more specific measures to prevent contamination and to minimise any adverse impacts;
- PPGN 6: Working at Construction or Demolition Sites (Ref. 30) is a document that mirrors much of PPGN 5, but with particular emphasis on the situations likely to occur at demolition and construction sites; and
- PPGN 21: Pollution Incident Response Planning (Ref. 31) assists those developing site-specific pollution incident response plans to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.

3.4 Other relevant policy, standards and guidance that serve as reference to this topic includes:

- Contaminated Land, DEFRA Circular 01/2006 (Ref. 32);
- Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (Ref. 33);
- Human Health Toxicological Assessment of Contaminants in Soil, Science Report SC050021/SR2 (Ref. 34);
- Guiding Principles for Land Contamination (GPLC 1, 2 and 3) (2010) (Ref. 36);
- Construction Industry Research and Information Association (CIRIA) Guidance C532, ‘Control of Water Pollution from Construction Sites’ (Ref. 37);
- The Chartered Institute of Environmental Health Local Authority Handbooks (Ref. 38);
- British Standard (BS) 8485:2007 Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments (Ref. 39);
- Guidance C665, ‘Assessing Risks Posed by Hazardous Ground Gases to Buildings’ (Ref. 40);
- Contaminated land exposure assessment (CLEA) tool, (spreadsheet based models) (Ref. 41); and
- Groundwater protection: Principles and Practice (GP3) (Ref. 42).

Assessment Methodology

Methodology for Determining Baseline Conditions and Sensitive Receptors

3.5 The information used in the assessment for the baseline characterisation of ground conditions has been obtained from the sources listed previously. A review of the baseline conditions has allowed for the identification of the potential sources of land contamination across the Site.

3.6 Whilst the focus of the assessment is on land contamination in terms of ground conditions, geology, hydrogeology and hydrology, other ground related aspects have been considered, including underground obstructions, the potential for Unexploded Ordnance (UXO), underground structures and utilities, and other geotechnical considerations, such as land stability.

3.7 Current UK guidance advocates the use of a conceptual risk assessment model. The three conditions shown in the paragraph below comprise the basis of this approach in that, without each of the three elements (‘source’, ‘pathway’ and ‘receptor’), 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 problem exists, since the contamination must be defined in terms of pollutant linkages and unacceptable risk of harm.
3.8 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 requires three conditions to be satisfied:

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

3.9 Receptors potentially sensitive to changes in ground conditions have been identified following the assessment of baseline conditions and the identified sources of contamination. Each receptor has been assigned a level of sensitivity. The level of sensitivity is based on a variety of considerations including but not limited to, national, regional and local designations, the function of a receptor (e.g. whether an aquifer which underlies a site is used as a potable water supply or not) and the end use of a site (e.g. residential end use).

3.10 In terms of ground conditions, the criteria for assessing receptor sensitivity are defined in Table 1 and the identified site specific sensitive receptors are provided in Table 1. In defining the criteria for receptor sensitivity, industry standards and best practice guidance have been taken into consideration where appropriate.

Table 1: Example Receptors and Criteria for Assessing Receptor Sensitivity

<table>
<thead>
<tr>
<th>Receptor Sensitivity</th>
<th>Receptor Examples</th>
</tr>
</thead>
</table>
| **High**             | Principal Chalk Aquifer – layers of rock or drift deposits that have high inter-granular and / or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply (portable resources) and / or river based flow, and are important in terms of water quantity and quality.  
Demolition and construction site workers – in relation to human exposure through direct contact, inhalation / dermal uptake of contaminated soils, dusts, gases and particulates, exposure to UXO / flammables, fire and blast damage. Workers are assumed to be ‘fit and healthy for the job’.  
Neighbouring uses, occupiers, and the general public immediately adjacent to or in proximity (i.e. within 100m) of active construction compound / site – high sensitivity due to proximity to demolition and construction works, in addition to the presence of potentially sensitive groups of people i.e. the elderly, disabled and children.  
Redevelopment end users – residents, visitors, shoppers and on-site employees for example.  
Nationally designated/protected area – e.g. Site of Special Scientific Importance (SSSI), Special Protection Area, National Nature Reserve. |
| **Medium**           | Secondary Aquifers – sub-divided as:  
• Secondary A – permeable layers 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;  
• Secondary B – predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering; and  
• Secondary Undifferentiated Aquifers – assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.  
Existing and Redevelopment of the Site introduced materials, structures and services – e.g. foundations based on current understanding / knowledge of local ground conditions e.g. aggressive ground and local geotechnics.  
Regionally designated habitats or local amenity areas – e.g. Sites of Importance for Nature Conservation (SINCs), the River Thames and local nature reserves, parks, playing fields. |
| **Low**              | Unproductive Strata - rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow  
Land stability – low sensitivity due to regional geographical conditions.  
Neighbouring uses, occupiers, and the general public > 100m from the site boundary of active construction compound – low sensitivity as located at a distance from the site. |
3.11 Following identification of the potential sources of ground contamination and having taken into consideration other ground related aspects, such as the presence or absence of above and below ground storage tanks, asbestos and other subsurface utilities and structures, the likely pathways between the source of contamination or other ground related aspects and the receptor have been identified.

3.12 After defining the sources, the pathways and receptors, potential impacts (pre-mitigation) have been qualitatively defined.

3.13 Table 2 presents an example source-receptor-pathway interaction leading to a potential impact.

**Table 2: Example of Source-Receptor-Pathway Interaction**

<table>
<thead>
<tr>
<th>Source</th>
<th>Receptor</th>
<th>Receptor Sensitivity</th>
<th>Pathway</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocarbon contamination in soil materials disturbed and volatized during earth works</td>
<td>Demolition &amp; construction site workers</td>
<td>High</td>
<td>E.g. Inhalation and dermal contact with hydrocarbon impacted soils and dusts.</td>
<td>Impact to human health.</td>
</tr>
</tbody>
</table>

**Methodology for Determining Effects on Ground Conditions**

3.14 Following the determination of the baseline conditions and sensitive receptors, the methodology for identifying the potential ground conditions-related effects, as a result of the implementation of the illustrative masterplan, is based on the following stages:

- Preparation of a conceptual site model, identifying feasible pollution sources and pathways during the demolition and construction works, and once the illustrative masterplan is completed and operational;
- Determination of the magnitude of change of the potential impacts of the illustrative masterplan on the sensitive receptors;
- Evaluation of the significance of the effects, relative to the receptor sensitivity;
- Identification of suitable and appropriate mitigation measures for the illustrative masterplan; and
- Assessment of the significance of any residual effects.

**Significance Criteria**

**Magnitude of Change from the Baseline Condition**

3.15 The magnitude of change to the ground conditions from the baseline conditions at the Site as a result of the illustrative masterplan has been classified as either being: high, medium, low or very low / negligible. The criteria and their respective magnitude of change classification are detailed within Table 3.
<table>
<thead>
<tr>
<th>Magnitude of Change</th>
<th>Demolition and Construction works:</th>
<th>Completed and occupied development:</th>
</tr>
</thead>
</table>
| **High**            | • Activities result in a major pollution release (1) or create/remove a pollutant linkage with a substantial pollutant source.  
                     • Serious risk / improvement to human health / life. |
|                     | • The development introduces or removes a large-scale source of potential contamination or pollutant linkage. |
| **Medium**          | • Activities result in a moderate pollution release (2) or create/remove a pollutant linkage with moderate pollutant source.  
                     • Moderate risk / improvement to human health / life. |
|                     | • The development introduces or removes a relatively small-scale source of potential contamination or pollutant linkage. |
| **Low**             | • Construction activities result in a minor pollution release (3) or create/remove a pollutant linkage with a minor pollutant source. Temporary pathway or receptor is introduced or removed during demolition or construction.  
                     • Minor risk / improvement to human health. |
|                     | • The development introduces or removes a minor source of potential contamination or pollutant linkage. |
| **Very Low / Negligible** | • An insignificant pollution release or creation/removal of a pathway with an insignificant pollutant source.  
                     • No / reversible affect to human health. |
|                     | • No foreseeable measurable change to the existing conditions. No appreciable impacts/ reversible impacts. |

**Footnotes**

1. A major pollution release corresponds to a Category 1 pollution incident, which is defined by the Environment Agency as having persistent and extensive impacts on water, land and air quality, major damage to all ecosystems, closure of a potable abstraction, major impact on land, property, major impact on amenity value, major damage to agriculture and/ or commerce and serious impact upon man.

2. A moderate pollution release corresponds to a Category 2 pollution incident, which is defined by the Environment Agency as having a significant impact on water, land and air quality, significant damage to all ecosystems, non-routine notification of abstractors, significant impact on land, property, reduction in amenity value, significant damage to agriculture and/ or commerce and impact on man.

3. A minor pollution release corresponds to a Category 3 pollution incident, which is defined by the Environment Agency as having a minimal impact on water, land and air quality, minor damage to local ecosystems, marginal impact on amenity value and minimal impact to agriculture and/ or commerce.

**Assessment of the Significance of Effects**

3.16 A level of significance has been assigned to both potential effects (pre-mitigation) and residual effects (post mitigation). Essentially, the combination of the sensitivity of the receptor and the magnitude of change from the baseline condition as a result of the implementation of the illustrative masterplan qualitatively assess the significance of the effect. Table 4 presents the matrix for defining the effect significance.

3.17 Effects have the potential to be adverse, beneficial or negligible. For example, in terms of beneficial effects, the illustrative masterplan may result in the removal of a source of contamination or it may close a pathway that currently links a source to a receptor.

3.18 Effects also have the potential to be:
• Temporary (short (weeks / months), medium (several months to a year) or long (several years) term) or permanent (non-reversible); and
• Can occur at local (on-site or in close proximity to the area), district (within the LLDC/LBTH/LBN), regional (within Greater London), national (UK), or international levels.

3.19 With regards to the residual effect significance, the level of effect takes into account the sensitivity of the receptor, the magnitude of the change and the mitigation measures applied to reduce the likelihood of significant effects to receptors. Mitigation measures implemented have the potential to alter the magnitude of impact, e.g. demolition and construction workers utilising appropriate Personal Protective Equipment (PPE) during the demolition and construction phase.

Table 4: Criteria for Assessing Effect Significance

<table>
<thead>
<tr>
<th>Receptor Sensitivity</th>
<th>Magnitude of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>Major</td>
</tr>
<tr>
<td>Medium</td>
<td>Major</td>
</tr>
<tr>
<td>Low</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

3.20 Descriptions of the levels of effects are outlined within Table 5. Potential effects that are determined as being moderate or major are classed as ‘significant’ effects. Where an effect has been anticipated to be negligible or minor, these are classed as ‘insignificant’ effects.

Table 5: Description of Effect Levels

<table>
<thead>
<tr>
<th>Level of Effect</th>
<th>Description</th>
</tr>
</thead>
</table>
| Major Adverse   | • Potential serious or moderate risk to human health of site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the site;  
• Major or moderate pollution release or creation of a pollutant linkage with a substantial or moderate pollutant source to Principal Chalk Aquifer and nationally designated / protected areas; and  
• Major pollution release or creation of a pollutant linkage with a substantial pollutant source to Secondary Aquifer, Secondary Undifferentiated Aquifer and regionally designated / protected areas or local areas. |
| Moderate Adverse| • Potential minor risk to human health of site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the site;  
• Potential serious risk to human health of neighbouring uses, occupiers and the general public >100m from the Site;  
• Potential serious risk to land stability;  
• Major pollution release or creation of a pollutant linkage with a major pollutant source to Unproductive Strata;  
• Moderate pollution release or creation of a pollutant linkage with a moderate pollutant source to Secondary Aquifer and Regionally designated / protected areas or local areas;  
• Minor pollution release or creation of a pollutant linkage with a minor pollutant source to Principal Chalk Aquifer and nationally designated / protected areas; and  
• Introduction of existing or new relatively small-scale source of potential contamination or pollutant linkage (via existing and Redevelopment introduced materials, structures and services). |
| Minor Adverse    | • Potential moderate pollution release or creation of a pollutant linkage with moderate pollutant source to Unproductive Strata;  
• Potential moderate risk to land stability;  
• Potential moderate risk to human health of neighbouring uses, occupiers and the general public >100m from the site; and  
• Minor pollution release or creation of a pollutant linkage with a minor pollutant source to...
<table>
<thead>
<tr>
<th>Level of Effect</th>
<th>Description</th>
</tr>
</thead>
</table>
| Negligible       | • Potential minor pollution release or creation of a pollutant linkage with minor pollutant source to Unproductive Strata and no / reversible effect to human health of neighbouring uses, occupiers and the general public >100m from the site;  
                     • Potential minor risk to land stability;  
                     • An insignificant pollution release or creation / removal of a pathway with an insignificant pollutant source to all remaining sensitive receptors; and  
                     • No / reversible effect to human health of site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the site. |
| Minor Beneficial | • Potential removal of a pollutant linkage with moderate pollutant source to Unproductive Strata;  
                     • Potential moderate improvement to human health of neighbouring uses, occupiers and the general public >100m from the site;  
                     • Removal of a minor pollutant linkage with a minor pollutant source to Secondary Aquifer and regionally designated / protected areas; and  
                     • Removal of existing minor source of potential contamination or pollutant linkage (via existing and Redevelopment introduced materials, structures and services). |
| Moderate Beneficial | • Potential minor improvement to human health of site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the site;  
                      • Potential serious improvement to human health of neighbouring uses, occupiers and the general public >100m from the site;  
                      • Potential serious improvement to land stability;  
                      • Removal of major pollution linkage with a major pollutant source to Unproductive Strata;  
                      • Removal of a moderate pollutant linkage with a moderate pollutant source to Secondary Aquifer and Regionally designated / protected areas or local areas;  
                      • Removal of a minor pollutant linkage with a minor pollutant source to Principal Chalk Aquifer and nationally designated / protected areas; and  
                      • Removal of existing relatively small-scale source of potential contamination or pollutant linkage (via existing and Redevelopment introduced materials, structures and services). |
| Major Beneficial  | • Potential serious or moderate improvement to human health of site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the site;  
                      • Removal of a moderate pollutant linkage with a substantial or moderate pollutant source to Principal Chalk Aquifer and nationally designated / protected areas; and  
                      • Removal of a major pollutant linkage with a substantial pollutant source to Secondary Aquifer, Secondary Undifferentiated Aquifer and Regionally designated / protected areas or local areas. |

**Consultation**

3.21 AECOM submitted a Scoping Opinion request to the LLDC PPDT setting out the proposed approach, methodology and scope of the Environmental Impact Topic Reports, including this Ground Conditions Impact Topic Report, on the 10th March 2016. The LLDC PPDT did not request any changes to the approach set out in the Scoping Opinion Request.

3.22 Subsequent to the submission of the Scoping Opinion Request, and a further review of the committed developments in the area, those currently under construction are taken to be in the baseline scenario (rather than assessed cumulatively) as these developments are likely to be completed and occupied prior to any works for the redevelopment of the Site getting underway. Table 6 and Figure 1 below sets out the list of committed developments and where these are considered within this report.
<table>
<thead>
<tr>
<th>Application No.</th>
<th>Scheme</th>
<th>Applicant</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14/00191/FUL</td>
<td>Cooks Road</td>
<td>Bellway Homes</td>
<td>Cooks Road, London, E15 L.B Newham</td>
<td>Demolition of existing buildings and erection of two blocks ranging from five (5) to eight (8) storeys above ground level with a maximum parapet height of 30m AOD to provide: 349 residential units including affordable housing (Use Class C3), 3,113 sq. m of commercial floor space (Use Classes A1-A3/B1/D1/D2), together with podium level, car parking including blue badge parking, cycle parking, refuse areas, plant room, servicing, open space, landscaping. Considered in the assessment of cumulative effects</td>
</tr>
<tr>
<td>14/00422/FUL</td>
<td>Marshgate</td>
<td>Workspace 14 Limited</td>
<td>Land at Marshgate Lane, Pudding Mill, Stratford, London, E15 2NH</td>
<td>Demolition of existing buildings and the erection of 8 buildings ranging from 3 to 12 storeys in height, comprising a total of 254 residential dwellings and 4,257 sq. m GIA of B1 (business) floor space, together with basement, servicing, car parking, cycle parking, cycle storage, plant, open space and landscaping. Considered in the assessment of cumulative effects</td>
</tr>
<tr>
<td>11/90619 FUMODA</td>
<td>68-70 Stratford High Street</td>
<td>Lancaster PLC</td>
<td>68-70 Stratford High Street, London, E15 2NE</td>
<td>Demolition of existing buildings and erection of new development comprising linked buildings of one, five, nine and eighteen storeys to provide 731 sq. m of commercial floor space (A1,A2,A3,B1,D1&amp;D2) at ground floor and 173 residential units, with 36 car parking spaces, 213 cycle parking spaces, refuse and recycling facilities, access, landscaping and amenity areas. Considered in the assessment of cumulative effects</td>
</tr>
<tr>
<td>06/90011 FUMODA</td>
<td>80-92 Stratford High Street</td>
<td>Manser Homes Ltd</td>
<td>Stratford Edge, 80-92 Stratford High Street, London, E15 2NE</td>
<td>Redevelopment of the site to provide a 27 storey tower with a 6-storey street building comprising of 2902 residential units, 792 sq. m of offices at ground floor and first floor, 218 sq. m of a café/bar (Class A3/A4) or office or leisure use at ground and first floor with 65 car parking spaces, 150 cycle spaces, 32 motorcycle spaces in a basement car park with access via the High Street and associated landscaping. Considered in the assessment of cumulative effects</td>
</tr>
<tr>
<td>Application No.</td>
<td>Scheme</td>
<td>Applicant</td>
<td>Address</td>
<td>Description</td>
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<tr>
<td>----------------</td>
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<td>-------------</td>
</tr>
</tbody>
</table>
| 10/90519/FUMODA | Capital Towers | Galliard Homes | 2 - 12 High Street, Stratford, London, E15 2PW | Development comprising 15 and 35 storey building to provide 765 sq. m of commercial floor space and 191 residential units with 41 car parking spaces, 307 cycle parking spaces, gym, crèche, landscaping and riverside walkway.  
**Considered in the baseline** |
| 11/90621/OUTODA/PDZ8 | Pudding Mill | LLDC | Pudding Mill Lane LB Newham | Pudding Mill site (Site PDZ8), received outline planning permission with a total of 158,235sqm of floorspace, delivering 118,290m² residential (Class C3) (including up to 4000m² of Sheltered Housing), 5,045m² retail (Classes A1-A3), 23,791m² office (Class B1a), 12,158m² employment (Class B1b/B1c), 169m² leisure (Class D2) and 1,482m² community (Class D1).  
The proposals also include a drop-in health centre, nursery school and general community space.  
**Considered in the assessment of cumulative effects** |
| PA/08/1161 | St Andrews | Barratt Homes | St Andrews Hospital, Devas Street, E3 3NT | Demolition of existing hospital and construction of: 27 storeys & basement (block D), 18 storeys (Block E), and between 4-13 storeys (Blocks A-C) for 964 dwellings, 303 sq. m of A1, A2, A3 & A4 floor space. Up to 897 sq. m (D1) and/or (D2) & 2,004sq. m Primary Care Trust (PCT) facility (D1).  
**Granted: 2009**  
**Considered in the baseline** |
| PA/11/02423 | Bow River Village | Southern Housing Association | Thames Gateway (East London) | Planning permission was granted in 2012 for a Masterplan delivering over 700 units and 100,000 sq. ft. of commercial space. As a portion of this committed development sits within the Site itself, only the elements outside of the Site are considered within the assessment of cumulative effects, comprising demolition of the existing buildings and construction of 8 blocks to provide 453 residential units, a car dealership, an additional 1,718m² GIA commercial floorspace, open space and parking.  
**Considered in the baseline** |
<table>
<thead>
<tr>
<th>Application No.</th>
<th>Scheme</th>
<th>Applicant</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/00336/LTGOUT</td>
<td>Strand East</td>
<td>Vastinct LandProp</td>
<td>Strand East</td>
<td>10 Hectare mixed-use development comprising: 1,200 new homes (40% 3 beds), 620,000 sq. ft. of business and commercial space, including local shops =, cafes, restaurants and other community facilities, together with a 350-bedroom hotel. Considered in the assessment of cumulative effects</td>
</tr>
<tr>
<td>PA/11/03549/A1</td>
<td>Lock Keepers</td>
<td>Peabody</td>
<td>Units 1, 2 &amp; 3 Riverside Industrial Estate, 18 Gillender Street, E3</td>
<td>Demolition of existing storage/warehouse buildings &amp; redevelopment to provide 1,778 sq. m mixed commercial (B1) &amp; 109 residential units (C3) within three buildings from 5/6 to 12/13 storeys, new ground level community amenity &amp; children’s playspace; disabled and car club residential parking spaces and commercial service bays. Granted: 2012 Considered in the baseline</td>
</tr>
</tbody>
</table>
Limitations and Assumptions

3.23 The ground conditions impact assessment has been based upon details of the Illustrative Masterplan, provided by KCA Architects, and reports made available for review (e.g. the Envirocheck® Report (Ref. 2), Phase I Geoenvironmental Assessment Report (URS, January 2009) (Ref. 20), Tesco Store Ltd Environmental Statement (GL Hearn, April 2010) (Ref. 21) and Environmental Statement (Alliance Planning; April 2012) (Ref. 22).

3.24 AECOM have not independently verified the data included within third party reports.
BASELINE CONDITIONS

Introduction

4.1 This section of the report provides a description of the current baseline conditions present at the Site in relation to ground conditions, contaminated land and groundwater.

Baseline Conditions

Geological Conditions

4.2 The Site is located in Hancock Road, Bromley By Bow, London, immediately north of Bromley By Bow Underground Station. The general topography of the Site slopes at a gentle gradient upwards from the River Lea toward Hancock Road.

4.3 Based on a review of published geological maps (Geological Map 256 – North London) and the BGS Geology of Britain Viewer (Ref. 25), it is understood that the Site is within an area underlain by diversified drift geology, including Alluvium and River Terrace Deposits (Taplow Gravel Formations and Kempton Park Gravel) in order of depth. Below the drift, the geological succession comprises London Clay, overlying Lambeth Group and Thanet Sand, with the Upper Chalk at depth.

4.4 BGS Borehole logs (Ref. 25) from boreholes drilled on-site align with the expected geological conditions, which are further described below:

- Made Ground – Mixed lithology to varying depths across the area, up to 4.5m bgl; BGS boreholes reported silty sandy gravelly clay with bricks, ash, glass, nail, brickwork, metalwork and ferric nodules. Hydrocarbon evidence was reported in TQ38SE2866;
- Alluvium - described as silty organic-rich clay (encountered in TQ38SE2866 between 4.45m and 5.05m bgl);
- River Terrace Deposits – described as sandy silty gravel, encountered from approximately between 1.5 and 4.2m bgl to approximately 3m and 8m bgl;
- London Clay – described as grey stiff silty clay with occasional sandy pockets, encountered from approximately between 3 and 8m bgl to approximately 17m and 22m bgl;
- Lambeth Group (Woolwich and Reading Beds) – sandy clayey silt with gravel and shell fragments; and
- Thanet Sand Formation – Sand with silty clayey pockets, encountered from approximately 19.5m bgl.

4.5 Ground conditions under the Site are summarised in Table 7.

Table 7: Published Geological Stratigraphy

<table>
<thead>
<tr>
<th>Boreholes</th>
<th>Proven Data from BGS Boreholes</th>
<th>Groundwater record</th>
</tr>
</thead>
<tbody>
<tr>
<td>TQ38SE253</td>
<td>0 to 2.74m: Made ground. 2.74 to 3.35m: Sand and gravel. 3.35 to 4.6m: Yellow clay. 4.6 to 15.24: Blue clay.</td>
<td>NA</td>
</tr>
<tr>
<td>TQ38SE411</td>
<td>0 to 2m: Made ground – mottled silty sandy CLAY with flint fragment and brick fragments. 2m to 3.70m: Sandy gravel with clayey pockets. 3.70m to 4.20m: yellow brown sandy gravelly clay with occasional iron staining. 4.20m to 19.70m: clay, silty clay and sandy gravel (LONDON CLAY) 19.70m to 20.0m: silty sandy clayey gravel.</td>
<td>Groundwater strikes: 1.50m (rose to 1.40m) 12.20m 19.30m (rose to 9.0m bgl)</td>
</tr>
<tr>
<td>Boreholes</td>
<td>Proven Data from BGS Boreholes</td>
<td>Groundwater strikes:</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>TQ38SE863</td>
<td>0m to 1.40m: Made ground – mottled gravelly sandy silty clay with extensive ash, cinder, brickwork, metalwork. 1.40m to 3.90m: Sandy gravel with clay (THAMES BALLAST). 3.90m to 18.60m: silty clay (LONDON CLAY). 18.60m to 37.10m: sandy clayey silt, gravel and sand with shell fragments (LAMBETH GROUP). 37.10m to 40.00m: silty sand (THANET SAND FORMATION).</td>
<td>18.60m (rise to 8.30m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groundwater strikes:</td>
</tr>
<tr>
<td>TQ38SE2866</td>
<td>0m to 4.45m: Made ground – concrete above gravelly silty sandy clay with extensive brickwork, concrete and strong hydrocarbon colour (odour?). 4.45m to 5.05m: Silty organic-rich clay (ALLUVIUM). 5.05m to 7.80m: Sandy silty gravel (THAMES BALLAST). 7.80m to 25.00m: silty clay with occasional sandy pockets (LONDON CLAY) below (LAMBETH GROUP). No precise indication of the transaction from London Clay to Lambeth Group.</td>
<td>5.05m (rise to 4.80m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groundwater strikes:</td>
</tr>
<tr>
<td>TQ38SE4108</td>
<td>0m to 1.90m: Made ground – silty sandy clay with gravel and bricks and glass fragments. 1.90m to 3.80m: Very sandy gravel with silty pockets. 3.80m to 19.50m: Clay with occasional silty sand pockets (LONDON CLAY). 19.50m to 22.10m: silty clay gravel with clay (LAMBETH GROUP). 22.10m to 24.00m: sand with silty clayey pockets (THANET SAND FORMATION).</td>
<td>- 14m  - 17m  - 19m (rise to 10.70m bgl)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groundwater strikes:</td>
</tr>
<tr>
<td>TQ38SE4109</td>
<td>0m to 1.50m: Made ground – mottled gravelly silty clayey material with occasional ferric nodules. 1.50m to 2.80m: Silty sandy gravel and sand. 2.80m to 16.80m: Clay with occasional silty sandy pockets (LONDON CLAY). 16.80m to 18.90m: silty sandy gravel with clay. 18.90m to 22.30m: sand with silty clayey pockets. 22.30m to 28.00m: silty sandy/very sandy clay.</td>
<td>- 8.30m (rise to 8.25m bgl)  - 16.70m (rise to 9.80m bgl)  - 18.90m (rise to 12.30m bgl)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groundwater strikes:</td>
</tr>
<tr>
<td>TQ38SE4113</td>
<td>0m to 1.70m: Made ground – sand and flint gravel with cobbles. 1.70m to 2.65m: Very sandy gravel with occasional cobbles. 2.65m to 21.35m: Clay and silty sandy clay with occasional silty sandy pockets (LONDON CLAY). 21.35m to 25.00m: sand and clayey silty pockets (LAMBETH GROUP).</td>
<td>- 11.50m (rise to 10.59m bgl)  - 17.85m (rise to 9.02m bgl)  - 20.00m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groundwater strikes:</td>
</tr>
<tr>
<td>TQ38SE4114</td>
<td>0m to 4.05m: Made ground – clayey sandy silt with gravel. 4.05m to 4.80m: silty clayey sand with gravel. 4.80m to 16.70m: Clay and silty sandy clay with occasional silty sandy pockets (LONDON CLAY). 16.70m to 19.55m: sand, gravel and clay (LAMBETH GROUP). 19.55m to 25.00m: silty sand and very sandy silty clay (THANET SAND FORMATION).</td>
<td>- 2.90m  - 7.70m (rise to 7.45m bgl)  - 16.70m (rise to 10.45m bgl)</td>
</tr>
</tbody>
</table>

Footnotes: m = metres, bgl = below ground level
4.6 Table 8 summarises the levels of potential geotechnical hazards identified at the Site in the Envirocheck® Report (Ref. 2).

Table 8: Potential Geotechnical Hazards

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Reported Hazard Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential for Collapsible Ground Stability Hazards</td>
<td>No Hazard to very Low</td>
</tr>
<tr>
<td>Compressible Ground Stability</td>
<td>No Hazard to Moderate</td>
</tr>
<tr>
<td>Ground Dissolution Stability</td>
<td>No Hazard</td>
</tr>
<tr>
<td>Landslide Ground Stability</td>
<td>Very Low (to Low 178m NE of site)</td>
</tr>
<tr>
<td>Running Sand Ground Stability</td>
<td>Very Low</td>
</tr>
<tr>
<td>Shrinking or Swelling Clay Ground Stability</td>
<td>No hazard to Low (to Moderate 218m SW of site)</td>
</tr>
<tr>
<td>Radon Affected Areas</td>
<td>No, the property is in an intermediate probability radon area, as between 1 and 3% of homes are above the action level</td>
</tr>
</tbody>
</table>

4.7 The overall potential for geotechnical hazards at the Site is low. However, the Envirocheck Report highlights a moderate hazard associated with compressible ground stability on-site. The URS Phase I Report (Ref. 24) recommends that areas of soft ground such as soft alluvium or peat should be investigated and eventually removed or improved.

4.8 The Tower Hamlets Cemetery Park, located approximately 900m west of the Site, is designated as a Local Nature Reserve.

4.9 Nitrate Vulnerable Zone records produced by DEFRA are recorded from approximately 20m north-east of the Site and continuing upstream (to the north) and downstream (to the south) along the River Lea watercourse.

Hydrogeological and Hydrological Conditions

4.10 Review of the Landmark Report (Ref. 2) and EA’s website (Ref. 28) indicate that the Site overlies a Secondary Undifferentiated Aquifer, associated with the alluvial deposits along the eastern border and Secondary A Aquifers, associated with the Taplow Gravel Formation and Kempton Park Gravel Formation.

4.11 The status of Secondary Undifferentiated Aquifer has been assigned in cases where the layer has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

4.12 Secondary A Aquifers are described by the EA as permeable layers 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. These are generally aquifers formerly classified as minor aquifers.

4.13 The underlying solid geology of London Clay Formation is classified as Unproductive Strata. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Consequently, the London Clay reduces the likelihood of the vertical migration of shallow groundwater to deeper aquifer units.

4.14 The underlying solid geology of Lambeth Group and Thanet Sands are classified as Secondary A Aquifers. Secondary aquifers are considered to be moderately vulnerable to pollutants, due to permeability. In terms of receptor sensitivity, Secondary Aquifers are assessed as being of ‘Moderate Sensitivity’.

4.15 The Chalk strata, which is at depth beneath the Lambeth Group is classified as a Principal Aquifer. These are layers of rock or drift deposits that have inter-granular and/or fracture permeability and can often provide a high level of water storage. They may support water supply and/or river base flow in a strategic scale. Due to their high permeability, Principal Aquifers are considered to be highly
vulnerable to pollutants. In terms of receptor sensitivity, the Principal Chalk Aquifer is assessed as being of 'Very High Sensitivity'.

4.16 Shallow groundwater is present within the alluvial deposits, potentially in hydraulic continuity with the nearby River Lea.

4.17 BGS boreholes logs show groundwater strikes between 1.5 and 5.0m bgl, within the drift geology (alluvium and River Terrace Deposits) (Ref. 29).

4.18 BGS boreholes logs show groundwater strikes within the deeper geology at between 7.7m and 21.8m bgl, in confined condition (Ref. 29).

4.19 The nearest surface water feature is the River Lea, adjacent to the eastern border of the Site. Based on the EA’s river basin management plan data (2009), the River Lea was classified as having a fair ecological quality and a fairly good chemical quality (Ref. 2).

4.20 Review of the EA’s website indicates that the Site is not located within a Groundwater Source Protection Zone (SPZ). The nearest SPZ (Zone III - Total Catchment) is located approximately 810m north of the Site. A Zone II (Outer Protection Zone) is located 820m north of the Site (Ref. 2).

4.21 The Envirocheck® Report (Ref. 2) has not identified any surface water or groundwater abstraction licenses within 250m of the Site.

4.22 The closest groundwater abstraction is 670m east of the Site and is registered to Anjuman-E-Iscahlul-Muslimeen Of Uk, for non-evaporative cooling. The remaining fourteen abstractions within 1km of the Site are predominantly used for non-evaporative cooling, dust suppression, environmental purposes (pump & treat pollution remediation) or for process water (Ref. 2).

4.23 The closest abstraction of surface water is 390m north-west of the Site from Bow Back River and is registered to British Waterways Board for industrial/commercial/public services (general use) (Ref. 2).

4.24 The Envirocheck® Report (Ref. 2) has identified twenty-seven discharge consents up to 1km from the site, two of these within 250m. The closest consent, held by Leycol Printers Ltd, is approximately 40m north of the Site to the River Lea Navigation and is for discharge of other matter-surface water (revoked on June 1991). The other consent, held by J & W Nicholson & Co (Holding) Ltd, is approximately 110m east of the Site for discharge of cooling water into land (revoked on September 1992).

4.25 The EA’s website (Ref. 27) shows that the Site falls in an area that has between low and very low chance of flooding from rivers or sea. ‘Low’ means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%). ‘Very low’ means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%). This takes into account the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail.

4.26 The site falls in an area that has very low chance of flooding from water surface. ‘Very low’ means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%) (Ref. 28).

**Contamination Potential**

4.27 The potential for the on-site contamination of soils and groundwater has been based on a review of the land-use history of both the Site and surrounding area.

**Historical Uses - On-Site**

4.28 The historical development of the Site was traced from old Ordnance Survey maps (Ref. 2) dating between 1869 and 2016.

4.29 The 1869 maps indicate steam boiler and tanks works in the south-western side. Residential properties are shown along the western boundary. Open land is shown to the north east. Imperial Works (Washing Chemicals) and a mill are shown to the south-east.

4.30 The very detailed historical building plan from 1893 (Scale 1" : 80") most notably shows (from the north to the south of the Site), a stone yard, mouldings, saw mill, picture frame facility, wharf, Crown chemical works, Vulcan chemical manufacturing, Safety Oil Company, jute spinning mill, moat, pottery and boiler and tank works.
4.31 The 1896 maps indicate steam boiler works and spinning mills in the south-western side replacing the previous features. Residential units appear to be extended to the south and are faced on Imperial Street. A large block is shown to occupy the open land to the north-east. Works are shown to the north-east (north of Three Mill Lane). Imperial Works and the mill are no longer identified.

4.32 By 1916, steam boiler works and spinning mills are no longer indicated on the map. Wharfs are shown to the north-east (Express Wharf) and to the south of Three Mill Lane.

4.33 The 1948 – 1950 maps indicate engineering works along the southern boundary and a travelling crane to the north of the works. Residential properties to the north are replaced by blocks. Tanks are shown on the northern area. An area labelled ‘ruin’ is present to the north east. Express Wharf is shown north of Three Mill Lane. Boiler house, tanks and oil storage tanks are located to the east, south of Three Mill Lane.

4.34 By 1953, engineering works and travelling crane are no longer identified on the map.

4.35 The very detailed historical building plan from 1958 (Scale 1” : 80’) most notably shows (from the north to the south of the Site), a Bitumen and Taroleum, many asbestos clad dwellings, Crown Chemical Works, saw mill, iron and steel stockyard, and boiler and tank works.

4.36 The 1961 – 1982 maps show new structures and tanks across the entire northern area. An electrical substation is indicated to the north.

4.37 The 1974 – 1982 maps show a warehouse to have replaced the residential units to the north of Imperial Street (south-west side of the Site). Works are still present on the south of the Site. By 1974, the wharf, boiler house, tanks and oil storage tanks south of Three Mill Lane are thought to be dismantled. By 1982, the wharf to the north of Three Mill Lane is no longer shown to be present.

4.38 By 1991, some redevelopment has occurred; the works and the warehouse in the southern area are no longer labelled on the map and the tanks in the north are not shown. Two electrical substations are shown to the north; a further electrical substation is shown to the east, south of Three Mill Lane. A superstore is located to the central area.

4.39 By 2006, the Site has evolved into its present layout, with a superstore in the central area, south of Three Mill Lane, a warehouse and further three small buildings in the northern area, three buildings south of Imperial Street and an open space in the south-east.

4.40 The Envirocheck® report (Ref. 2) identifies seven inactive contemporary trade directories on-site. The on-site inactive entries include asphalt & coated macadam laying contractors, printers, garage services, joinery manufacturers, home furnishings – manufacturers and commercial cleaning services.

**Historical Uses - Off-Site**

4.41 The Site is located in an area of East London that has a significant industrial heritage. Many generic works, factories, warehouses, wharfs and depots are shown in the proximity of the Site from 1882. Railway lines (labelled as London, Tilbury & Southend Section in the 1896 map and then identified as District and Hammersmith & City lines) run along the southern boundary.

4.42 The historical map dated 1869 shows Lloyds Paper Mills (150m north), soap works (100m north), lime works (250m north), safe works (200m north) Stepney Union Workhouse (100m west) and starch works (100m west).

4.43 The historical map dated 1896 shows London and Glasgow Foundry (iron foundry) immediately north of the Site, gas works (200m south-east), stone works (150m north-east), blue works (150m north-east), boiler works (150m north-east), asphalt works (250m north-east), Bromley maltings (200m south), Three Miles Distillery (100m east), manure works (250m south-east), St Leonard’s Work (200m south), malting works (200m south), stone works (200m north-east), blue works (200m north east), workhouses (200m south-west), brush and fibre works (500m north), soap works (500m north), saw mill (500m north), gas works (700m north-east) with the associated GER goods and coal depot (1000m north-east), chemical works (800m north-east), Bromley gas works (250m south-east), printing ink works (250m north) and match manufactory (400m south-west).

4.44 By 1920, a starch factory is shown 50m east of the Site.

4.45 By 1948-1950, a number of engineering works (Riverbank Works) are in place north-east of the Site. Tredegar Wharf is directly north of the Site, St Leonard Works (textile) are 100m north, Meesons
Wharf (animal charcoal) is 100m north-east, printing ink works are 250m north-east. Tanks, oil tanks, spent wash tanks and electrical substations are shown within the Three Mills Distillery (100m east).

4.46 The historical maps dated 1951 to 1955 show lime work (250m north), Bromley Good Depot (20m south), St Andrew Hospital (20m south-east), Russia Wharf and saw mills (300m south-west).

**Present Uses - On-Site**

4.47 A site reconnaissance visit was undertaken on 22nd March 2016. The site visit was limited to the publicly accessible areas of the Site only.

4.48 Photographs from the site visit are included below.

4.49 The Site is circa 6 hectares (ha) in size and currently accommodates the following (from north to south):

A large unlabelled warehouse with offices and car parking (2 No ICB's one labelled scrap oil at rear of building)
Petit Forestier depot, maintenance garages and sub station (unbunded fuel / oil tanks, block plinth, and heavy oil staining observed on the floor, around ten trucks awaiting repair or scrapping stored at the rear of the garage/ maintenance workshop)

Nightclub
Tesco supermarket, with the associated car parks, loading bay, sub-station and recycling bins.

Tesco filling station and sub station.

Derelict site, with security guards (south-west).
Automec offices and car parking

Scaffolding yard, offices and car parking
4.50 During the URS site visit in October 2008 (Ref. 20) the privately occupied site areas were accessible and the following was noted:-

- The large unlabelled warehouse with offices and car parking was identified as the Leycol Printers site. The northern portion of the Site was occupied by a large two storey warehouse building. Discussions with the operations manager (at that time) indicated that the site used to form part of the adjacent Petit Forestier Colas site to the south (occupied by Ideal Furniture Ltd in 2008) and could have been in use as a bunker.

- The only other built structure on-site was an electricity substation in the south-west corner. The ground floor of the warehouse was occupied by the printing and finishing machinery, waste chemical storage, ink and chemical storage, offices and welfare amenities and product dispatch area. Reprographics rooms and paper storage are located on the first floor. The plant room was situated on the roof of the building along with air conditioning units.

- Ideal Furniture (now labelled as occupied by Petit Forestier) consisted of a small, two storey office building, and a large vehicle maintenance depot. A large above ground storage tank (approximately 13,000 litre volume) for road diesel was noted in the centre of the Site. This was not in use for the 2008 site operations and was allegedly a legacy from the former site operators. The gauge on the side of the tank indicated that approximately 2000 litres of fuel remained in the tank.

**Present Uses - Off-Site**

4.51 The Site is located within a predominantly commercial area. It is bounded to the west by Hancock Road and the Blackwall Tunnel Northern Approach (A12), and beyond that by residential areas with Bromley Recreational Ground; to the north by a construction site, previously occupied by a warehouse and further industrial developments; to the east by the River Lea, and beyond by further warehouses (to the north-east) and schools (East London Science School, Three Mills Studios and the International School of Screen Acting); to the south by railway lines (District and Hammersmith & City lines) and gas holders beyond.

4.52 The Envirocheck® report (Ref. 2) identifies 22 entries within 250m (three active and 19 inactive). The active entries recorded within 250m of the Site include aluminium fabricators and lighting manufacturers.

4.53 The Envirocheck® report (Ref. 2) identifies an operational fuel stations (Tesco filling station) approximately 117m east.

4.54 According to the Envirocheck report, there are five Integrated Pollution Controls (IPC) permits located within 1 km of the Site. These relate to manufacture and use of organic and inorganic chemicals. The closest IPC permit, held by Pigments Ltd, is located approximately 350 m north-west of the Site, for manufacture and use of organic chemicals.
4.55 There are thirteen Integrated Pollution Prevention and Control (IPPC) permits located between 250 m and 1 km of the Site. These relate to manufacture and use of organic and inorganic chemicals. The closest IPPC permit, held by City Oils Limited, is located approximately 425 m north-west of the Site, for organic chemicals.

4.56 Two historic landfills for inert waste, in use between 1983 and 1984 and between 1993 and 1994, were located approximately 700m north-east and 930m north-west of the Site.

4.57 Four Licensed Waste Management Facilities are located within 500m from the Site; the closest are a metal recycling site, held by Collins Tony Dennis and located 260m north of the Site and a special waste transfer station, held by yy Waters (Leyton) Ltd, 380m south-east of the Site.

Previous Reports Review

GL Hearn, April 2010; Tesco Store Ltd, Environmental Statement (ES)

4.58 The April 2010 Tesco Store ES relates to the central and southern part of the Site, located between Three Mill Lane and the rail lines, currently occupied by the Tesco Store, filling station, car parking, scaffolding yard and depot. The ES quotes a site investigation report, although this was not available for review at the time of writing.

4.59 The ES states that the available data on the extent of the contamination is not comprehensive, especially across the area of the existing Tesco Store. Made ground across the southern section of the site is reported to be impacted by metals including arsenic, chromium and lead. A number of potentially discrete hydrocarbon hotspots in the soil, with known plumes of hydrocarbon contamination, are reported in the groundwater in the south-west and south-east. The latter is reported to be likely associated with the in-filled moat. The ES reports a plume of dissolved selenium in the groundwater across the southern end of the site and that such contamination may also be present in the north of the Site, but has not been fully investigated. No asbestos was found on the Site.

4.60 The ES concluded that “based on the currently available information, the main contamination issues on the site have been identified, although more detailed investigation is required to accurately delineate the extent of impacts across the site. It is considered that such issues could be addressed through a suitable planning condition”.

4.61 Following the investigations, a preliminary remediation strategy has been developed by GL Hearn, and although unavailable for review at time of writing was described in the ES as follows:

“the development proposals include provision of a shallow basement across a significant area of the site. As the soil contamination is generally contained within the near surface Made Ground, this will reduce the amount of residual contamination on site, simply as a result of construction activities. In addition the nature of the development includes hard cover over most of the site, with managed landscaping provided in the north east. This type of development, with a suitably design capping layer effectively provides a barrier which isolates residual soil contamination from site users.

Given the shallow groundwater, basement construction may result in a requirement for local dewatering. This will potentially remove some contaminated groundwater. However, some additional local groundwater treatment may be necessary to protect the groundwater and surface water from the effects of residual contamination which does not pose a risk to site occupants.

In addition, it is likely that the infilled moat feature may have acted as sump to collect contamination. Assuming additional investigation proves this to be the case, local removal of contamination for disposal or treatment will be required.

All soils to be removed from the Application Site will be disposed in accordance with The EU Landfill Directive. The capping layers will be provided, and basement excavation soils removed, during the ongoing development of the Application Site.

In addition to soil remediation, there will be a requirement to provide protection against a low risk of soil gas ingress. Typically a gas membrane, and possibly passive underfloor venting, would be incorporated in the building construction. Validation reports will be submitted on completion of the relevant phases/works to the Regulatory Bodies for their comment and approval.”

4.62 The remediation strategy proposed to remove basement spoil and treat or remove additional residual hotspots of soil contamination. It also suggests the removal of free product and the application of associated groundwater treatment as necessary. Provision of suitable capping layers in areas of
landscaping together with the hard covering of the site by the buildings and roads mitigates against the potential adverse impacts of contamination on flora and fauna as well as occupants.

4.63 The ES suggests a suitable mitigation strategy with respect to selection of pipework materials, especially for water supply pipes on-site.

4.64 The ES states that the implementation of suitable gas protection measures, typically a gas impermeable membrane and possibly passive underfloor venting, (subject to confirmation) will mitigate against potential adverse impacts associated with soils gases.

URS, January 2009; Phase I Geoenvironmental Assessment Report

4.65 The January 2009 Phase I report relates to the northern side of the Site (north of Three Mill Lane). It also considers the area north of the Site, up to the High Street A11.

4.66 The report identifies moderate potential for ground contamination from historic and current site activities.

4.67 The report identifies the secondary aquifer and the River Lea as the main potential receptors of contaminants in soil. It is anticipated that the presence of the river wall may afford the River Lea some degree of protection, however this would be dependent on its condition. If a perched water table is present within the made ground, this may also act as a source of contamination to the underlying secondary aquifers. A potential human health risk may exist to current site users in areas where hardstanding is damaged, incomplete or absent through dust and vapour inhalation pathways.

4.68 The report identifies a likely risk from soil gas on the Site due to the likely presence of made ground and the underlying natural Alluvium.

4.69 In conclusion, a targeted geoenvironmental investigation is recommended in the accessible areas of the Site to assess ground, groundwater and ground gas contamination. In particular the proposed intrusive investigation should be targeted on areas around identified fuel storage tanks and electricity substations, and in areas where historic land uses such as chemical works, engineering works, and storage tanks were identified.

4.70 The Phase I suggests that future geotechnical investigations would need to address the following uncertainties related to ground conditions:

• The top and the thickness of the London Clay;

• Groundwater elevations and conditions within shallow ground, including an estimate of potential tidal effects. Groundwater conditions within the Lambeth Group / Thanet Sand may also be investigated, especially if high structures are expected on site;

• Soil strength information for shallow alluvial soil and deeper London Clay and Lambeth Group; and

• Obstructions resulting from foundations or basements of existing buildings.

4.71 A future detailed site investigation scope would likely involve boreholes to depths of approximately 10 to 15 m bgl, with at least two boreholes at depths of 20-25 m to prove the full thickness of the London Clay. The investigation should also include in situ testing of soils, laboratory testing for soil strength and contamination levels, and installation and monitoring of groundwater and gas monitoring wells.

Alliance Planning; April 2012; Environmental Statement – Bromley by Bow North/Bow River Village

4.72 The Alliance Planning ES relates to the Bromley by Bow North/Bow River Village scheme which encompasses the northern end of the Site (north of Three Mill Lane). It also considers the area north of the Site, up to the High Street A11.

4.73 The ES identified potential sources of contamination which could pose a risk to sensitive receptors such as site workers, the River Lea, the groundwater, local services and the new development.

4.74 The preliminary conceptual model for the Site indicates a number of historic and current potentially significant contaminative uses both on-site and around the Site. These include various metal chemical works, bitumen and petrol works, a foundry, vehicle servicing and MOT garages, a soap works, and an electroplating works amongst others. There are also known and historic tanks for the bulk storage of hydrocarbons, oils and other liquids.
4.75 Intrusive investigation is suggested to confirm the nature and extent of any contamination on the Site and to accurately assess the risks, prior to any development commencing on site.

Contamination Summary - On-Site

4.76 The historical review indicates that significant potential sources of ground based contamination are present on-site and in the surrounding areas. Potential contamination sources include various historical uses of the Site, such as steam boiler and tank works, chemical works, engineering works, Oil Company, mills, iron and steel stock yards, wharfs, asbestos clad dwellings and many tanks. Existing made ground is also considered a potential source of contamination, as it is likely to have incorporated demolition materials from historic developments on-site.

4.77 Potential sources of contamination currently present on-site are the filling station, vehicle maintenance and garage facilities, various oil/fuel tanks, electrical substations, various waste and recycling areas, car parking areas, fly tipping and the printing works.

4.78 A number of suspected Asbestos Containing Materials (ACM) have been reported to have been identified during former site visit on-site (Ref. 20 and 22).

4.79 The Site has been the subject of a number of desk studies and ground investigations which have been carried out to establish the geology and the groundwater conditions and identify the presence of contamination in the soil and/or groundwater. Based on the available information, it is clear that the site is impacted by contamination, but the full extent and severity is uncertain.

4.80 In order to determine the current contaminative status of soil and groundwater on site, a Phase II Environmental Site Investigation will be undertaken prior to any intrusive works for the redevelopment. The Site Investigation is expected to be undertaken in response to a planning condition. This investigation could also provide further geotechnical information to aid the foundation design process, gas monitoring data to provide details of any gas protection measures required and classification of soils requiring excavation and off-site disposal.

Ground Gas

4.81 The ground gas regime has not been fully investigated across the entire site, since previous reports related to central and southern part of the site (Ref. 17) reported “no methane and up to 10.6% carbon dioxide, and no flow measurements provided”.

4.82 Flow measurements are essential to assess the risk and determine the requirement for any gas protection measures. Ground gas can emanate from any alluvial material rich in organics and the made ground and infill present beneath the site. Ground gas monitoring in line with current guidance British Standard (BS) 8485:2007 and CIRIA C665 (Ref. 43 and 44) will be carried out as part of the Phase II Site Investigation referred to in paragraph above.

Contamination Summary - Off-Site

4.83 There are a large number of off-site historical and current industrial land uses associated with heavy industry and the use of potential contaminants. These include iron foundry, railway lines, asphalt works, distilleries, manure works, gas works, printing ink works, match manufactory, sewage pumping stations, engineering works, starch factory, wharfs, electrical substations and storage of fuels.

Underground Structures

4.84 A number of underground assets are anticipated to be located beneath the Site associated with supplying utilities such as water, electricity, gas and telecommunications to the former buildings. Further data collection and review will be undertaken prior to demolition and construction work to confirm the presence or absence, and precise locations, of such assets.

4.85 The ES for the Tesco Store (Ref. 25) reported that numerous exploratory holes refused on encountering buried obstructions such as concrete slabs, probably related to residual structures and foundations buried on the site.

Unexploded Ordnance

4.86 The 2008 Bactec report ‘Explosive Ordnance Threat Assessment of Hancock Road, Bromley by Bow, London’ (Ref. 45) for URS focuses on the northern portion of the Site and identifies the risk of UXO at the Site due to the following:
• The Site is located in an area which sustained heavy bombing throughout World War II (WWII);
• Bomb records report a number of bombing incidents in close proximity to the Site, including a UXB within or close to the south-eastern corner of the Site;
• Bomb damage maps show that the majority of the structures on-site sustained severe damage and underwent repair;
• Potential for any UXO at the Site to have been buried by rubble from the damaged buildings;
• Potential for UXO to have fallen unnoticed into the River Lea and due to the river’s curve, penetrated the bank of the river along the Site’s boundary; and
• Anti-Aircraft Artillery (AAA) batteries were deployed around the area that the Site is located.

4.87 Although post war development has taken place over the Site, maximum bomb penetration depth has been assessed as being up to 14m below WWII ground level. Post war development may therefore not have fully mitigated the risk of UXO at depth.

4.88 A UXO risk assessment should be implemented for the remainder of the Site.

Baseline Summary - Conceptual Site Model

Potential Sources of Contamination

4.89 Potential on-site sources of contamination or hazards at the site have been identified as:
• General soil and groundwater contamination of the made ground and underlying superficial deposits;
• Potential for UXO; and
• Potential for ACMs.

4.90 The varied historical uses of the surrounding land provide many potential off-site sources of contamination or hazards at the Site.

Identified Receptors

4.91 The site specific receptors were identified based on the proposed land-use as well as the environmental setting of the site. Table 9 presents the identified potentially sensitive receptors that will be considered within the ground conditions assessment.

<table>
<thead>
<tr>
<th>Identified Receptors</th>
<th>Receptor Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human health – contractors carrying out demolition and construction works</td>
<td>High</td>
</tr>
<tr>
<td>Human health – Neighbouring uses, occupiers and the general public immediately adjacent to the Site, including users of the River Lea</td>
<td>High</td>
</tr>
<tr>
<td>Human health – Neighbouring uses, occupiers, and the general public &gt; 100m from the Site boundary</td>
<td>Low</td>
</tr>
<tr>
<td>Human health – Site Redevelopment end users</td>
<td>High</td>
</tr>
<tr>
<td>Secondary A and Undifferentiated Aquifers</td>
<td>Medium</td>
</tr>
<tr>
<td>Principal Chalk Aquifer</td>
<td>High</td>
</tr>
<tr>
<td>Surface water features (River Lea)</td>
<td>Medium</td>
</tr>
<tr>
<td>Existing and proposed new utilities and infrastructure both on site and in close proximity (e.g. foundations, utilities and associated pipework)</td>
<td>Medium</td>
</tr>
<tr>
<td>Identified Receptors</td>
<td>Receptor Sensitivity</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Land stability (based on known geology in the area)</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Potential Pathways**

4.92 Human health exposure pathways are dependent on the proposed end-use of the Site (residential led mixed-use development). The human health exposure pathways that are considered viable based on UK guidance (CLEA (Ref. 44)) are listed below:

- Direct ingestion of soil and dust;
- Dermal contact with soil and dust;
- Ingestion of groundwater;
- Inhalation of dust; and
- Inhalation of vapours (from soils and groundwater).

4.93 The evaluation of exposure pathways for controlled waters receptors requires an understanding of geological and hydrogeological pathways beneath the Site. The controlled waters pathways considered viable with respect to the site are as follows:

- Leaching and downward vertical migration of contaminants from the made ground into the underlying secondary aquifers (Alluvium and River Terrace deposits);
- Downward vertical migration of contaminants from the made ground through the superficial deposits and the London Clay into the underlying Lambeth Group and Thanet Sand Secondary A Aquifers (via preferential pathways created through piling) and into the underlying Chalk Principal Aquifer; and
- Lateral migration of perched water and surface runoff to surface water features (e.g. River Lea) or off-site.
DESCRIPTION OF THE ILLUSTRATIVE MASTERPLAN
DESCRIPTION OF THE ILLUSTRATIVE MASTERPLAN

Introduction

5.1 This section provides a description of the illustrative masterplan in relation to ground conditions. This section also outlines the redevelopment parameters which are applicable to the assessment of a worst-case scenario for ground conditions.

Review of Illustrative Masterplan

5.2 The redevelopment of the Site will comprise the demolition of the existing buildings and the construction of a residential led mixed-use development to be accommodated over a number of new buildings shown in the illustrative masterplan to be ranging in height from up to 2 storeys to a maximum of up to 25 storeys (Ref. 26).

5.3 The illustrative masterplan comprises the following uses and quantum of development:

- 1,690 residential units;
- 4,160m² gross internal area (GIA) workspace;
- 2,324m² GIA retail (excluding the new Tesco store);
- 1,341m² GIA retail store (Tesco);
- 727m² GIA social infrastructure;
- 2,844m² GIA primary school;
- Parking; and

- Public open space, public realm, communal courtyards and play areas.

5.4 The illustrative masterplan does not include the provision of any basements. Figure 2 provides the illustrative ground floor layout (KCA drawing 266-A-D-100-00 illustrative ground floor plan).
Environmental Design and Management

5.5 A number of environmental mitigation measures are expected to be employed as standard to minimise impacts to both human health and controlled waters during the demolition and construction phase of the redevelopment of the Site.

5.6 A number of potential environmental impacts that will be avoided, prevented, reduced or offset through these mitigation measures include:

- Human exposure through direct contact / inhalation / dermal uptake of contaminants;
- Creation of preferential pathways and mobilisation of contamination;
- Contamination of natural soils, driving of contamination into an aquifer during piling, contamination of groundwater with concrete, paste or grout;
- Pollution and degradation of water quality of any underlying aquifer;
- Infiltration and / or run off into the local drainage / sewerage network - pollution of drainage and sewerage network and any adjacent surface water features;
- Run off and infiltration of contaminants from material stockpiles;
- Contamination of drainage and sewerage network and / or groundwater; and
- Spread of nuisance dusts and soils to the wider environment and local roads.

5.7 Table 10 below lists the mitigation measures expected to be employed throughout the demolition and construction process. These mitigation measures are being considered at this early stage in this chapter to avoid the consideration of impact assessment scenarios that are unrealistic and usually mitigated by best practice demolition and construction techniques.

Table 10: Demolition and Construction Standard Mitigation Measures

<table>
<thead>
<tr>
<th>Mitigation Measures</th>
<th>Regulatory / Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Work will be carried out in accordance with relevant Construction Design Management (CDM) Regulations 2015 (Ref. 45), details of these measures will be presented within the Health and Safety Plan (H&amp;SP), and the Environmental Management Plan (EMP).</td>
<td>2. The EMP will be prepared prior to commencement of works, setting out the management, monitoring, auditing and training procedures, and the mitigation measures that will be put in place during demolition and construction, to maintain compliance with the applicable regulations. In order to reduce the likelihood of contamination and protect human health and controlled waters from effects related to ground conditions, the EMP will include mitigation measures such as those presented here.</td>
</tr>
<tr>
<td>2. The EMP will be prepared prior to commencement of works, setting out the management, monitoring, auditing and training procedures, and the mitigation measures that will be put in place during demolition and construction, to maintain compliance with the applicable regulations.</td>
<td>3. A competent/licensed contractor will survey (pre site preparation survey as defined by the HSE) and remove asbestos containing materials and other materials and structures contaminated with asbestos fibres.</td>
</tr>
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<td>4. A Pollution Response Plan will be drafted prior to the commencement of works on-site. The plan will outline key pollution mitigation measures including a Control of Substances Hazardous to Health (COSHH) / fuel inventory and key contacts to be notified in the event of a significant pollution incident, which may subsequently lead to the contamination of controlled waters. Directly and indirectly purchased bulk fuel and COSHH items will be stored in accordance with the relevant Environment Agency Pollution Prevention Guidance notes. Tanks and dispensing pumps will be locked when not in use to prevent unauthorised access. Information regarding spill prevention and disposal of COSHH items will be provided as part of the standard site induction presentations and during regular toolbox talks and the works progress.</td>
</tr>
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<td>5. Piling will be carried out in accordance with EA Guidance Note on Piling / Penetrative Ground Improvement Methods on Land Affected by Contamination (Ref. 47) and ground investigations will inform the Foundation / Piling Works Risk Assessment which will define the appropriate piling methods and foundation design to mitigate risk.</td>
</tr>
<tr>
<td>5. Piling will be carried out in accordance with EA Guidance Note on Piling / Penetrative Ground Improvement Methods on Land Affected by Contamination (Ref. 47) and ground investigations will inform the Foundation / Piling Works Risk Assessment which will define the appropriate piling methods and foundation design to mitigate risk.</td>
<td>6. Specification of concrete used in foundations and building structures will be selected based on the results of the chemical composition of the site soil and groundwater. Guidance is provided by the Building Research Establishment (BRE) series 'Concrete in Aggressive Ground' (Ref. 48).</td>
</tr>
<tr>
<td>Waste</td>
<td>Waste materials will be disposed of by the contractor/s to appropriate recycling facilities or appropriately licensed landfills in line with the Site Waste Management Plan (SWMP). The</td>
</tr>
</tbody>
</table>
### Mitigation Measures

appropriate landfill for the disposal of any contaminated soil off-site will depend on the waste classification determined from the chemical analysis or Waste Acceptance Criteria testing as necessary.

8. Waste effluent will be tested for appropriate physical and chemical parameters and where necessary, disposed of at the correctly licensed facility by a licensed specialist contractor/s.

9. Complaints about dust will be investigated at the earliest opportunity and appropriate action taken to control the source or remedy the impact as appropriate.

10. Access roads will be regularly cleaned and damped down with water.

11. All vehicles entering and leaving the site during the demolition and construction period will pass through a wheel washing facility. Vehicles used to transport materials and aggregates will be enclosed or covered in a tarpaulin. Vehicle movements will be kept to a minimum and vehicle speeds within the site will be limited.

12. Appropriate use of PPE and implementation and adherence to Health & Safety Protocols, Plans and Procedures. Demolition and construction workers will remain vigilant of ground conditions at all times and will report to the Principal Contractor any suspect areas of potential contamination.

13. Potentially contaminated made ground will be removed from excavations.

14. Advice should be sought by an environmental specialist should materials suspected of being contaminated be uncovered.

### Demolition and Construction Related

15. Oils and hydrocarbons will be stored in designated locations with specific measures to prevent leakage and release of their contents, include the siting of storage area away from surface water drains, on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked up when not in use. Details of appropriate storage and handling measures will be presented within the EMP.

16. Vehicles should be well maintained to prevent accidental pollution from leaks. Static machinery and plant should include drip trays beneath oil tanks/engines/gearboxes/hydraulics, which will be checked and emptied regularly via a licensed waste disposal operator.

17. The appropriate utility company will be consulted on the potential requirement for an oil interceptor and sediment trap at the point where site surface water runoff enters the sewerage network.

18. A spillage Emergency Response Plan (ERP) will be produced (and could form part of the EMP), which site staff will be required to have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material.

19. Appropriate handling and disposal of pile arisings, concrete, pastes and/or grouts during the laying of foundations.

20. During the demolition and construction stage of work, the contractor/s will employ dust suppression measures when necessary to prevent the potential mobilisation of contaminated dust particles and their migration off site.

21. Stockpiles and material handling areas will be kept as clean as practicable to avoid nuisance from dust. Dusty materials will be dampened down using water sprays in dry weather or covered.

22. The length of time materials are stockpiled on-site before being removed for re-use, recycling or disposal is to be kept to a minimum and stockpiles are to be covered with tarpaulins prior to disposal.

23. Dust generating equipment e.g. mobile crushing and screening equipment will be located to minimise potential nuisance impacts to receptors, as far as practicable.
POTENTIAL EFFECTS AND MITIGATION MEASURES
POTENTIAL EFFECTS AND MITIGATION MEASURES

Introduction

6.1 This section outlines the significance of likely operational effects of the illustrative masterplan in relation to ground conditions associated with potentially contaminated soils and groundwater and provides mitigation measures and further considerations recommended for later detailed design associated with any future planning application/s for the Site, or any part thereof.

Operational Effects

Effects of Hazardous Materials and Ground Contamination

6.2 Upon completion and occupation of the redevelopment (based on the parameters set-out in the illustrative masterplan), the Site will mainly be covered by a combination of buildings and hardstanding forming an effective barrier to any residual contamination. However the illustrative masterplan does include areas of soft landscaping between buildings.

6.3 Whilst the potential for end users to be exposed to contamination once the illustrative masterplan is completed and occupied is low in areas of hardstanding, where soft landscaping is proposed there is the potential for end users to be affected by any residual contamination beneath the Site.

6.4 The illustrative masterplan end users (residents, employees, and visitors) are considered to be of high sensitivity. The magnitude of change resulting from ground contamination is defined as medium. Therefore, this would result in an effect of local, long-term permanent major adverse significance on the health of the end users once the redevelopment of the Site is complete and operational.

6.5 The risk posed by contact with or exposure to residual contaminated ground in the areas of soft landscaping will be assessed through the Phase II Site Investigation and Quantitative Risk Assessment as part of the demolition and construction works. This will allow for recommendations for remediation works, or design of a suitable capping/break layer between any residual contaminated ground and the soft landscaping areas within the redevelopment of the Site.

Effects from Demolition and Construction Excavation during Operation - Land Stability and Proposed Structures / Surrounding Properties

6.6 In order to address effects of land settlement which may arise during demolition and construction works, mitigation measures (such as dewatering and shoring of excavations as appropriate) will be implemented during the demolition and construction phase of the redevelopment of the Site. Therefore, it is considered that the effects of the complete and occupied illustrative masterplan on land stability (low sensitivity) will be negligible.

Additional Mitigation and Monitoring

Operational Phase Mitigation

6.7 As mitigation will be implemented during the demolition and construction phase of the redevelopment of the Site, resulting in reduced magnitude of impact once the redevelopment of the Site is completed and occupied, it is considered that no further mitigation measures would be required during this phase.

Further Considerations for Detailed Design and Future Planning Applications

Demolition and Construction Considerations

6.8 Following a review of baseline conditions for the Site, it is considered that earthworks (including excavation, piling and breaking up of the existing hard standing, and demolition of the existing buildings where required) could disturb potentially localised ground contamination and expose demolition and construction workers through dermal contact, inhalation and / or ingestion pathways.
There is also the potential for ground gas to emanate from made ground and infill beneath the Site, and accumulate in poorly ventilated confined spaces where demolition and construction workers could be required to work. In addition to demolition and construction workers, neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the Site could also be affected by the demolition and construction works. Mitigation measures would be required to protect both construction workers and neighbouring uses/the general public, and a Phase II Site Investigation and Quantitative Risk Assessment will be required prior to any demolition/construction works starting.

6.9 Disturbance of made ground (and any unknown existing contamination) during the demolition and construction phase could introduce the risk of contamination to the underlying Secondary Aquifers. Such activities may increase the leaching potential of contaminants through the creation of preferential pathways along the stratigraphic column. It is also possible that areas of contamination not previously identified as part of the baseline assessment or further ground investigation works may be disturbed during the demolition and construction works. This further increases the potential for mobilisation of contaminants into the underlying strata and controlled waters. The increased use of water during demolition and construction works (e.g. for dust suppression and wheel washing) may also lead to increased potential for contaminated water and increased surface water run-off. This poses a risk to the underlying Secondary Aquifers and to surface water features (River Lea) through increased percolation rates, downward transfer of contaminants, lateral migration of perched water and surface runoff. Furthermore, the existing and proposed new utilities and infrastructure (e.g. local sewerage network) may also be at risk.

6.10 The design of any piled foundations will need to take into account the presence of the Upper Chalk Principal Aquifer, which is not in hydraulic continuity with the Secondary Aquifers. The National Groundwater and Contaminated Land Centre Report NC/99/73: Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (Ref. 49) published by the EA presents guidance on piling on contaminated sites. The proposed piling methodology will need to be agreed with the EA in advance of piling works.

6.11 Earthworks including excavations for any basements and foundations, and the lowering of the groundwater table, could adversely affect land stability and, subsequently, the proposed and surrounding structures through uncontrolled settlement. Areas of soft ground such as soft alluvium or peat should be investigated and eventually removed or improved.

Phase II Investigations

6.12 The Phase II Site Investigation and Quantitative Risk Assessment would need to address the following uncertainties related to ground conditions:

- The top and the thickness of the London Clay;
- Groundwater elevations and conditions within shallow ground, including an estimate of potential tidal effects;
- Geotechnical properties for shallow alluvial soil and deeper London Clay and Lambeth Group; and
- Obstructions resulting from foundations or basements of existing buildings.

6.13 The Phase II scope would likely involve boreholes to depths of approximately 10 to 15 m bgl, with at least two deeper boreholes to prove the full thickness of the London Clay. The investigation should also include in situ testing of soils, laboratory testing for geotechnical assessment and chemical contamination levels, and installation and monitoring of groundwater and gas monitoring wells.

6.14 The Phase II Site Investigation and Quantitative Risk Assessment, will provide recommendations for remediation works or design of a suitable capping/break layer between any residual contaminated ground and the soft landscaping areas within the illustrative masterplan.

Unexploded Ordnance

6.15 The risk posed by potential UXO during demolition and construction should be assessed through the commissioning of an Explosive Ordnance Threat Assessment prior to commencing any intrusive works including Phase II Assessments, substantial excavation and piling works.
RESIDUAL EFFECTS AND CONCLUSIONS

Introduction

7.1 This section provides a summary of the residual effects associated with ground conditions.

Residual Effects

7.2 Following the implementation of mitigation measures, it is anticipated that the identified operational effects of the illustrative masterplan will be reduced so that residual effects will be negligible. Therefore, no likely significant effects to ground conditions are expected once the redevelopment of the Site is complete and occupied.

7.3 Table 11 presents a summary of the residual effects of the redevelopment of the Site on ground conditions.
<table>
<thead>
<tr>
<th>Description of Effect</th>
<th>Receptor</th>
<th>Sensitivity of Receptor</th>
<th>Nature of Effect and Geographic Scale</th>
<th>Magnitude of Change (Incorporating environmental design and management)</th>
<th>Classification of Effect and Statement of Significance (Incorporating environmental design and management)</th>
<th>Mitigation and Monitoring</th>
<th>Residual Effect and Statement of Significance (Incorporating mitigation and monitoring)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Completed and Occupied Development</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Contact with residual contaminated ground where areas of soft landscaping are proposed</td>
<td>Illustrative masterplan end users</td>
<td>High</td>
<td>Local Long Term Permanent</td>
<td>Medium</td>
<td>Major Adverse - significant</td>
<td>The commissioning of a Phase II Site Investigation and Quantitative Risk Assessment prior to the demolition and construction phase to further assess the risk to human health from contamination in areas of soft landscaping. The assessment will allow for recommendations for remediation works or design of a suitable capping/break layer between any residual contaminated ground and the soft landscaping areas of the Redevelopment of the Site.</td>
<td>Negligible – not significant</td>
</tr>
</tbody>
</table>
Conclusions

7.4 The commissioning of an Explosive Ordnance Threat desk study and assessment prior to further investigation, substantial excavation and piling works is recommended. The Explosive Ordnance Threat Assessment will provide recommendations for site specific mitigation measures and/or further works.

7.5 A Phase II Site Investigation and Risk Assessment is recommended to better assess conditions beneath the Site. The investigation should include groundwater and ground gas monitoring, and tidal assessment, and could be tailored to incorporate geotechnical aspects at the same time to assist with the detailed foundation design.

7.6 With regards to operational effects on ground conditions of the illustrative masterplan, these will be reduced to negligible through the implementation of mitigation measures during the demolition and construction phase of the redevelopment of the Site or any part thereof.
CUMULATIVE EFFECTS ASSESSMENT

Introduction

8.1 This section provides an assessment of cumulative effects in relation to ground conditions and contaminated land and groundwater.

Assessment of Type 1 Interaction Effects

8.2 A number of development sites have been identified for consideration within the cumulative assessment. The majority of these are mixed use developments of offices, retail and residential units.

8.3 Provided that the requirements of relevant policy and legislation relating to land contamination and remediation are adopted in design and that appropriate mitigation measures are applied during the demolition and construction phases of each development, it is considered that the cumulative residual effects of the identified developments on ground conditions will be negligible.

8.4 Any remediation works, or the removal of contaminated soils associated with the demolition and preparatory ground works, basement and foundation excavations carried out at each of these development sites would be expected to result in a moderate to major beneficial cumulative effect to the local environment.

Assessment of Type 2 In-Combination Effects with Committed Developments

8.5 Provided that the requirements of relevant policy and legislation relating to land contamination and remediation are adopted in design and that appropriate mitigation measures are applied during the demolition and construction phases of each development in Table 6, it is considered that the cumulative residual effects of the identified developments on ground conditions will be negligible.
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