

THE GOODSYARD

Environmental Statement Addendum Volume 2

September 2019 – Chapter 8 of 21

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CHAPTER 8: GROUND CONDITIONS

8.1 INTRODUCTION

- 8.1.1

This chapter of the Environmental Statement Addendum (ES) reports the findings of an assessment of the likely significant effects on ground conditions as a result of the Revised Scheme in the London Borough of Tower Hamlets (LBTH) and the London Borough of Hackney (LBH). The assessment is an amendment of the Ground Conditions chapter of the ES completed by Aecom in 2015.
- 8.1.2

The changes made in this amended assessment are summarised below. Where relevant reference has been made to the 2015 assessment and to aid comprehension and reduce the need to cross-reference the earlier assessment parts of the 2015 assessment have been reproduced.
- 8.1.3

The legislation, regulations and guidance have been updated where required.
- 8.1.4

The assessment methodology and the importance assigned to identified receptors and the assessment methodology remains unchanged throughout.
- 8.1.5

Baseline ground conditions have not changed since the 2015 assessment and there has been no additional site investigation.

8.2 SCOPE OF ASSESSMENT

- 8.2.1

This chapter of the ES Addendum assesses the likely significant effects of the Revised Scheme in terms of Ground Conditions and is supported by **ES Addendum Volume 4, Appendix 8: Ground Conditions**.
- 8.2.2

Consideration of impacts associated with potentially contaminated soils and groundwater is made in the context of existing site conditions (i.e. the baseline conditions), throughout the demolition and construction works and once the Revised Scheme is complete and operational.
- 8.2.3

The significance of impacts is assessed pre-mitigation. The requirement for any mitigation measures throughout the demolition and construction stage and once the Revised Scheme is complete and operational is then confirmed. Following the application of the mitigation measures, the resultant residual impacts are identified and assessed in accordance with impact significance criteria.
- 8.2.4

A Landmark Envirocheck® Report was commissioned in 2015; this provides an account of historical and existing operations and services within a 1km radius of the site boundary. Where appropriate, the information has been used in conjunction with this assessment. The Envirocheck® Report and associated maps and figures are provided in **ES Volume 4, Appendix 8: Ground Conditions**. In addition to this, a Ground Contamination Risk Assessment & Outline Remediation Strategy compiled by ARUP in June 2008 and a Factual Site Investigation Report compiled by Concept in August 2008 have also been reviewed as part of the baseline research and have informed the impact assessment where relevant.¹ All data sources are referenced as relevant in the following sections.
- 8.2.5

The potential for impact interactions and combined impacts (Type 1 impacts) on ground conditions are discussed in **Chapter 19: Effect Interactions**. Combined cumulative ground conditions effects (Type 2 impacts) of the Revised Scheme with other development schemes are discussed later in this chapter.

8.3 KEY LEGISLATION, POLICY AND GUIDANCE CONSIDERATIONS

- 8.3.1

The Ground Conditions assessment has been undertaken within the context of relevant planning policies, guidance documents and legislative instruments. These are summarised below.
- Legislation and Regulation

Relevant legislation and regulation for the Ground Conditions assessment include:

- Control of Pollution Act 1974;
 - EC Dangerous Substances Directive (76/464/EEC);
 - EC Fisheries Directive (2006/44/EC);
 - Environmental Protection Act 1990;
 - Environment Act 1995;

¹ ARUP, 2008. Ground Contamination Risk Assessment & Outline Remediation Strategy, Bishopsgate Goods Yard, London, UK. Concept, 2008. Factual Site Investigation Report.

- UK Water Quality (Water Supply) Regulations 2010;
- Water Framework Directive (2000/60/EC);
- Contaminated Land (England) (Amendment) Regulations 2012; and
- Environmental Damage (Prevention and Remediation) Regulations 2009.

National Planning Policy

National Planning Policy Framework (2019)

- 8.3.2

The National Planning Policy Framework (NPPF)² was published in February 2019, replacing the 2018 version. The NPPF 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.

Paragraph 170 of the NPPF states that '*The planning system should contribute to and enhance the natural and local environment by: [sub-paragraph e)] Preventing both new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability; and [sub-paragraph f)] Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*'

A core planning principle described in Section 117 of the NPPF states that '*Planning policies and decisions should promote an effective use of land ... in a way that makes as much use as possible of previously developed or 'brownfield' land.*'

In Paragraph 178 it also states that: '*a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination (as well as potential impacts on the natural environment arising from that remediation); [sub-paragraph b)] 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 [sub-paragraph c)] adequate site investigation information, prepared by a competent person is available to inform these assessments.*'

Regional Planning Policy

The London Plan (2016)

- 8.3.3

The London Plan³ was formally adopted in March 2016 and consolidated a number of alterations into the previous 2011 plan. It sets out the new spatial development strategy for Greater London. The London Plan sets out an integrated economic, environmental, transport and social framework for the development of London over a 20- to 25-year period (to 2031).

Of particular reference to ground conditions is Strategic Policy 5.21 – Contaminated Land. The policy states that: '*The Mayor supports the remediation of contaminated sites and will work with strategic partners to ensure that the development of brownfield land does not result in significant harm to human health or the environment and to bring contaminated land to beneficial use*'.

In addition, the policy requires that appropriate measures should be taken to ensure that development on previously contaminated land does not activate or spread contamination.

In this context paragraph 5.95A states that: '*Where potentially contaminating activities are proposed, development should include appropriate measures to mitigate any potential harmful effects.*'

Additional relevant wording includes Policy 5.22 Hazardous Substances and Installations, which states:

'Strategic

'The Mayor will work with all relevant partners to ensure that hazardous substances, installations and materials are managed in ways that limit risks to London's people and environment. He will consider publishing supplementary guidance to support the application of this policy.

'Planning Decisions

'When assessing developments near hazardous installations:' [sub-paragraph a] 'site specific circumstances and proposed mitigation measures should be taken into account when applying the Health and Safety Executive's Planning Advice Developments near Hazardous Installations (PADHI)1 methodology'; [sub-paragraph b] 'the risks should be balanced with the benefits of development and should take account of existing patterns of development'.

² Ministry of Housing, Communities and Local Government, February 2019. National Planning Policy Framework.

³ Mayor of London, March 2016. The London Plan: the Spatial Development Strategy for London Consolidated with Alterations since 2011.

	<p>'LDF Preparation</p> <p><i>'In preparing LDFs, boroughs should:'</i> [sub-paragraph a] <i>'Identify the locations of major hazards (including pipelines carrying hazardous substances);'</i> [sub-paragraph b] <i>Consult and give due weight to advice from the Health and Safety Executive to ensure that land use allocations take account of proximity to major hazards;</i> [sub-paragraph c] <i>'Consult utilities to ensure that the timing of decommissioning and the implications for development are reflected in proposals;'</i> [sub-paragraph d] <i>Ensure that land use allocations for hazardous installations take account of the need to incentivise and fund decommissioning.</i></p> <p><i>'Boroughs should periodically review consents granted under the Planning (Hazardous Substances) Act 1990 to ensure they reflect current conditions and the physical capacity of the site.'</i></p> <p>Supplementary Planning Guidance – Sustainable Design and Construction (2014)</p>
8.3.4	<p>A Supplementary Planning Guidance note (SPG)⁴ was published in April 2014 after an initial period of public consultation. 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 with a list of 'Mayor's Priorities' and best practice approaches for sustainable design and construction. 'Mayor's Priorities' of relevance to the Revised Scheme include the following.</p> <ul style="list-style-type: none"> • 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; and • Potentially polluting uses are to incorporate suitable mitigation measures. London Plan policy 3.2, 5.3, 5.21. <p>Local Planning Policy</p> <p>London Borough of Tower Hamlets (LBTH)</p> <p><i>Bishopsgate Goods Yard Interim Planning Guidance (2010)</i></p>
8.3.5	<p>LBTH has a series of plans which supplement the Development Plan. These plans provide additional detail to demonstrate how the council's planning policies will be implemented. One of these was drawn up for the Revised Scheme.⁵ This document was prepared prior to the adoption of the Local Plan and adopted as interim planning guidance. It was used for the purpose of development management and is used alongside the Local Plan to determine planning applications and states <i>"The guidance has been approved as planning guidance by LBTH and LBH by the Mayor as being consistent with the London Plan and Planning for a Better London. Ultimately the planning guidance will form part of the Local Development Frameworks for both Hackney and Tower Hamlets and will be a material consideration in determining future planning applications."</i></p> <p><i>LBTH Core Strategy (September 2010)</i></p>
8.3.6	<p>The Core Strategy⁶ was adopted by the Council on 15 September 2010. The policy of relevance to ground conditions concerns "Achieving wider sustainability - SO3". With this policy, the council aims to protect and enhance the environmental quality of the borough by <i>"Minimising the use of natural resources, working pro-actively to protect and enhance the quality of the environment, improving air, land and water quality by minimising air, noise, land and water pollution"</i>.</p> <p><i>LBTH Managing Development Document (MDD) – Development Plan Document (2013)</i></p>
8.3.7	<p>The LBTH Managing Development Document⁷ was adopted on the on 17th April 2013. It provides the planning policies and site allocations required to meet the strategic objectives set out in the Core Strategy. It aims to support the delivery of key infrastructure required within the Borough.</p> <p>With respect to land contamination Policy DM30 – Contaminated Land and Development and Storage of Hazardous Substances states:</p> <ul style="list-style-type: none"> • <i>"1. Where development is proposed on contaminated land or potentially contaminated land, a site investigation will be required and remediation proposals agreed to deal with the contamination before planning permission is granted."</i>
	<p>⁴ Mayor of London, April 2014. Sustainable Design and Construction: Supplementary Planning Guidance. London Plan 2011 Implementation Framework.</p> <p>⁵ London Borough of Tower Hamlets, Mayor of London, London Borough of Hackney, 2010. Bishopsgate Goods Yard, Interim Planning Guidance 2010.</p> <p>⁶ London Borough of Tower Hamlets, September 2010. Core Strategy 2025: Development Plan Document.</p>

	<ul style="list-style-type: none"> • <i>"2. Development will not be supported which involves the storage or use of hazardous substances or new developments in close proximity to hazardous installations where it would cause a significant hazard to health and the environment."</i> <p>LBTH Supplementary Planning Guidelines (SPGs), Supplementary Planning Documents (SPDs) & Other Documents</p>
8.3.8	<p>Strategy for the Identification of Contaminated Land, 2005</p> <ul style="list-style-type: none"> • LBTH developed a strategy to identify areas of contaminated land in the borough.⁸ It states that, <i>"The strategy sets out how the London Borough of Tower Hamlets (LBTH) proposes to identify 'Contaminated Land' within its Borough in accordance with the requirements of Part IIA of the Environment Protection Act 1990 ("Part IIA"). The intention of the strategy is to ensure that unacceptable risks to human health or to the wider environment, from exposure to 'Contaminated Land', are addressed in an appropriate and cost-effective manner."</i> <p>London Borough of Hackney</p> <p><i>LBH Saved and Retained UDP Policies (2010)</i></p>
8.3.9	<p>The Local Development Framework (LDF)⁹ is part of the Government's planning system, introduced by the Planning and Compulsory Purchase Act 2004. The LDF, together with the London Plan, will form the development plan that will determine how the planning system will shape the community in the future. LBH's LDF comprises a suite of planning documents, including Local Plans (LPs) and Supplementary Planning Documents (SPDs).</p> <p>LBH Core Strategy (November 2010)</p>
8.3.10	<p>LBH Core Strategy Development Plan Document¹⁰ is part of the LDF. The policies of relevance to ground conditions are summarised below:</p> <p><i>"The borough's Pollution Control team supports the Council in fulfilling its contaminated land responsibilities. Recent research by Hackney's Pollution Control team identified that sources of contamination may cover as much as 22% of the land area of Hackney. Possible sources of contamination typically include areas of old industrial land which has been redeveloped. Sustainable development involves bringing brownfield, contaminated sites back into active use. The planning process is the preferred means of dealing with contaminated land issues as the cost of investigation and any remediation is born by the developer. Where necessary, enforcement action will be taken. Contamination issues will continue to be addressed during the planning process as required by PPS23, Defra Circular 01/2006 and in line with the general emphasis of London Plan policies 4A.33 and 4A.34, future Development Management Policies will set out the detailed approach to dealing with hazardous substances".</i></p> <p>LBH Supplementary Planning Guidelines (SPGs), Supplementary Planning Documents (SPDs) & Other Documents</p> <p><i>Contaminated Land Strategy (July 2001)</i></p>
8.3.11	<p>In July 2001, in response to new legislation (Part 2A of the Environmental Protection Act 1990), the LBH published its contaminated land strategy¹¹. The strategy sets out how contamination issues will be dealt with in LBH, (NB being updated at the time of writing).</p> <p><i>"This strategy is intended to identify the land in Hackney that may have been contaminated in the past. Where such land has been identified, the current land use shall be examined to discover whether there is a public health risk associated with that contamination. Where contamination has been found to be a public health risk, action shall be taken in conjunction with the responsible person to render the land safe. A register of statutorily contaminated land will be set up and available for inspection."</i></p> <p><i>The information gathered will also be used to inform planning decisions and to place conditions on future developments as necessary. The information gathered will be made available to landowners and developers for a fee".</i></p>
8.3.12	<p>In order to meet the requirements under Part IIA, the LBH has also set up the <i>"Procedure Note Part2A: Identification of</i></p>
	<p>⁷ London Borough of Tower Hamlets, April 2013. Managing Development Document: Development Plan Document.</p> <p>⁸ London Borough of Tower Hamlets, 2005. Strategy for the Identification of Contaminated Land.</p> <p>⁹ The London Borough of Hackney; Local Development Framework. September 2004.</p> <p>¹⁰ The London Borough of Hackney (December, 2010); Core Strategy Development Plan Document.</p> <p>¹¹ The London Borough of Hackney; Contaminated Land Strategy. December 2010.</p>

sites of potential concern and completion of desk study, site visit and intrusive investigation work under the contaminated land regime¹². This Work Instruction identifies the Council's approach to identifying potential areas of contaminated land, defining 'sites of potential concern', and completing desk study, site visits and intrusive investigation work, to identify whether land should be determined as contaminated land under Part IIA of the Environmental Protection Act 1990 (Part 2A)."

8.3.13 The Council has also prepared the guidance "Information on Hackney's approach to dealing with contaminated land under Part 2A of the Environmental Protection Act 1990" for environmental professionals in order to assist with decision making for contaminated land issues¹³.

Development Management Local Plan (Adopted July 2015)

8.3.14 The Local Plan (previously Local Development Framework) guides and manages development in the borough. The Local Plan comprises the Core Strategy and the Managing Development Document (MDD). Together these documents provide spatial policies, development management policies and site allocations to guide and manage development in the borough.

Other Relevant Policy, Standards and Guidance

8.3.15 DEFRA provides general guidance on pollution prevention on its web site, the earlier Environment Agency (EA) Pollution Prevention Guidance Notes (PPGN) having been withdrawn. The guidance gives advice on statutory responsibilities and good environmental practice.

8.3.16 Other specific guidance relevant to Ground Conditions include:

- Contaminated Land, DEFRA Circular 01/2006;¹⁴
- EA Remedial Targets Methodology;¹⁵
- Human Health Toxicological Assessment of Contaminants in Soil;¹⁶
- EA, 2004; Contaminated Land Report 11;¹⁷
- Environment Agency, Guiding Principles for Land Contamination;¹⁸
- CIRIA, Guidance C532, Control of Water Pollution from Construction Sites;¹⁹
- The Chartered Institute of Environmental Health guidance for Local Authorities;²⁰
- BSI, Code of practice for the characterization and remediation from ground gas;²¹ and
- CIRIA, Guidance C665, Risks Posed by Ground Gases to Buildings.²²

8.4 CONSULTATION

8.4.1 In January 2014 a Scoping Opinion was issued jointly by the LBTH (Ref: PA/14/107) and LBH (Ref: 2014/0249) on the Proposed Development (see **ES Addendum Volume 4 - Appendix A Scoping**). A review of the Scoping Opinion was requested by the Applicant in March 2019 subject to the Revised Scheme. **Table 8.1** outlines the comments received in the 2014 Scoping Opinion and the 2019 Scoping Opinion Review and where they have been addressed within the documentation.

Table 8.1 LBTH Scoping Opinion Comments and Response

Topic / Section	Summary of Comment	Location within the ES Addendum where comments are addressed
Paragraph 4.63	"reference should be made to current good practice that will be adhered to within the assessment".	Section 8.3

¹² The London Borough of Hackney; Procedure Note part2A/01 The identification of sites of potential concern and completion of desk study, site visit and intrusive investigation work under the contaminated land regime. December 2010.

¹³ The London Borough of Hackney; Information on Hackney's approach to dealing with contaminated land under Part 2A of the Environmental Protection Act 1990. January 2011.

¹⁴ DEFRA, September 2006. Defra Circular 01/2006: Environmental Protection Act 1990: Part 2A: Contaminated Land.

¹⁵ Environment Agency, 2006. Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination.

¹⁶ Environment Agency, 2009. Human Health Toxicological Assessment of Contaminants in Soil, Science Report SC050021/SR2.

¹⁷ Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR 11).

Topic / Section	Summary of Comment	Location within the ES Addendum where comments are addressed
Paragraph 4.65	"The previous site investigation report and remediation strategy should be provided as technical appendices to the ES Chapter."	Please see ES Addendum Volume 4, Appendix D: Ground Conditions.
2019 Scoping Opinion Review	"The assessment methodology and significance criteria...will require detailed description in the ES. The assessment should include consideration of previous site investigation results in the light of the proposed residential land use and should include consideration of ground gases...geotechnical or other issues ...as well as potential impacts on groundwater. A site visit should be included in the assessment [...] LBTH expects all reports assessment and data should be evaluated against up to date assessment criteria, reviewing baseline conditions and potential receptors – The applicant's review and update of assessments/investigations, against the original 2013 assessment where necessary will have to be comprehensive.	Section 8.5 Section 8.8 Section 8.5 (Paragraph 8.5.2)

8.5 ASSESSMENT METHODOLOGY

Determination of Baseline

8.5.1 The baseline consists of a description of current conditions related to the Revised Scheme and its environment, and is put together using a summary of all relevant knowledge about the Revised Scheme and the surrounding area. This includes a description of the topography, geological conditions, geotechnical consideration, hydrogeological and hydrological setting and contamination potential. This assessment draws on a previous assessment of the existing ground conditions, carried out by Arup²³. The site has had no significant development since this assessment was completed and is considered to be an accurate representation of the current baseline conditions on the site.

8.5.2 It is noted within the Scoping Opinion Review received from LBTH that it is requested to re-appraise all previous site investigation data in line with current criteria for the Revised Scheme and include a site visit in the assessment. We acknowledge that the data provided from previous site investigations is now approximately 10 years old and as part of this Chapter have considered this in accordance with current best practice and guidance. Given the Revised Scheme will largely be either suspended above existing railway lines which are to remain or include a significant basement, it was not considered beneficial to update the land quality assessments using current criteria as it was deemed that this would not have a material effect the proposed mitigation measures to be adopted. Furthermore, following the granting of planning permission and via suitable condition, further site investigation and assessment together with a Piling Risk Assessment will allow appropriate risk mitigation and/or remediation measures to be properly defined.

¹⁸ Environment Agency, 2010. Guiding Principles for Land Contamination (GPLC 1, 2 and 3). These documents are still hosted by CL:AIRE (www.claire.co.uk), although archived by DEFRA.

¹⁹ CIRIA, 2001. Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors. Guidance C532.

²⁰ CIEH, 2019. https://www.cieh.org/policy/resources/

²¹ BSI, 2015. Code of practice for the characterization and remediation from ground gas in affected developments. BS 8485:2015.

²² CIRIA, 2007. Assessing Risks Posed by Hazardous Ground Gases to Buildings. Guidance C665.

²³ ARUP, 2008. Ground Contamination Risk Assessment & Outline Remediation Strategy, Bishopsgate Goods Yard, London, UK

Topography

- 8.5.3
- The topography of the site is complex and considered to be of man-made origin. Street level along the northern perimeter is reported to be approximately +15m Ordnance datum (mOD). Two historical railways were located on site at different topographic levels: the upper rail level on viaducts was above street level, and the lower rail level, which ran approximately at street level. In addition, the live railway cutting to Liverpool Street and the suburban railway tunnel are located along the southern part of the site. The track level within these areas is reported to be approximately +8mOD and street level along the southern perimeter approximately +14mOD ²³.
- 8.5.4
- The site is surrounded by 6 conservation areas: Brick Lane, South Shoreditch, Fournier Street, Redchurch Street, Boundary Estate and Elder Street.
- 8.5.5
- There are two Grade II listed structures on site: Braithwaite Viaduct and the Forecourt Wall, Oriel and Gates to Goods Station.
- 8.5.6
- There are several schools and community services such as GP surgeries, Police Stations, Fire Stations and Community centres in the vicinity of the site.

Geological Conditions

- 8.5.7
- Based on a review of published geological maps for the site and borehole logs from previous environmental investigation²³, the stratigraphic succession beneath the site comprises the following strata from surrounding street level down:
 - Made Ground – likely to be highly variable in composition;
 - Alluvium – fine particle of silt and clay and large particles of sand and gravel;
 - River Terrace Deposit – Taplow Gravel. A sheet of predominantly flint gravel and sand;
 - London Clay Formation – Stiff dark or bluish-grey Clay;
 - Lambeth Group Formation – Clay with inter-bedded sand;
 - Thanet Sands Formation – Green well sorted sand; and
 - Upper Chalk - Regionally, the Cretaceous Chalk underlies the Thanet Sand and comprises micritic limestone with flint nodules.
- 8.5.8
- Table 8.2** summarises the geology beneath the site and the approximate thicknesses of the different strata as recorded in borehole logs from Arup ²³.

Table 8.2 Geological Stratigraphy

Stratum	Top of Stratum (mOD)	Thickness of Stratum (m)	Description
Western Portion of the Site (Site A1 in Arup Ground Contamination Risk Assessment & Outline Remediation Strategy) – corresponding to Plots A, Plot F and western part of Plot G			
Made Ground	+13.45 to +15.00	1.00 to 4.60	Brown sand with much gravel to cobble sized brick and concrete fragments and occasional pottery fragments. The base of the Made Ground was generally dark grey very sandy clay with some brick, bone and shell fragments.
Alluvium	+11.44 to 10.46	0 to 2.15	Dark brown slightly sandy slightly gravelly clay.
River Terrace Deposit	+9.96 to +10.63	3.35 to 4.30	Medium dense, brown sandy clayey gravel, becoming yellowish brown sandy flint gravel
London Clay	+6.01 to 7.13	8.15 to 21.45	Firm becoming stiff, grey sandy clay with occasional pockets of brown sand and fissures.
Central Portion of the Site (Site A2 in Arup Ground Contamination Risk Assessment & Outline Remediation Strategy) – corresponding to Plot B, western part of Plot C and eastern part of Plot G			
Made Ground	+14.14 to +14.71	0.85 to 5.50	Dark brown sandy clay with some brick and concrete fragments.

Stratum	Top of Stratum (mOD)	Thickness of Stratum (m)	Description
Alluvium	+9.92 to + 11.94	0 to 1.10	Firm, dark orangey brown occasionally mottled grey clay.
River Terrace Deposit	+9.21 to +11.31	0.95 to 2.90	Medium dense, orangey brown very sandy, clayey gravel becoming a yellowish brown very sandy gravel.
London Clay	+6.73 to 10.36	20.40 to 22.50	Firm becoming stiff, grey sandy clay with occasional pockets of brown sand and fissures.
Eastern Portion of the Site (Site B + C in Arup Ground Contamination Risk Assessment & Outline Remediation Strategy) – Corresponding to Plot D, E, H, I J and the eastern part of Plot C			
Made Ground	+12.28 to 14.12		Loose dark brown and mottled orangey brown gravelly to silty sand with gravel sized brick fragments, concrete and pottery fragments and animal bones. Occasional grey sandy gravelly clay.
Alluvium	+10.30 to 11.67	1.10 to 1.20	Orangey brown sandy clay, occasionally mottled grey, with occasional gravel.
River Terrace Deposit	+8.54 to 10.17	1.20 to 1.90	Loose, yellowish brown sand with some gravel becoming sandy clayey gravel.
London Clay	+7.24 to 8.37	22.0 to 22.90	Firm becoming stiff, grey sandy clay with occasional pockets of brown sand and fissures.

Geotechnical Consideration

- 8.5.9
- Table 8.3** summarises the reported hazard potential for a range of geotechnical hazards for the site and the surrounding area. In terms of land stability, overall the stability of the land is of low sensitivity due to regional geological conditions.

Table 8.3 Potential geotechnical Hazards (from Envirocheck®)

Hazard Type	Reported Hazard Potential
Collapsible Ground Stability	Very Low (on-site) to low (42m SE of the site)
Compressible Ground Stability	No Hazard
Ground Dissolution Stability	No Hazard
Landslide Ground Stability	Very Low
Running Sand Ground Stability	Very Low (on-site) to no hazard (42m SE of the site)
Shrinking or Swelling Clay Ground Stability	Moderate (on-site) to very low (72m S of the site), and Moderate (129m NW of the site)
Radon Affected Areas	Less than 1% of homes above action level
Radon Protection Measures	None required

Hydrogeological and Hydrological Setting

- 8.5.10A review of on-line DEFRA data²⁴ indicates that the site overlies a Secondary A aquifer associated with the underlying superficial deposits (Taplow Gravel). The status of Secondary A aquifers is described 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. Secondary aquifers are considered to be moderately vulnerable to pollutants, due to permeability. In terms of receptor sensitivity, a Secondary A aquifer is assessed as being of ‘Moderate Sensitivity’.
- 8.5.11The London Clay formation, underlying the Taplow Gravel deposits, is classified by the EA as unproductive strata which are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Unproductive strata are considered to have low vulnerability to pollutants, due to limited permeability. In terms of receptor sensitivity, unproductive strata are assessed as being of ‘Low Sensitivity’.
- 8.5.12The Chalk strata, which is at depth beneath the Lambeth Group and Thanet Sands, 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’.
- 8.5.13Review of the published groundwater vulnerability map for the site suggests that soils overlying the London Clay have been assigned soil leaching potential class ‘HU’.²⁵ This indicates they have been assigned a high leaching potential as a worst-case scenario due to the limited amount of data available within any urban area. Soils of a high leaching potential are considered to have little ability to attenuate diffuse source pollutants and to allow liquid discharges to move rapidly to underlying strata and to shallow groundwater.
- 8.5.14London lies in a basin with the deep groundwater contained within the Thanet Sand and the deeper Chalk stratigraphy (Principal Aquifer). Across London, the Lambeth Group, together with the overlying London Clay (where present) typically act as a low permeability layer above the Thanet Sand and the Principal Chalk Aquifer below. These low permeability layers impede the hydraulic continuity between the shallow groundwater (River Terrace Deposits, in this case, Taplow Gravel) and deeper groundwater in the Principal Aquifer of the Chalk, thus preventing the shallow and deeper groundwater from mixing.
- 8.5.15A review of the Ground Contamination Risk Assessment and Outline Remediation Strategy²⁶ indicated that in March 2008 groundwater was at 6m to 7m below ground level (bgl) (or +7 to +8mOD).
- 8.5.16The hydraulic gradient across the site was calculated and presented in the Arup, Ground Contamination Risk Assessment and Outline Remediation Strategy²⁶ to be approximately 0.036 and the Groundwater flow direction was interpreted to be southward toward the River Thames.
- 8.5.17No surface waterbodies are present on the site and the nearest major surface water body is the River Thames, approximately 1.7 km south of the site, and Regent Canal, approximately 1.5 km north east of the site. The River Thames is tidal in this location.
- 8.5.18The former course of the River Walbrook (a tributary of the Thames) is located approximately 100m west of the site. At present, the River Walbrook is contained within a culvert beneath Curtain Road, to the east of Shoreditch High Street²¹.
- 8.5.19The site is located within Flood Zone 1 and is therefore at low risk of flooding from fluvial and tidal sources, with an annual exceedance probability (AEP) of <0.1% (1 in 1000) from fluvial or tidal flooding in any year²⁷.
- 8.5.20Based on a review of the Strategic Flood Risk Assessments (SFRA) the site is at low risk from both tidal, fluvial flooding and groundwater flooding. However the site is at risk of surface water flooding.²⁸
- 8.5.21The site does not lie within a source protection zone (SPZ) for the protection of potable water supply abstractions. The Envirocheck® Report has identified 28 groundwater abstraction licences within 1km of the site, the closest of these is located 119m to the north west of the site for a heat pump.
- 8.5.22The Envirocheck® Report has identified one active discharge consent for cooling water to the Thames, approximately 91m north west of the site.

Contamination Potential

- 8.5.23The potential for on-site soil and groundwater contamination has been based on a review of the land-use history of both the site and surrounding area. The assessment considers also the findings of the previous site investigation carried out on the site.²⁶

²⁴ <https://magic.defra.gov.uk/MagicMap.aspx>

²⁵ Landmark Envirocheck®; Report 49413378_1_1 dated 23 September2013.

Ground Contamination Risk Assessment

- 8.5.24The Risk to Human Health was summarised in the Arup, Ground Contamination Risk Assessment and Outline Remediation Strategy²⁶ as follows:
- 8.5.25*“During the ground investigation, no obvious sources of significant contamination to potential construction workers and site neighbour receptors were identified. The concentrations of most contaminants measured from the extensive testing of Made Ground were below values that might be regarded as posing an acute risk to construction workers. However, occasionally elevated lead concentrations have been reported in a small proportion of the results.”*
- 8.5.26In total 60 samples were collected and analysed from Made Ground across the site; twelve of these reported lead concentrations above the Commercial Screening Criteria (750mg/kg). Details on the location of the exceedances are provided below:
 - Two of the 28 samples of Made Ground taken from the north section (Plots 1, 4, 5, 6, and 10) of the site reported concentrations above the screening value to a maximum of 1300 mg/kg (in EP12P);
 - All the lead results from the SW portion of the site (Plot 2) were below the screening level;
 - One of the two samples collected from Quaker Street reported a lead concentration above the screening criteria (1900mg/kg);
 - Five of the eight samples from the soils on the top of the viaduct (Plots 2, 8A - C) exceeded the lead screening criteria;
 - Four of the seven Made Ground samples from the SE of the site (Plots 8A-C) exceeded the lead screening criteria;
 - No exceedances were reported in Plots 1,4, 5 and 6.

- 8.5.27**Table 8.4** summarises the reported lead concentrations above the Commercial Screening Criteria of 750 mg/kg. The elevated lead concentrations were detected both in the Outline and the Detailed Development Plots.

Table 8.4 Lead Concentration above the Commercial Screening Criteria (750 mg/kg)

Location	Lead Concentration (mg/kg)	Plot
Detailed component of the Revised Scheme		
BH02	1900	Quaker Street
BH09	3100	Plot G
EP05	1700	Plot H
EP06	7000	Plot H
EP14	2400	Plot G
EP15	1800	Plot G
EP19	780	Plot I
EP20	3000	Plot J
EP08	3300	Plot I
EP09	820	Plot J
Outline component of the Revised Scheme		
BH14	1100	Plot B
EP12P	1300	Plot E

²⁶ Ove Arup & partners Ltd (2008); Ground Contamination Risk Assessment & Outline Remediation Strategy, Bishopsgate Goods Yard, London, UK.

²⁷ <https://flood-map-for-planning.service.gov.uk>

²⁸ London Borough of Tower Hamlets (2016); Strategic Flood Risk Assessment

<i>The Risk to Controlled Water</i>		8.5.34	Overall, based on the history of the site over the last 130 years, it is concluded that the site has been used by activities that have had the potential to cause a moderate to high level of soil contamination. We note, however, that the previous investigation ²⁶ identified no significant or widespread contamination.
		<i>Present Uses – On-Site</i>	
8.5.28	The majority of results for toxic metals and hydrocarbons in soils such as phenols, herbicides, polyaromatic hydrocarbons and BTEX compounds were very low, and either below method detection limits or the conservative screening criteria. The Arup, Ground Contamination Risk Assessment and Outline Remediation Strategy ²⁶ states that “Concentrations of Selenium and TPH were reported above the initial screening criteria. ... Results of the 2:1 extraction of the leachability analysis undertaken on 29 samples of Made Ground indicated that 8 parameters exceeded the initial screening values. However, none of the parameters detected at elevated concentrations in the leachability analysis were present in the groundwater samples at elevated concentrations. This suggests that although Made Ground soils contain potentially mobile contaminants, they are not leaching into the RTD groundwater at significant concentrations”.	8.5.35	Shoreditch High Street Station on the London Overground is located in the centre of the site and includes the ‘boxed’ high level London Overground line running across the northern section of the site from east to west. The central to southern section of the site contains extensive railway arches (including the Grade II listed Braithwaite Viaduct) supporting an elevated section of land which terminates at Brick Lane.
<i>Historical Uses - On-Site</i>		8.5.36	The southern border of the site is defined by the Main Line Railway and railway tunnel which lead towards the main line terminus at Liverpool Street Station. The western border of the site contains the original main entrance to the Goods Yard, including the Grade II listed Forecourt Wall, Oriel and Gates to the Good Station which is currently boarded up with hoarding to prevent deterioration.
8.5.29	The Envirocheck® historical maps for the site date back to 1882, ²⁵ where the site is shown to be occupied by a railway station (Bishopsgate Station) in the west with railway tracks present in the eastern half of the site. By 1920 the railway is labelled Bishopsgate Goods Station, indicating that it has been converted from passenger to a good station. The 1971 map shows the western end of the site is used as a car park and the central area appears partly vegetated and partly used as a lorry park. Since 2004 the new Shoreditch High Street Station on the London Overground has opened up in the centre of the site.	8.5.37	In addition to the London Overground and the Main Line Railway an eight track reserve runs adjacent to the Main Line. The Central Line runs beneath the site from north to south west and a BT Tunnel runs beneath the site from north to south.
8.5.30	The following historical tanks and energy facilities are reported on site by Envirocheck® Report: <ul style="list-style-type: none"> No. 3 oil storages and no. 12 potentially fuel-related tanks, which are potentially significant sources of fuel and oil; No. 3 electrical plant equipment (electricity substations), which are potentially significant sources of Polychlorinated Biphenyl (PCB) and organic contaminants. 	8.5.38	The site contains a number of temporary uses including a number of Power League temporary football pitches and the temporary Box Park Shopping Mall, comprising of shops and cafes, in refurbished shipping containers.
8.5.31	The Arup, Ground Contamination Risk Assessment and Outline Remediation Strategy ²⁶ reported the following potential sources of contamination: <ul style="list-style-type: none"> <i>Made Ground</i> – Made Ground is present across the site, with highly variable thickness and composition. Ash, clinker, brick, pottery, concrete, plastic pipe, wood and glass fragments and animal bones were recorded on logs. At one location (EP11P at +13.22mOD), located in Plot C, hydrocarbon odour was noted on the log, however sample results at this location did not record significant concentrations of hydrocarbon contaminants. Due to the site history and the former site activities, some contamination of the ground may have occurred and it is clear that the Made Ground includes a significant amount of anthropogenic materials. However, no further significant indicators of ground contamination were identified during the ground investigation such as odours or oils. <i>Railways and rail maintenance/depots</i> Railways – these features are considered a potentially contaminative site use. The principal contaminants associated with these features are fuels and oils, hydraulic oils associated with the wagon hoists, toxic metals, solvents, polychlorinated biphenyls (PCBs) associated with transformers, herbicides (weed control). No obvious signs of contamination were observed. <i>Former fuel tanks</i> - Network Rail archive records within the Arup Geotechnical Desk Study include a drawing of a 3000-gallon underground petrol tank (of undetermined location) and a 4’6” diameter underground diesel tank (located on the inclined roadway in the north-east of the site – Plot E). During the ground investigation, no existing tanks were identified and no obvious signs of contamination were observed. <i>Electrical transformers</i> - One transformer was identified during the walkover survey, located within a purpose-built enclosure and above a concrete slab. During the ground investigation, no obvious signs of contamination were identified. More transformers may have been located on-site that were not recorded or documented. Therefore the potential remains to encounter other apparatus during development. <i>Former bottling works</i> - This area of the site included a boiler house that may have contained fuel storage tanks. No obvious sign of contamination resulting from the plant were identified. 	8.5.39	Overall, the current site use is not considered to present a potentially significant contaminative use.
		<i>Present Uses - Off-Site</i>	
		8.5.40	The surrounding land use appears to be a mixture of commercial and residential use. The Envirocheck® report identifies a large number of active and inactive contemporary trade directory entries within 250 m of the site. Of these there are 143 inactive and 31 active contemporary trade directory entries located within 250 m of the Site. The nearest active entry is approximately 15 m east of the site and is for leather garments and products. The remaining active entries recorded within 250 m of the site include car dealers, office equipment service and maintenance, oil and gas exploration supplies and services, printing and copying services, garage services and repairers, chemical manufacturers, engineers, dry cleaners, works and various different retail units. There is one active fuel station within 250 m of the site and further 3 active fuel stations between 500 and 1km.
		8.5.41	The Envirocheck® Report has reported ten registered radioactive substances associated with the Royal London Hospital within 1km from the site.
		8.5.42	The Envirocheck® Report indicates a registered waste treatment or disposal site at 172m from the site, classified as very small (less than 10,000 ton per year).
		<i>Ground Gas</i>	
		8.5.43	Ove Arup & Partners (‘Arup’) carried out six rounds of ground gas monitoring between March and May 2008 from six locations (gas standpipes installed in boreholes). ²⁶ Very low gas flow rates are reported in the boreholes (≤0.1l/hr). Methane was reported at very low concentrations in up to two locations on two rounds. The ‘steady methane’ concentrations did not rise above the detection limit. Low concentrations of carbon dioxide to a maximum of 3.9% v/v were detected during two monitoring rounds. No detectable concentrations of carbon monoxide or hydrogen sulphide were recorded.
		<i>Asbestos</i>	
		8.5.44	Arup’s, Ground Contamination Risk Assessment and Outline Remediation Strategy reported that an asbestos survey and abatement project has been undertaken at the site which included the removal of asbestos materials from site. ²⁶
		8.5.45	No asbestos was identified in any of the samples tested and presented in the Arup, Ground Contamination Risk Assessment and Outline Remediation Strategy. ²⁶ While this reduces the likelihood of asbestos or ACM’s being present in the made ground across the site, it does not negate the possibility.
		8.5.46	Historic drawings for the construction of the viaduct did show asbestos materials specified in the construction. If it was missed during the survey and abatement works, there remains the possibility for asbestos and asbestos containing materials (ACM) to be present on site in any structures (above or below ground), within building rubble/demolition arisings or within made ground / fly tipping.
		<i>Underground Structures</i>	
		8.5.47	The following operational underground services are known to exist on and in the vicinity of the site: <ul style="list-style-type: none"> Central Line Underground (two tunnels); Eight track reserve line;

- Thames Water Utilities (TWU) water supply and drainage/sewerage;
- Electricity;
- Gas infrastructure;
- British Telecom (BT) infrastructure (including main BT tunnel); and
- Broadband and fibre optic infrastructure.

Unexploded Ordnance

- 8.5.48 Based on the London County Council Bomb Damage Map 51,²⁹ the area had been heavily bombed during the WWII. No damage is shown within the site on the map, however this is likely because bomb damage to rail infrastructure was not shown on maps, rather than the site not having been bombed.
- Summary of Site's Contaminative Status*
- 8.5.49 Arup (2008), in its Ground Contamination Risk Assessment and Outline Remediation Strategy, stated that “*no significant widespread contamination has been identified on site*”. They concluded that although concentrations of lead above both residential and commercial screening criteria have been identified on Made Ground, their risk assessment indicated that this does not result in a significant risk of harm to end users.
- 8.5.50 Arup continues to state that risk is still present for development workers likely to come into direct contact with ground soil. However, this potential risk will be mitigated adhering to relevant H&S legislation, and in particular using “*specific precautions to minimise exposure of construction workers and exposure to dust*”.
- 8.5.51 Arup identified a potential pollutant linkage associated with ground gases and vapours subsequent to development. However, the concentrations of all volatile contaminants and hazardous ground gases including methane, carbon dioxide, and hydrogen cyanide were reported to be very low and below concentrations that might represent a risk to end users.
- 8.5.52 With regards to groundwater resources, the site is judged to be located in a moderate sensitivity setting. This is based on the highly urbanised setting of the site, the properties of the underlying geology and the way in which these resources are currently utilised. The Taplow Gravel Secondary A aquifer lies directly beneath the Made Ground. The Lambeth Group, together with the overlying London Clay, typically acts as a low-permeability layer above the Thanet Sand and the Principal Chalk Aquifer below. These low-permeability layers impede the hydraulic continuity between the shallow groundwater (River Terrace Deposits, in this case, the Taplow Gravels) and deeper groundwater in the Principal Aquifer of the Chalk, thus preventing the shallow and deeper groundwater from mixing. The anticipated proposed piling depths beneath the Revised Scheme could pierce the London Clay and terminate in the Lambeth Group strata. As noted, the Lambeth Group is of low permeability; however, this does still have the potential to create preferential pathways for contamination to migrate towards the underlying Principal Chalk Aquifer, which is considered to be a very high sensitivity receptor.
- 8.5.53 To prevent the risk of groundwater pollution (such as from the elevated selenium and TPH reported by Arup) migrating from the Secondary Aquifer to the Principal Aquifer, appropriate precautions and mitigation measures, such as following the (now archived) EA guidance on piling on land effected by contamination³⁰ will need to be taken.
- 8.5.54 It is considered that there is a moderate risk to the Secondary A Aquifer within the Taplow Gravel Formation from existing conditions at the site. The historical land uses of the site do present potential contamination sources, and overall the risk to the site has a potential for moderate levels of soil contamination.

Prediction Methodology

- 8.5.55 The prediction methodology has followed the generic approach as set-out in **Volume 2 Chapter 3, EIA Methodology** of this ES Addendum.
- 8.5.56 The significance of an effect has been determined by assessing the value/sensitivity of the resource and the magnitude of an impact shown in **Table 8.5**, **Table 8.6** and **Table 8.7**.

²⁹ London Topographic Society (2005), Bomb Damage Maps 1939 – 1945.

Table 8.5 Determining Value/Sensitivity of Resource

Sensitivity	Criteria	Example Receptors
High	Resources/features which are unique and if lost cannot be replaced or relocated, including water resources used for water supply. Receptors of greatest sensitivity including human health, and water resources which are of ecological importance.	Human Health, including, that of construction and maintenance workers, future site users/occupants and third party neighbours Sites of Special Scientific Interest with geological or hydrogeological pathways from the Assessment Site Sensitive water receptors such as Principal Aquifers, aquifers within groundwater source protection zones (GSPZ) and surface water features adjacent to the Assessment Site or with significant hydraulic continuity to the Assessment Site. Water bodies of good or very good status as defined by the Water Framework Directive
Medium	Resources/features of important consideration at a regional or district scale. Receptors vulnerable to changes in land quality/contamination levels	Built development; residential, business and agricultural land holdings. Allotments and gardens, amenity/open green space areas. Secondary aquifers not within groundwater source protection zones. Other water features or water resources at or within 250 metres of the Assessment Site which are not classed as 'High' value. Mineral reserves.
Low	Features important at a local scale. Receptors with a moderate sensitivity to changes in land quality/contamination levels	Other land uses which pose no threat to human health or controlled waters, e.g. forestry or derelict land.
Negligible	Features of minor importance or with a low sensitivity to changes in land quality/contamination levels	Land within proximity to the Assessment Site which is not used and is inaccessible

- 8.5.57 The magnitude of change, or how considerable the change to the ground conditions are from the baseline conditions as a result of an activity or action resultant from demolition, construction and once the Revised Scheme is complete and operational, has been classified as either being: Large, Medium, Small or Negligible. The criteria and their respective magnitude of change classification are detailed further within **Table 8.6**.

Table 8.6 Criteria for Assessing Magnitude of Change from Baseline Conditions

Magnitude of Change	Criteria
Very high	There would be fundamental changes to the ground conditions causing significant and long-term impact on a receptor. (e.g. major contamination of controlled waters).
High	There would be material but non-fundamental changes to the ground conditions causing impact on a receptor. (e.g. contamination of controlled waters).
Medium	There would be detectable but non-material changes to the ground conditions causing minor and transient impact on a receptor (e.g. temporary minor degradation of baseflow to controlled waters).
Low	Some detectable change to ground conditions or hydrogeology will occur but will have negligible impact on receptors.
Negligible	No detectable change is anticipated to occur to ground conditions or hydrogeology.

Assessment of the Significance of Impacts

- 8.5.58 A level of significance has been assigned to both potential impacts (pre-mitigation) and residual impacts (post-mitigation). Essentially, the combination of the sensitivity of the receptor and the magnitude of the change (or impact) provide a qualitative definition of the significance of the impacts. **Table 8.7Error! Reference source not found.** presents the matrix

³⁰ Environment Agency, 2001. Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention.

- for defining the impact significance.
- 8.5.59 Impacts have the potential to be adverse, beneficial or negligible. For example, in terms of beneficial impacts, the Revised Scheme may remove a source of contamination or it may break a pathway that currently links a source to a receptor.
- 8.5.60 For the purposes of this report temporary impacts can be broken down into short (week/months), medium (years) or long term (decades); and permanent impacts.
- 8.5.61 The scale of impacts can also be broken down as local level (on site or neighbouring site), district level (within the LBTH), regional level (within Greater London), national level (UK) or International level.
- 8.5.62 With regards to the residual impact significance, the level of significance takes into account not only the sensitivity of the receptor and the magnitude of the impact, but the mitigation measures applied to reduce the likelihood of significant impacts to receptors. Mitigation measures implemented have the potential to alter the magnitude of impact, e.g. construction workers utilising appropriate Personal Protective Equipment (PPE) during the demolition and construction phase.

Table 8.7 Criteria for Assessing Impact Significance

Receptor Sensitivity	Magnitude of Change (or Impact)				
	Very high	High	Medium	Low	Negligible
High	Major	Moderate	Minor	Minor	Minor
Medium	Moderate	Minor	Minor	Negligible	Negligible
Low	Minor	Minor	Negligible	Negligible	Negligible
Very low	Minor	Negligible	Negligible	Negligible	Negligible

- 8.5.63 Impacts are defined by the terms 'beneficial', 'negligible' or 'adverse'.
- 8.5.64 Effects are defined using the terms:
- 'Short', 'medium' or 'long-term' (short – up to 1 year, medium – 1 to 10 years, or long-term – over 10 years) effect;
 - 'Temporary' or 'permanent'; and
 - 'Local level' (e.g. on site or neighbouring site); 'district level' (e.g. borough); 'regional level' (e.g. county); 'national level' (UK); 'international level'.

Scale of Residual Impact Significance

- 8.5.65 Taken together, the following terms and definitions will be used to assess the potential and residual impacts arising from the Revised Scheme.
- **Major adverse:** Potential major impact upon human health. Severe permanent reduction in the quality of a potable groundwater or surface water resource of local, regional or national importance. Permanent or severe, long term detrimental impact on animal or plant populations.
 - **Moderate adverse:** Potentially moderate impact upon human health or occupancy of buildings. Severe short-term temporary change to water quality of ground water or surface water body. Short term temporary harmful impact on animal or plant populations.
 - **Minor adverse:** Potentially short term temporary or minor impact upon human health. Minor, local-scale reduction in the quality of potable groundwater or surface water resources of local importance, fully reversible with time. Partially reversible widespread reduction in the quality of groundwater or surface water resources used for commercial or industrial abstractions. Fully reversible small-scale detrimental impact on animal or plant populations.
 - **Negligible:** No appreciable impact upon human health, potable groundwater or surface water resources of any importance, animal or plant health. Any small impacts are fully reversible.
 - **Minor beneficial:** Minor improvement in potential impacts upon human health. Minor local-scale improvement to the quality of potable groundwater or surface water resources. Moderate to significant improvement to the quality of groundwater or surface water resources used for commercial or industrial abstraction only. Minor improvement in potential impact on animal or plant populations.
 - **Moderate beneficial:** Moderate improvement in potential impacts upon human health and safe occupancy of buildings. Moderate local scale improvement to the quality of Controlled Waters. Moderate improvement in potential impact on animal or plant populations.
 - **Major beneficial:** Major improvement in potential impacts upon human health. Significant local-scale to significant

regional scale improvement to the quality of potable groundwater or surface water resources. Major improvement in potential impacts on animal or plant populations.

Limitations and Assumptions

- 8.5.66 The assumptions and conclusions presented in this report are based upon information provided by the Applicant and from external third-party sources (e.g. the Envirocheck report, BGS maps, other consultants' intrusive investigation reports).

8.6 BASELINE ASSESSMENT AND IDENTIFICATION OF KEY RECEPTORS

Baseline Assessment

Assessment of Baseline Conditions

- 8.6.1 The ground conditions impact assessment has involved the review and collation of readily available information pertaining to the current condition of the soils and groundwater on/beneath the site. This information has been used to characterise the baseline conditions of the site in respect of ground conditions and contaminated land, which has then been reviewed in the context of the Revised Scheme to evaluate the temporary (short / medium / long term), and permanent impacts on ground conditions, geology, hydrology and the hydrogeology of the site and the surrounding area. The assessment methodology considers both the detailed component of the Revised Scheme and the outline component of the Revised Scheme.
- 8.6.2 The information used in the assessment for the baseline characterisation of ground conditions has been obtained from the following sources.
- Landmark Envirocheck® Report 49413378_1_1 dated 23 September 2013;
 - Arup, Ground Contamination Risk Assessment & Outline Remediation Strategy, Bishopsgate Goods Yard, London, UK, 2008;
 - Concept, Site Investigation Report, Bishopsgate Goods Yard, London, UK;
 - WSP, Foundation Statement;
 - Plans, sections and elevations of the Revised Scheme; and
 - Environment Agency (EA) Data.
- 8.6.3 A review of the baseline conditions has allowed for the identification of the potential sources of land contamination across the site.
- 8.6.4 Whilst the focus of the assessment is on land contamination in terms of ground conditions, 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 and ground gas.

8.7 IDENTIFICATION AND DESCRIPTION OF CHANGES LIKELY TO GENERATE EFFECT

Conceptual Site Model

- 8.7.1 The Conceptual Site Model identifies plausible source-pathway-receptor linkages that must be active for any effect to be generated.
- Potential Contaminant Sources**
- 8.7.2 Potential sources of contamination at the site have been identified as:
- Contaminated Made Ground and/ or natural soils;
 - Contaminated groundwater within perched water within the Made Ground;
 - Asbestos; and
 - Dust and rubble associated with the demolition of buildings currently present across the site.

Specific Receptors Identified

8.7.3 Based on a review of the baseline conditions and an understanding of the end uses of the Revised Scheme, **Table 8.8** presents the receptors and their sensitivity that will be carried through into the ground conditions impact assessment.

Table 8.8 Summary of Receptors Relevant to the Ground Conditions Impact Assessment

Receptor	Receptor Sensitivity	Active During
Receptors Identified through review of the Baseline Conditions		
Human Health - Neighbouring uses, occupiers and the general public immediately adjacent to the Site	High	Construction and Operation
Human Health – Demolition and Construction workers	High	Construction
Principal Chalk Aquifer	Very High	Construction and Operation
Secondary A Aquifer	Moderate	Construction and Operation
On Site Utilities & Infrastructure (Including Off Site but in close proximity to the site boundary)	Low to Moderate	Construction and Operation
Land Stability	Low to Moderate	Operation
In addition, the following receptors associated with the completed Revised Scheme is identified		
Human Health – Revised Scheme End Users	High	Operation
Revised Scheme – Introduced Materials and Structures, e.g. foundations, utilities & associated pipework	Moderate	Operation

Potential Pathways

- 8.7.4 Human health exposure pathways are dependent on the proposed end-use of the site (residential and commercial). The human health exposure pathways that are considered viable based on UK guidance (CLEA) are listed below:
- Inhalation, ingestion and dermal contact with contaminated soils, groundwater;
 - 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).
- 8.7.5 For this site the Revised Scheme is expected to be covered by hard standing with the green areas being raised / contained, thus removing the pathways involving ingestion and direct contact during the operational phase. However, should any of the made ground on site be reused as soil for the green areas the pathways would remain viable.
- 8.7.6 The evaluation of exposure pathways for controlled waters receptors requires an understanding of geological and hydrogeological pathways beneath the site. The controlled waters pathway considered viable with respect to the site is:
- Leaching and downward vertical migration of contaminants into perched water within the Made Ground beneath the site; and
 - ‘Forced’ migration of contamination within the Made Ground to the underlying aquifers through piling works.
- 8.7.7 The first pathway would be eliminated for the operational phase by the covering of the site by hard standing that would eliminate infiltration of water from the surface.
- 8.7.8 The main pathways providing the risk to the Revised Scheme (introduced materials, built structures, new utilities and

infrastructure ground stability) and existing utilities and infrastructure, are:

- Mobilisation of aggressive ground and direct contact with contamination in soil materials;
- Infiltration and/or runoff into the local drainage and sewerage network; and
- Compromised land stability from, for example, the settlement of land, subsidence, dewatering (lowering water table and reducing the soil moisture content).

8.8 ASSESSMENT OF LIKELY SIGNIFICANT EFFECT

Embedded Mitigation Measures

- 8.8.1 Mitigation can be carried out through design or management, and the strategy should be informed by the following hierarchy of options:
- Avoidance;
 - Reduction;
 - Compensation;
 - Remediation; or
 - Enhancement.
- 8.8.2 Site investigation and risk assessment have previously been undertaken to investigate and identify potential contamination sources throughout the site. The site investigation report reviewed for the compilation of this ES Addendum chapter is presented in **ES Addendum Volume 4, Appendix D: Ground Conditions**.
- 8.8.3 Based on the Ground Contamination Risk Assessment and Outline Remediation Strategy,³¹ some scheduled investigation locations were not undertaken because the access to the “sliver” was denied.³² Therefore, it was recommended to complete the investigation in the above location, prior to the demolition and construction of the Revised Scheme taking place.
- 8.8.4 A Code of Construction Practice (CoCP) will be prepared following receipt of planning permission and prior to commencement of site works. This CoCP will set out the management, monitoring, auditing and training procedures that will be in place to ensure compliance with the applicable regulations. It will contain all the procedures and mitigation measures through which the construction works will be carried out.
- 8.8.5 Precautions will be taken to minimise the exposure of workers and the general public to potentially harmful substances during the demolition and construction phase. The risks to site personnel will be controlled through the implementation of site safety procedures and the use of suitable personal protective equipment (PPE). All works will be carried out in accordance with the Construction (Design and Management) Regulations (2015) and Safe Systems of Work that will be implemented. The risks to general public will be controlled through implementing an exclusion zone around the site.
- 8.8.6 Whilst no significant impacts are expected from the Revised Scheme in relation to ground conditions, mitigation measures for potentially significant adverse impacts which will be implemented on site are provided in **Table 8.9**. These should be adhered to in accordance with best practice procedures.

Table 8.9 Mitigation Measures

Description
An Environmental Risk Management Strategy (ERMS) and remediation method statement have been prepared following completion of the site investigation to address any pollutant linkages identified.
Specification of concrete used in foundations and building structures will be selected based on the results of soil and groundwater sulphate analyses. Guidance is provided by the Building Research Establishment. ³³
Installation of service pipes will be suitable to the site ground conditions in consultation with the local water provider.
A suitable Piling Method Statement and Risk Assessment will be prepared incorporating available geotechnical information from previous ground investigations.

³¹ Arup, 2008, *op. cit.*

³² The sliver is the narrow basement area (at an elevation of around +8mOD) located between the live railway cutting at the southern site boundary and the suburban rail line which runs parallel to it (Appendix E to previous application).

³³ BRE, 2005. BRE Special Digest 1:2005: Concrete in Aggressive Ground.

Description	
Ensure appropriate audit trail, testing frequency and verification to ensure chemically suitable materials across the site, in particular in landscaped area and imported materials.	
Concentrations of TPH were recorded in groundwater. Although these were identified in the less volatile C10+ hydrocarbon fractions, potentially significant risk from groundwater volatilisation to indoor air may exist. Therefore appropriate gas membranes will be installed within a number of the new buildings on site to prevent the ingress of volatile gases.	
A specialist contractor will undertake an unexploded bomb survey/investigation and mitigation plan to be implemented in the proposed CoCP.	
<p>The following measures detailing provisions for environmental and human health protection will be observed during the construction:</p> <ul style="list-style-type: none">• Keeping the length of time materials will be stockpiled on-site before materials are removed for re-use, recycling or disposal to a minimum;• Locating stockpiles as far from sensitive receptors as possible; Regularly dampening stockpiles to reduce dust generation; Covering stockpiles with tarpaulins prior to disposal;• Ensure all vehicles are well maintained to prevent accidental pollution from leaks; Use of wheel washing facilities at all Site access and egress points;• The use of PPE and implementation of Health and Safety Protocols, Plan and Procedures for all demolition and construction workers; and• Disposal of any contaminated soil off-site, to a landfill appropriate to the level of contamination present and the waste classification determined from the chemical analysis or Waste Acceptance Criteria testing as necessary.• 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 DCEMP. Wherever possible, plant and machinery will have drip trays beneath oil tanks/engines/gearboxes/hydraulics, which will be checked and emptied regularly via a licensed waste disposal operator.	
<p>The following measures detailing provisions for environmental protection should be included in the CoCP and followed during construction:</p> <ul style="list-style-type: none">• Measures for the management of site drainage, accidental spills and storage of materials to prevent pollution of surface and groundwater (including establishment of emergency response procedures in accordance with Environment Agency guidelines and provision and maintenance of spill containment equipment);• Risk to construction workers to be dealt with by the Contractor. The Contractor will be responsible for site health and safety and will manage the risk through control of suitable Health and Safety measures including provision of Personal Protective Equipment (PPE), education of the workforce and inductions for all site staff and visitors;• Good site practice measures with regards to the on-site storage, handling and transfer of fuels, chemicals and waste material;• Adherence to Pollution Prevention Guidelines;• Regulation of Health and Safety Rules including provision welfare facilities;• A Materials Management Strategy will be put in place for managing all excavated soils prior to transfer to a treatment centre or disposal by a suitably licensed contractor. All copies of the paper work and transfer notes will be retained on site. Made Ground derived from basement excavations and service and foundations trenches may need to be treated if it is to be re-used across the Site.• Verification testing will be carried out for landscape areas and imported materials; and• An environmental watching brief during site enabling works.	

Anticipated Effects: Human Health

- 8.8.7

Following a review of baseline conditions for the site, possible risks to the identified human health receptors may be expected from concentrations of heavy metals in Made Ground across the site. In particular, the Ground Contamination Risk Assessment and Outline Remediation Strategy³⁴ reported lead concentrations above the commercial screening criteria (750mg/kg) in twelve of the 60 soil samples analysed. Heavy metals (in particular Selenium) and TPH were also detected above the screening values in groundwater.
- 8.8.8

Ground-gas assessment did not identify methane at the site and detected low concentrations of carbon dioxide (maximum of 3.9% v/v).

- 8.8.9

Previous intrusive investigations did not report positive asbestos detections. However, due to the industrial nature of the site and the specification for asbestos in the viaduct construction historic drawings³⁴, the presence of asbestos-containing materials (ACM) within soil beneath the site cannot be ruled out.

Demolition and Construction Workers

- 8.8.10

It is identified that the demolition and construction phase may give rise to potential impacts upon workers. Demolition and construction workers can be assigned as high, moderate or low sensitivity dependent on the mitigation measures employed; pre-mitigation workers in this case are assigned as high risk. The magnitude for change is defined as large because the construction activities will include disturbance of the ground during earthworks and installation of foundations with associated dust generation and the potential to encounter unexploded ordnance. Furthermore, it is identified that there is potential for ground contamination (lead) at the site (based on ground investigations undertaken at the site) and asbestos in soil.
- 8.8.11

The potential impacts upon construction workers would be limited for the duration of the construction phase activities (i.e. medium-term). As such, the overall pre-mitigation significance of the impact upon health of construction workers during the construction phase is defined as major adverse.
- 8.8.12

The possible presence of ACM in soil would give an overall pre-mitigation significance of the impact upon human health during the demolition construction phase as **major adverse**. This potential impact would be **medium to long term** and **permanent**.

Public and Nearby Residents

- 8.8.13

It is identified that the demolition and construction phase may give rise to potential impacts to the high sensitivity nearby visitors or residents. The magnitude for change is defined as medium because the main pathway of potential contamination will be through inhalation of dust generated during the demolition and construction. Potential risks associated to unexploded ordnance may also affect nearby residents and the public, although the impact would be lower than construction workers.
- 8.8.14

The potential impacts upon the nearby public and residents would be limited for the duration of the construction phase activities. As such, the overall pre-mitigation significance of the impact upon health of nearby public and residents during the demolition construction phase is defined as **moderate adverse**. This potential impact would be **temporary** over the **medium term**.
- 8.8.15

The likely impact of dust is discussed further in **Volume 2, Chapter 12: Air Quality** of this ES Addendum.

Anticipated Effects: Controlled Waters

- 8.8.16

Based on the Ground Contamination Risk Assessment and Outline Remediation Strategy,³⁴ concentrations of heavy metals above the screening values were detected in Made Ground across the site. Heavy metals and select TPH fractions were detected above the screening values in groundwater.
- 8.8.17

Sources of oils and hydrocarbons constitute a potential source of contamination for controlled waters, including storage tanks, plant and machinery, spillage and leakage at refuelling areas and vandalism. As such, the overall pre-mitigation significance of the impact upon controlled waters during the demolition construction phase is defined as **moderate adverse**. This potential impact would be **temporary** over the **medium term**.

Principal Aquifer (Thanet Sands and Upper Chalk)

- 8.8.18

It is identified that the demolition and construction phase is unlikely to give rise to potential impacts upon the Thanet Sands and Upper Chalk Principal Aquifer, due to its depth and the significant thickness of the London Clay. The Thanet Sands and Upper Chalk Principal Aquifer is assigned a high sensitivity due to its national importance as a potable groundwater source. However four main categories of piles have been reviewed for potential use for the Revised Scheme; one of these will be extending into the Thanet Sands and have the potential to affect the Principal Aquifer, creating potential preferential pathways for contamination.
- 8.8.19

Taking into account the possibility of piles creating a preferential pathway the demolition and construction activities could have an impact on groundwater quality and as such the overall pre-mitigation significance of the impact upon the Thanet Sands and Upper Chalk Principal Aquifer during the demolition and construction phase is defined as **long-term, major, adverse**. However should a piling technique be employed that does not penetrate the London Clay the overall pre-mitigation significance of the impact upon the Thanet Sands and Upper Chalk Principal Aquifer during the demolition and construction phase would result in a potential likely environmental impact of **negligible** significance.

River Thames and River Walbrook

- 8.8.20

Potential impacts from demolition and construction activities on the River Thames and River Walbrook are likely to be low.

³⁴ Arup, 2008, *op. cit.*

The River Thames is 1.7 km to the south of the site and considered too far for there to be plausible pathways from the site to the receptor. The River Walbrook is culverted in the vicinity of the site, and therefore any potential pathway from the Site to the receptor is unlikely. Therefore, the magnitudes of any impact to these features will result in a potential impact of negligible significance.

Utilities, Infrastructure and Ground Stability

- 8.8.21It is identified that the demolition and construction phase may give rise to potential impacts on utilities and infrastructure on site. These could include the deterioration and contamination of new materials and built structures, utilities and infrastructure; or the pollution of existing drainage and sewerage network.
- 8.8.22The potential impacts upon the low to moderate sensitivity utilities and infrastructure could exist beyond the demolition and construction phase activities into the operational phase and are therefore classed as **long term**. The overall pre-mitigation significance of the impact upon utilities and infrastructure during the construction phase is defined as **moderate adverse**.
- 8.8.23Earthworks including excavations for basements and foundations could adversely affect land stability and, subsequently, the proposed and surrounding structures through uncontrolled settlement. It is considered that any settlement of land would represent a small magnitude of change to land stability, which is of low sensitivity. Therefore, the demolition and construction activities would result in a **negligible** impact to land stability and, subsequently, the proposed and surrounding structures.

Anticipated Effects of Applying the Minimum Development arameter

- 8.8.24The extent of Revised Scheme of each of the Plots is defined within the Development Specification and is set out on the Parameter Plans (both in terms of a maximum and minimum building envelope).
- 8.8.25The approach to the ground conditions assessment focuses on the site area and does not differentiate between the outline and detailed components or consider the scale or layout of the massing. Therefore the ground conditions assessment does not apply either the maximum or minimum building envelope as the elements required are common to both.
- 8.8.26There is a potential for the maximum development parameter to require some deeper piling to support taller buildings; and additional excavation and soils management for basement areas not included under the minimum development parameter. However, these would not result in any change to the effects outlined above.

8.9 SCOPE FOR ADDITIONAL MITIGATION MEASURES

Potential Additional Mitigation Measures

- 8.9.1If required on the basis of additional information acquired during site works, remediation works may be recommended to reduce the risks from any potential contamination to identified receptors. Based on currently available data, potential measures for the issues identified are shown in **Table 8.10**.

Table 8.10Possible Additional Mitigation Measures

Description
Areas of Made Ground across the Site may exceed the relevant environmental screening levels (for lead). As such, remediation works will be implemented based on available remediation strategies completed for the site. In particular, where areas of potentially contaminated Made Ground may not be removed, suitable cover systems will be used, in accordance with BRE guidance, ³⁵ which in this case is likely to be addressed through hardstanding and buildings.
No asbestos was identified in any of the samples tested and presented in the Arup, Ground Contamination Risk Assessment and Outline Remediation Strategy. However, due to the industrial nature of the site and the specification for asbestos in the viaduct construction historic drawings the presence of asbestos-containing materials (ACM) within soil beneath the site cannot be ruled out. Therefore if ACM are suspected or identified during demolition and construction works, their removal will be undertaken in accordance with the Control of Asbestos at Work Regulations and disposed of in accordance with appropriate waste legislation and Duty of Care responsibilities.
The operational Environmental Management Plan (EMP) will include site maintenance, storage of fuels, chemicals,

³⁵ BRE, 2004. Cover Systems for Land Regeneration, Thickness Design of Cover Systems for Contaminated Land.

Description
waste management and emergency response procedures to protect the soil and groundwater from operational activities, to protect the ground water etc. from contamination.

Likely Effectiveness of Additional Mitigation Measures

- 8.9.2If new data indicate that risks are more severe than they currently appear, it is very likely that the additional measures described in Section 8.9 ‘Scope for Additional Mitigation Measures’ will reduce the potential effect to negligible significance.

8.10 RESIDUAL EFFECTS

- 8.10.1**Table 8.11** provides a summary of the residual effects resulting from the Revised Scheme after effective implementation of the embedded and additional mitigation measures proposed above.

Table 8.11Residual Effects

Phase	Resource or Receptor Affected	Residual Effect
Construction	Impact of Contaminated Soils, Groundwater and Ground Gas to construction workers.	Negligible
	Impact of Contaminated Soils, Groundwater and Ground Gas on controlled waters.	Negligible
	Impact of Contaminated Soils, Groundwater and Ground Gas to on-site residents.	Negligible
Operation	Impact from soil and groundwater contamination on human health	Minor to Major Beneficial
	Land contamination due to new activities on site: spillages of fuels in car parks; leakage from chemical	Negligible
	Impact on proposed structures	Negligible

8.11 CUMULATIVE EFFECTS

- 8.11.1Cumulative effects are the combined effects of several development schemes (in conjunction with the Revised Scheme) which may, on an individual basis be insignificant but, cumulatively, have a significant effect.
- 8.11.2The ES Addendum has given consideration to ‘Cumulative ‘Effects’ for schemes located within (1) km radius from the boundary of the site. A full list of the committed developments considered is detailed in **ES Volume 2, Chapter 3: EIA Methodology Table 3.8**.
- 8.11.3There are currently 42 development sites within a 1 km radius of the site. Five of these are within 250 m to the west with a further site within 250 m south of the site and a further site within 250 m north of the site. The majority of these development sites are former commercial/industrial and residential sites, with development proposed for primary high-rise, mixed-use developments including offices, retail, residential, community and leisure uses.
- 8.11.4It is considered that the residual cumulative impact of the identified developments on ground conditions will be negligible to major beneficial provided that the requirements of relevant policy and legislation relating to land contamination and remediation of sites occur in the redevelopment process due to identified contamination, this will add to the beneficial impact of reducing the stock of contaminated land in the Borough.

8.12 QUALITATIVE COMPARISON BETWEEN THE 2015 PROPOSED DEVELOPMENT AND THE 2019 REVISED SCHEME

- 8.12.1

We have noted above that this updated assessment does not differ greatly from the assessment for the 2015 Proposed Development. There is no change to the baseline and the proposals represent very similar works proposed to those for the 2015 Proposed Development which has resulted in no difference to the pre mitigation effects or the residual effects reported in the 2015 ES.

8.13 SUMMARY AND CONCLUSIONS

- 8.13.1

The baseline assessment was carried out for the 2015 original assessment and has not since altered. Occasional low levels of ground contamination were identified and described. The baseline assessment was used to develop a conceptual site model that identifies potential sources of harm, relevant receptors that may be affected, and pathways by which harmful effects may propagate from source to receptor.
- 8.13.2

The methodology examined the significance of likely effects, including standard and good practice precautionary measures to protect receptors, and then considered the requirement for additional mitigation.
- 8.13.3

The identified receptors included site workers, nearby residents and site users; groundwater beneath the site; and on-site and nearby buildings.
- 8.13.4

Based on current knowledge of the site conditions, the likely negative effects in all cases were judged to be negligible, requiring no additional mitigation actions. However, in the event that additional or higher-level contamination were identified during demolition and construction works, remediation of soils or groundwater might become necessary.
- Conclusion**
- 8.13.5

The potential impact of the Revised Scheme on environmental receptors in relation to ground conditions are assessed as being of negligible significance, on the assumption that standard good practice and mitigation measures are applied as discussed in this chapter.
- 8.13.6

It should be noted that the removal of contaminated soils associated with the preparatory ground works and foundation excavations of the Revised Scheme will result in a moderate beneficial residual effect to the local environment, as this will reduce the net contaminant loading in the area.
- 8.13.7

In relation to Ground Conditions this amended scheme does not differ from the original scheme assessed in 2015, other than a potential beneficial change in the reduction of piling through the London Clay Formation.
- 8.13.8

Table 8.12 summarises the residual effects resulting from the Revised Scheme.

Table 8.12 Summary of Residual Effects

Receptor/ Affected Group	Value or Sensitivity (Significance) of Receptor	Activity or Impact	Embedded Design Mitigation	Magnitude/ Spatial Extent/ Duration/ Likelihood of Occurrence	Significance of effect	Additional Mitigation	Residual Magnitude of Impact	Significance of Residual effect
Construction								
Construction workers	High	Impact of Contaminated Soils, Groundwater and Ground Gas	Contractor Health and Safety measures including provision of Personal Protective Equipment (PPE), education of the workforce and inductions for all site staff and visitors	High, Direct Local Medium-term Likely	Major Adverse	If significant contamination, including ACM, is identified during works, remediation.	Very Low	Negligible
Controlled waters	High	Impact of Contaminated Soils and Groundwater	Appropriate piling method and provision of piling risk assessment	High Indirect Local to District Medium-term Unlikely	Major Adverse	If significant soil or water contamination is identified during, remediation.	Very Low	Negligible
Local residents	High	Impact of Contaminated Soils, Groundwater and Ground Gas		Moderate Direct Local Medium-term Unlikely	Moderate Adverse	If significant soil or water contamination is identified during, remediation.	Very Low	Negligible
Operation								
Site workers / residents, controlled waters	High	Impact from soil and groundwater contamination on human health and controlled waters	None	Minor to Major Direct Local to District Medium-term Unlikely	Minor to Major Beneficial	None		Minor to Major Beneficial
Site workers / residents, controlled waters	High	Land contamination due to new activities on site: chemical spillages	None	Minor Indirect Local Medium-term Unlikely	Minor	Adherence to EMP and good housekeeping		Negligible
On-site and nearby structures	Medium	Contaminated ground	Appropriate design of proposed structures	Negligible Direct Local Medium-term Unlikely	Negligible	None	Very Low	Negligible
Cumulative Effects - Construction								
None identified								
Cumulative Effects - Operation								
None identified								

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