



# ENVIRONMENTAL STATEMENT: 6.1 CHAPTER 17: GROUND CONDITIONS AND SOILS

**Cory Decarbonisation Project**  
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Revision A

**DECARBONISATION**

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## 17. GROUND CONDITIONS AND SOILS

### 17.1. INTRODUCTION

17.1.1. This chapter reports the assessment of the likely significant effects of the Proposed Scheme on ground conditions and soils during construction and operation and describes:

- relevant policy, legislation and guidance;
- consultation undertaken to date;
- the methodology for assessment;
- potential effects of the construction phase; and
- potential effects of the operation phase.

### 17.2. POLICY, LEGISLATION, AND GUIDANCE

17.2.1. The policy, legislation, and guidance relevant to the assessment of ground conditions and soils for the Proposed Scheme is detailed in **Table 17-1**.

**Table 17-1: Ground Conditions and Soils – Summary of Key Policy, Legislation, and Guidance**

Policy, Legislation or Guidance	Description
<b>Policy</b>	
<b>Overarching National Policy Statement (NPS) for Energy EN-1 2024<sup>1</sup></b>	<p>This Overarching National Policy Statement for Energy (EN-1) is part of a suite of NPS designated by the Secretary of State of DESNZ in January 2024. Paragraph 4.3.2 states that <i>“The Regulations specifically refer to effects on population, human health, biodiversity, land, soil, water, air, climate, the landscape, material assets and cultural heritage, and the interaction between them”</i>.</p> <p>Paragraph 5.11.3 states that <i>“Although the re-use of previously developed land for new development can make a major contribution to sustainable development by reducing the amount of countryside and undeveloped greenfield land that needs to be used, it may not be possible for many forms of energy infrastructure”</i>.</p> <p>Paragraph 5.11.4 states that <i>“Development of land will affect soil resources, including physical loss of and damage to soil resources, through land contamination and structural damage. Indirect impacts may also arise from</i></p>

Policy, Legislation or Guidance	Description
	<p><i>changes in the local water regime, organic matter content, soil biodiversity and soil process”.</i></p> <p>Paragraph 5.11.5 states that <i>“Where pre-existing land contamination is being considered within a development, the objective is to ensure that the site is suitable for its intended use. Risks would require consideration in accordance with the contaminated land statutory guidance<sup>21</sup> as a minimum”.</i></p> <p>Paragraph 5.11.8 states that <i>“The ES should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan. The assessment should be proportionate to the scale of the preferred scheme and its likely impacts on such receptors. For developments on previously developed land, the applicant should ensure that they have considered the risk posed by land contamination and how it is proposed to address this”.</i></p> <p>Paragraph 5.11.13 states that <i>“Applicants should also identify any effects and seek to minimise impacts on soil health and protect and improve soil quality taking into account any mitigation measures proposed”.</i></p> <p>Paragraph 5.11.14 states that <i>“Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination. The sustainable reuse of soils needs to be carefully considered in line with good practice guidance where large quantities of soils are surplus to requirements or are affected by contamination”.</i></p> <p>Paragraph 5.11.15 states that <i>“Developments should contribute to and enhance the natural and local environment by preventing new and existing developments 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”.</i></p>

Policy, Legislation or Guidance	Description
	<p>Paragraph 5.11.16 states that “Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans”.</p> <p>Paragraph 5.11.17 states that <i>“Applicants should ensure that a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination”</i>.</p> <p>Paragraph 5.11.18 states that <i>“For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination, and where contamination is present, applicants should consider opportunities for remediation where possible. It is important to do this as early as possible as part of engagement with the relevant bodies before the official pre-application stage”</i><sup>18</sup>.</p> <p>Paragraph 5.11.19 states that <i>“Applicants should safeguard any mineral resources on the proposed site as far as possible, taking into account the long-term potential of the land use after any future decommissioning has taken place”</i>.</p> <p>Paragraph 5.11.23 states that <i>“Although in the case of most energy infrastructure there may be little that can be done to mitigate the direct effects of an energy project on the existing use of the proposed site (assuming that some of that use can still be retained post project construction) applicants should nevertheless seek to minimise these effects and the effects on existing or planned uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction”</i>.</p> <p>Paragraph 5.11.28 states that <i>“Where a proposed development has an impact upon a Mineral Safeguarding Area (MSA), the Secretary of State should ensure that appropriate mitigation measures have been put in place to safeguard mineral resources”</i>.</p>

Policy, Legislation or Guidance	Description
<p><b>National Planning Policy Framework (NPPF) 2023<sup>2</sup></b></p>	<p>The NPPF sets out the Government’s planning policies for England and how these should be applied, with the following chapters relating to ground conditions and soils:</p> <p>Chapter 11: Making Effective Use of Land (paragraphs 119 to 120): <i>“Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or ‘brownfield’ land...Planning policies and decisions should...support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land”.</i></p> <p>Chapter 15: Conserving and Enhancing the Natural Environment (paragraphs 174 to 185): <i>“Planning policies and decisions should contribute to and enhance the natural and local environment by:</i></p> <ul style="list-style-type: none"> <li><i>a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);</i></li> <li><i>d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;</i></li> <li><i>e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and</i></li> <li><i>f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate...</i></li> </ul> <p><i>Planning policies and decisions should ensure that:</i></p> <ul style="list-style-type: none"> <li><i>a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability</i></li> </ul>



Policy, Legislation or Guidance	Description
	<p><i>and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); 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</i></p> <p><i>c) adequate site investigation information, prepared by a competent person, is available to inform these assessments...</i></p> <p><i>Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development”.</i></p> <p>Chapter 17: Facilitating the Sustainable Use of Minerals (paragraphs 210 to 216):</p> <p><i>“Planning policies should...Set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;...</i></p> <p><i>Minerals planning authorities should:...encourage underground gas and carbon storage and associated infrastructure if local geological circumstances indicate its feasibility... When determining planning applications, minerals planning authorities should ensure that the integrity and safety of underground storage facilities are appropriate, taking into account the maintenance of gas pressure, prevention of leakage of gas and the avoidance of pollution”.</i></p>



Policy, Legislation or Guidance	Description
<p><b>The London Plan 2021<sup>3</sup></b></p>	<p>The Spatial Development Strategy for Greater London setting out a framework for how London will develop over the next 20-25 years and the Mayor’s vision for Good Growth.</p> <p>Policy G9: Geodiversity and Policy SI17: Protecting and Enhancing London’s Waterways are the key policies specific to ground conditions and soils.</p> <p>Policy G9: Geodiversity: <i>“In Development Plans, boroughs should: ...Establish clear goals for the management of identified sites to promote public access, appreciation and interpretation of geodiversity...Development proposals should...make a positive contribution to the protection and enhancement of geodiversity”.</i></p> <p>Policy SI17: Protecting and Enhancing London’s Waterways: <i>“Development plans should support river restoration and biodiversity improvements... Development proposals should support and improve the protection of the distinct open character and heritage of waterways and their settings... Development proposals along London’s canal network, docks, other rivers and water space (such as reservoirs, lakes and ponds) should respect their local character, environment and biodiversity and should contribute to their accessibility and active water-related uses. Development Plans should identify opportunities for increasing local distinctiveness and recognise these water spaces as environmental, social and economic assets”.</i></p>
<p><b>The Bexley Local Plan 2023<sup>4</sup></b></p>	<p>The Local Plan, adopted on 26 April 2023, positively plans for sustainable development across the Borough, including measures to address geology and ground conditions.</p> <p>It is essential to the delivery of the Council’s other key plans and strategies, including the Bexley Plan, the Growth Strategy and the Connected Communities Strategy.</p> <p>Policies relevant to this chapter are:</p> <ul style="list-style-type: none"> <li>• Policy SP9 which relates to Protecting and Enhancing Biodiversity and Geological Assets;</li> </ul>

Policy, Legislation or Guidance	Description
	<ul style="list-style-type: none"> <li>• Policy DP20 which relates to Biodiversity and geodiversity in developments including the Protection of designated sites and habitats; and</li> <li>• Policy DP28 which relates to Contaminated land and development and storage of hazardous substances.</li> </ul>
<b>London Environment Strategy 2018<sup>5</sup></b>	<p>The London Environment Strategy objective 5.1 is to “<i>make more than half of London’s area green by 2050</i>” by significantly increasing the area of green cover in the built environment and providing opportunities to enjoy the capital’s natural heritage (including geology) and designed landscapes.</p>
<b>South East Inshore Marine Plan, June 2021<sup>6</sup></b>	<p>The South East Inshore Marine Plan area stretches from Felixstowe in Suffolk to west of Dover in Kent and incorporates the River Thames. The South East Inshore Marine Plan will help to enhance and protect the marine environment and achieve sustainable economic growth while respecting local communities both within and adjacent to the marine plan area. The following policies are relevant to ground conditions and soils:</p> <ul style="list-style-type: none"> <li>• Policy SE-DD-1 – which relates to dredging activity, including navigational dredging;</li> <li>• Policy SE-DD-2 – which relates to avoiding impacts on licensed disposal sites;</li> <li>• Policy SE-DD-3 – which relates to the disposal of dredged material and its assessment against the waste hierarchy;</li> <li>• Policy SE-WQ-1 – which relates to protecting, enhancing and restoring water quality and the avoidance of water pollution; and</li> <li>• Policy SE-MPA-3 – which relates to the avoidance of impacts on areas of designated geodiversity.</li> </ul>
<b>Legislation</b>	
<b>Environment Act 1995</b>	<p>Part IIA of the Environmental Protection Act 1990<sup>7</sup>, is introduced by Section 57 of the Environment Act 1995, requires an overall risk-based approach to dealing with contaminated sites, which is consistent with the general good practice approach to managing land contamination.</p>

<b>Policy, Legislation or Guidance</b>	<b>Description</b>
	<p>The regulatory regime set out in Part IIA is based on the following activities:</p> <ul style="list-style-type: none"> <li>● Identify the problem;</li> <li>● Assess the risks;</li> <li>● Determine the appropriate remediation requirements;</li> <li>● Consider the costs;</li> <li>● Establish who should pay; and</li> <li>● Implementation and remediation.</li> </ul> <p>Section 78A(2) of the Act defines Contaminated Land for the purpose of Part IIA as:</p> <p><i>"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that-</i></p> <p><i>(a) significant harm is being caused or there is a significant possibility of such harm being caused; or</i></p> <p><i>(b) pollution of controlled waters is being, or is likely to be, caused."</i></p> <p>The basis of the definition is complex and incorporates the concept of risk assessment. This involves identification of contaminant source, pathway and receptor with the essential establishment of pollutant linkages by which the contaminant from the source can reach the receptor via the pathway with the possibility to cause significant harm or the pollution of controlled waters.</p>
<p><b>The Construction (Design and Management) Regulations 2015 (CDM Regulations)<sup>8</sup></b></p>	<p>The main regulations for managing the health, safety and welfare of construction projects. CDM Regulations apply to all building and construction work, including new build, demolition, refurbishment, extensions, conversions, repair and maintenance.</p>
<p><b>Control of Substances Hazardous to Human Health (COSHH) 2002<sup>9</sup></b></p>	<p>Law requiring employers to control substances that are hazardous to health. Outlines a precautionary approach to risk management with control strategies aiming to reduce exposure as much as possible.</p>

Policy, Legislation or Guidance	Description
<b>Control of Asbestos Regulations 2012<sup>10</sup></b>	Provide a framework for the management of asbestos/asbestos containing materials (ACMs) in existing non-domestic premises and during any work activity involving asbestos. Duty holders must make sure anyone who carries out any work in non-domestic premises and any occupants of the premises are not exposed to asbestos from ACMs that may be present.
<b>The Environmental Permitting (England and Wales) Regulations 2016 (EP Regulations)<sup>11</sup></b>	These Regulations provide a system for permitting specified environmentally significant operations, a system of consenting of water discharges, a groundwater permitting system and a system of radioactive substances regulation. The EP Regulations require every regulated facility (as defined) to be operated under the authority of an Environmental Permit. They provide, among other things, for: the discharge of functions by the regulator in relation to permits, procedures for environmental permitting, enforcement notices and other enforcement measures and powers of the regulator.
<b>The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017<sup>12</sup></b>	Regulations that provide a framework for managing the water environment.
<b>The Water Act 2014<sup>13</sup></b>	The Water Act 2014 is an update to the Water Resources Act 1991 which enables greater competition for non-household customers and gives Ofwat new powers to make rules about charges and charging schemes, as well as making provisions for flood insurance and drainage boards. It is relevant for the Proposed Scheme due to its legislative power in ensuring the protection of controlled waters within the Site.

Policy, Legislation or Guidance	Description
<b>Guidance</b>	
<b>National Planning Practice Guidance (2021)<sup>14</sup></b>	<p>Sets out the Government’s planning policies for England and how these should be applied. The relevant policies under ‘Making effective use of land’, ‘Conserving and enhancing the natural environment’ and, ‘Facilitating the sustainable use of minerals’ are set out in the following Chapters:</p> <ul style="list-style-type: none"> <li>• Chapter 11 – Making Effective Use of Land, Paragraphs 119 to 120;</li> <li>• Chapter 15 – Conserving and Enhancing the Natural Environment, Paragraphs 174 to 185; and</li> <li>• Chapter 17 – Facilitating the Sustainable Use of Minerals, Paragraphs 210 to 216.</li> </ul>
<b>C552 Contaminated Land Risk Assessment: A Guide to Good Practice 2001<sup>15</sup></b>	<p>Guidance to assist those who carry out contaminated land risk assessments. Includes the overall risk management process involving identifying risks and assessing their significance.</p>
<b>C532 Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors 2001<sup>16</sup></b>	<p>Provides guidance on environmental good practice for the control of water pollution arising from construction activities. The document focuses on the potential sources of water pollution from within construction sites and the effective methods of preventing its occurrence.</p>
<b>C733 Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks 2014<sup>17</sup></b>	<p>Guidance to improve the process of risk assessment and risk management on sites that contain soils or made ground potentially contaminated by asbestos.</p>
<b>Land Contamination Risk Management (LCRM) 2023<sup>18</sup></b>	<p>Technical guidance to be followed by all parties engaged in and responsible for land contamination. To understand the management of contamination issues, the LCRM recommends the use of a Conceptual Site Model (CSM), comprising three elements: a source; a pathway; and a receptor. The CSM will be used to identify and assess the</p>

Policy, Legislation or Guidance	Description
	potential effects on the identified sensitive receptors (including human health, controlled waters, buildings and services) and to outline mitigation measures to manage the risks identified in the assessment.
<b>Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change 2022<sup>19</sup></b>	Presents clear practical guidance on how to include the potential effects of climate change in controlled waters risk assessment for land contamination.
<b>Groundwater Protection Technical Guidance 2017<sup>20</sup></b>	Guidance on managing and protecting groundwater through consideration of the impact on existing or potential uses of ground resources; hydraulic properties of the rock strata; the quality of any receiving groundwater; and any likely changes in circumstances over the time in which groundwater may be impacted.
<b>DMRB LA109 Geology and Soils<sup>21</sup></b>	<p>Guidance on assessing and managing the effects associated with geology and soils resulting in:</p> <ul style="list-style-type: none"> <li>• effects on bedrock geology and superficial deposits, including geological designations and sensitive/valuable non-designated features;</li> <li>• effects on soil resources; and</li> <li>• effects from contamination on human health, surface water and groundwater.</li> </ul>

### 17.3. CONSULTATION AND ENGAGEMENT

- 17.3.1. **Table 17-2** provides a summary of the consultation and engagement undertaken in support of the preparation of this assessment.
- 17.3.2. **Table 17-3** provides a summary of comments provided as part of the statutory consultation process and an appropriate response.
- 17.3.3. **Appendix 4-2: Scoping Opinion Responses (Volume 3)** provides a summary of the Planning Inspectorate and consultee comments on the EIA Scoping Opinion<sup>22</sup> and the Applicant's responses.

**Table 17-2: Consultation and Engagement Summary Table in relation to Ground Conditions and Soils**

Date and Method of Consultation	Consultee	Summary of Key Topics Discussed and Key Outcomes
13 <sup>th</sup> February 2023, Email	London Borough of Bexley	Contact made seeking environmentally pertinent information and substructure and geological hazard data held relevant to the Study Area.
27 <sup>th</sup> February 2023, Email	London Borough of Bexley	<p>Response received asking for a plan showing the approximate location of the Proposed Scheme to support the above enquiry with regard to contamination.</p> <p>The response included information from LBB’s Building Control Team regarding substructure and geological hazard information. The information is as follows:</p> <p><i>“The ground conditions in the area are typically a mixture of made ground, clay, and underlying peat to depths of up to approximately 12m in places. The vast majority of sites in this part of the borough opt for a pile foundation design to overcome issues in relation to poor substrata. Raft foundations are occasionally specified for smaller projects. This is true for the majority of Belvedere north of Abbey Road and Lower Road.</i></p> <p><i>Localised borehole investigation would be necessary on the proposed site to allow for a designed foundation solution from a structural engineer. Industrial projects locally have also seen it necessary to allow for piled road bases leading to and around the site”.</i></p>
28 <sup>th</sup> February 2023, Email	London Borough of Bexley	A plan was sent to LBB as requested. At the time of writing, no response has been received regarding pertinent contamination information relating to the Study Area.
27 <sup>th</sup> October 2023, Email	London Borough of Bexley	An email was sent to LBB requesting a response to the enquiry sent on 28 <sup>th</sup> February 2023. No response has been received at the time of writing.



Date and Method of Consultation	Consultee	Summary of Key Topics Discussed and Key Outcomes
27 <sup>th</sup> October 2023, Email	Environment Agency	Contacted for environmentally pertinent information including contamination issues, water quality, landfill records and remedial works relating to the Study Area.
31 <sup>st</sup> October 2023, Email	Environment Agency	Response received stating that the above enquiry had been forwarded on to the Environment Agency Customers and Engagements Team.
15 <sup>th</sup> December 2023, Email	Environment Agency	<p>Response to enquiry relating to pertinent environmental information for the Study Area.</p> <p>Within the response, the Environment Agency states that it has no record of any sites being determined as Contaminated Land under Section 78 of the Environmental Protection Act 1990<sup>7</sup> in the vicinity of the Site nor any designated special sites.</p> <p>The Environment Agency provided a list of sources where information relating to water quality, the presence of Above Ground Storage Tanks and gas meters, current permitted sites, pollution incidents, and historic landfill sites could be found. A review of these sources provided by the Environment Agency has been conducted and is presented in <b>Appendix 17-1: Preliminary Risk Assessment (Volume 3)</b>.</p>

**Table 17-3: Summary of the Statutory Consultation Comments in relation to Ground Conditions and Soils**

Statutory Consultee	Response
<b>Environment Agency</b>	
<p><i>“We note that hydrogen and battery storage proposals, mentioned in the previous consultation response from SL/2023/122661/01, are no longer proposed, and comments from our previous response have been acknowledged. The</i></p>	<p>The <b>Outline CoCP (Document Reference 7.4)</b> states that a Piling Risk Assessment will be produced prior to construction commencing. The Piling Risk Assessment would include measures to protect the underlying aquifers during the construction phase and mitigate risk of creating</p>

Statutory Consultee	Response
<p><i>scope of the proposed EIA is acceptable in principle in that it outlines key issues of concern including water quality and land contamination. We welcome the proposed inclusion of a piling risk assessment, and that sediment plume modelling will be undertaken. We note the consideration of the WFD assessments for the local groundwater body.</i></p> <p><i>Piling risk assessments should refer to the guidance document "Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention" (NGWCL Centre Project NC/99/73)."</i></p>	<p>preferential pathways for potential contamination. The Piling Risk Assessment would be drafted in accordance with the Environment Agency document titled Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (NGWCL Centre Project NC/99/73)<sup>23</sup>.</p> <p>Please refer to <b>Chapter 11: Water Environment and Flood Risk (Volume 1)</b> and <b>Appendix 11-4: Coastal Modelling Studies (Volume 3)</b> for details of the sediment modelling undertaken to inform this ES.</p> <p>A WFD assessment has been undertaken for the Proposed Scheme and is presented in <b>Appendix 11-2: Water Framework Directive Impact Assessment (Volume 3)</b>.</p>
<p><i>"It is assumed that wastes will either be treated on-site and disposed of to foul sewer (under consent) or taken for treatment/disposal at an appropriately licensed facility off-site. Note that any discharge to the environment would be subject to environmental permitting regulations."</i></p>	<p>As detailed in <b>Chapter 2: Site and Proposed Scheme Description (Volume 1)</b> a new connection to the local foul sewer network will be required for wastewater discharge. The nearest foul sewer is located at the junction between Norman Road and A2016 Picardy Manorway.</p>
<p><i>"Contaminated run-off – contaminated run-off (during construction and potentially operation) could result in degradation of habitats and wetlands in terrestrial parts of the TWUL's retained land, and would also affect foraging resources used by wintering birds. This degradation of ditch impact would also have significant negative impacts on water quality leading to die-off and degradation of ditch habitat supporting these species. Macroinvertebrates, water voles and</i></p>	<p>Potential effects to habitats, wetlands, and species by contaminated run-off are considered in <b>Chapter 7: Terrestrial Biodiversity (Volume 1)</b> and <b>Chapter 8: Marine Biodiversity (Volume 1)</b> during construction and in relation to potential sources of contamination resulting from construction of the Proposed Scheme. The potential effects of contamination on ecological receptors during the construction phase have been assessed in <b>Section 17.8</b> in relation to the potential for existing contamination (i.e. potential contamination as a result of historical site uses). This is in relation</p>

Statutory Consultee	Response
<p><i>freshwater fish, would all be impacted through changes to water quality resulting in fish mortality and degradation of ditch habitat supporting these species.”</i></p>	<p>to those ecological receptors which are considered to be in hydraulic connection with groundwater underlying the Proposed Scheme within the 1km Study Area.</p> <p>There are not considered to be any potentially significant effects regarding ground conditions and soils during the operation phase as it is anticipated that any contamination identified during the construction phase will be remediated in line with national and local planning policy upon consideration of the proposed end use.</p> <p>Run-off associated with pollution events will be controlled through measures set out in the <b>Outline CoCP (Document Reference 7.4)</b> and the <b>Outline Drainage Strategy (Document Reference 7.2)</b>.</p>
Natural England	
<p><i>“Under the Town and Country Planning (Development Management Procedure) (England) Order 2015 (DMPO) Natural England is a statutory consultee on development that would lead to the loss of over 20ha of ‘best and most versatile’ (BMV) agricultural land (land graded as 1, 2 and 3a in the Agricultural Land Classification (ALC) system, where this is not in accordance with an approved plan.</i></p> <p><i>Natural England has been unable to locate an assessment within the PEIR in relation to the assessment of impacts to land use and agricultural soils. That said, from the description of the development this application is likely to affect best and most agricultural land. We consider that the proposed development,</i></p>	<p>A review of post 1988 Agricultural Land Classification (ALC) mapping indicates that there are no soils of Best and Most Versatile (BMV) quality (ALC Grades 1 to 3a) at the Site. Therefore, an assessment of impacts to agricultural land and soils has been scoped out and it is considered that BMV soils will not be impacted during the construction and operation phases of the Proposed Scheme.</p> <p>In response to the EIA Scoping Opinion<sup>24</sup>, the Planning Inspectorate stated the following: <i>“Based on the urban location of the Proposed Development, the Inspectorate is in agreement that agricultural land uses and land classification can be scoped out of the assessment for the construction and operational phases.”</i></p>

Statutory Consultee	Response
<p><i>if temporary as described, is unlikely to lead to significant permanent loss of BMV agricultural land, as a resource for future generations. This is on the basis that the solar panels would be secured to the ground by steel piles with limited soil disturbance and could be removed in the future with no permanent loss of agricultural land quality likely to occur, provided the appropriate soil management is employed and the development is undertaken to high standards. We note that some components of the development, such as construction of a sub-station, may permanently affect agricultural land and this should be fully assessed within the Environmental Statement.</i></p> <p><i>However, during the life of the proposed development it is likely that there will be a reduction in agricultural production over the whole development area. Your authority should therefore consider whether this is an effective use of land in line with planning practice guidance which encourages the siting of large scale solar farms on previously developed and non-agricultural land.</i></p> <p><i>Paragraph 5.10.8 of the National Policy Statement for Energy details that ‘Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify</i></p>	

Statutory Consultee	Response
<p><i>any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed’.</i></p> <p><i>"Similarly, Paragraph 174b and footnote 53 of the National Planning Policy Framework (NPPF) states that:</i></p> <p><i>‘Planning policies and decisions should contribute to and enhance the natural and local environment by:</i></p> <p><i>recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland.’</i></p> <p><i>Footnote 53: Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality. We would also draw to your attention to Planning Practice Guidance for Renewable and Low Carbon Energy (March 2015) (in particular paragraph 013), and advise you to fully consider best and most versatile land issues in accordance with that guidance.</i></p> <p><i>Decision makers are responsible for ensuring that they have sufficient information to apply the requirements of the NPPF and the National Policy Statement for Energy. The weighting attached to a particular consideration is a matter of judgement for the decision maker. This is the case regardless of whether the proposed development is sufficiently large to consult Natural England.</i></p>	

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<p><i>Should you have any questions about ALC or the reliability of information submitted with regard to BMV land please refer to Natural England’s ‘Guide to assessing Development proposals on Agricultural Land’. This document describes the ALC system including the definition of BMV land, existing ALC data sources and their relevance for site level assessment of land quality and the appropriate methodology for when detailed surveys are required.</i></p> <p><i>Soil is a finite resource which plays an essential role within sustainable ecosystems, performing an array of functions supporting a range of ecosystem services, including storage of carbon, the infiltration and transport of water, nutrient cycling, and provision of food. It is recognised that a proportion of the agricultural land will experience temporary land loss. In order to both retain the long term potential of this land and to safeguard all soil resources as part of the overall sustainability of the whole development, it is important that the soil is able to retain as many of its many important functions and services (ecosystem services) as possible through careful soil management and appropriate soil use, with consideration on how any adverse impacts on soils can be avoided or minimised.</i></p> <p><i>General guidance for protecting soils during development is also available in Defra’s Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, and should the</i></p>	

Statutory Consultee	Response
<p><i>development proceed , we recommend that relevant parts of this guidance are followed, e.g. in relation to handling or trafficking on soils in wet weather.</i></p> <p><i>The British Society of Soil Science has published the Guidance Note Benefitting from Soil Management in Development and Construction which sets out measures for the protection of soils within the planning system and the development of individual sites, which we also recommend is followed.”</i></p>	



## 17.4. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

17.4.1. The ground conditions and soils assessment of the Proposed Scheme has been undertaken in line with the legislation, policy and guidance described in **Section 17.2**.

### POTENTIAL SIGNIFICANT EFFECTS

17.4.2. As set out in the EIA Scoping Report<sup>22</sup>, the following effects are considered to be significant and have been considered further in this assessment.

17.4.3. Further to the publication of the EIA Scoping Report and PEIR effects on ecological receptors in relation to potential exposure to existing contamination (i.e. potential contamination as a result of historical site uses) potentially spread by the Proposed Scheme during the construction phase have been considered. The assessment is in relation to those ecological receptors which are considered to be in hydraulic connection with groundwater underlying the Proposed Scheme within the 1km Study Area. Potential effects to habitats, wetlands, and species by contaminated run-off are considered in **Chapter 7: Terrestrial Biodiversity (Volume 1)** and **Chapter 8: Marine Biodiversity (Volume 1)** during construction and in relation to potential sources of contamination resulting from construction of the Proposed Scheme.

### Construction Phase

17.4.4. The following effects are considered likely to be significant and therefore have been considered further in this assessment:

- site users and staff (excluding construction staff) – in relation to potential exposure to contamination within the underlying soils/groundwater;
- construction staff – in relation to potential exposure to contamination within the underlying soils/groundwater and reuse of site-won materials (including dredged arisings);
- third party neighbours – in relation to potential exposure to contamination within underlying soils/groundwater;
- controlled waters – in relation to potential contamination within the underlying soils/groundwater;
- onsite and third party below ground services and building structures – in relation to potential contamination within the underlying soils/groundwater; and
- ecological receptors – in relation to potential exposure to contamination within underlying soils/groundwater.

17.4.5. The effects associated with potential contamination of the water environment not relating to legacy contamination, such as pollution of controlled water from spillages, is outlined in **Chapter 11: Water Environment and Flood Risk (Volume 1)**.

- 17.4.6. The reuse of site-won materials (including dredged arisings) on the Site will be dependent on the condition that the materials are assessed to be geochemically and geotechnically suitable for use. Further details of this assessment are set out in the **Outline CoCP (Document Reference 7.4)**.
- 17.4.7. The reuse of site-won materials is considered to only be of potential significance to construction staff as site users, staff and third party neighbours are highly unlikely to be in contact with potentially contaminative arisings during the construction phase.
- 17.4.8. The **Outline CoCP (Document Reference 7.4)** includes measures to mitigate the migration of potential contamination from site materials to controlled waters receptors. Below ground services and building structures will not come into contact with materials considered unsuitable for reuse.
- 17.4.9. As stated in **Chapter 16: Materials and Waste (Volume 1)**, it is anticipated that site-won materials will be reused on the Proposed Scheme, where suitable. If considered unsuitable, site-won materials will be taken offsite for reuse, unless circumstances dictate it must be disposed to landfill. Please refer to **Chapter 16: Materials and Waste (Volume 1)** for further details on the reuse of site arisings and the potential disposal method of dredged arisings.
- 17.4.10. There are not considered to be any potentially significant effects regarding ground conditions and soils during the operation phase as it is anticipated that any contamination identified during the construction phase will be remediated in line with national and local planning policy upon consideration of the proposed end use.

## **MATTERS SCOPED OUT**

- 17.4.11. The following effects are considered unlikely to be significant and therefore have not been considered further in this assessment:
- Construction Phase:
    - as there is no agricultural land within the Site, agricultural land and soils in relation to potential contamination within the underlying soils/groundwater (as agreed with the Planning Inspectorate); and
    - no GWTDE sites have been reported within close proximity of the Study Area and have therefore been scoped out. This is also demonstrated within Chapter 7: Terrestrial Biodiversity, Chapter 8: Marine Biodiversity and Chapter 11: Water Environment and Flood Risk of the EIA Scoping Report<sup>23</sup>.
  - Operation Phase:
    - human health, controlled waters, below ground services and building structures, ecological receptors and agricultural soils.

## BASELINE DATA COLLECTION

- 17.4.12. A desk-based data collection exercise has been undertaken in the form of a Phase 1 Preliminary Risk Assessment (PRA). The PRA includes a review of available information to determine the baseline conditions of the Study Area and assess potential land contamination constraints relevant to the construction phase of the Proposed Scheme.
- 17.4.13. The PRA is included as **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**.
- 17.4.14. The key sources of information used to determine the baseline ground and soils conditions are:
- Groundsure Report, within **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**;
  - British Geological Survey (BGS) Geology Online Viewer<sup>25</sup>;
  - British Geological Survey (BGS) GeoIndex Onshore Online Viewer<sup>26</sup>;
  - Coal Authority Interactive Map<sup>27</sup>;
  - Flood Map for Planning website<sup>28</sup>;
  - Multi Agency Geographic Information for the Countryside (MAGIC)<sup>29</sup>;
  - Public Health England, UK Maps of Radon<sup>30</sup>;
  - London Borough of Bexley Council Planning Applications<sup>31</sup>;
  - Zetica UXO Risk Maps<sup>32</sup>;
  - Google Earth satellite imagery<sup>33</sup>;
  - British Geological Survey (BGS)<sup>34</sup>;
  - Online GeoIndex Onshore<sup>35</sup>; and
  - Online Viewer – Hydrogeological Map of the UK, 1: 625,000<sup>36</sup>.
- 17.4.15. In addition, a walkover of the Site was undertaken the 8<sup>th</sup> February 2023.

## ASSESSMENT METHODOLOGY

- 17.4.16. Based on the potential significant effects set out above, the scope of the assessment is set out below. The assessment presented within this chapter considers potential impacts from the construction and operation of the Proposed Scheme alongside Riverside 1 and Riverside 2.
- 17.4.17. The Environment Agency's LCRM Guidance<sup>18</sup> has been followed, as is required by all parties engaged in and responsible for land contamination. In the context of ground conditions and soils, the LCRM Guidance provides a technical framework in the understanding of how contamination issues that may arise could be managed.
- 17.4.18. As set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, two options for the construction programme of the Proposed Scheme are being considered: Option 1 and Option 2. The estimated construction period is approximately 60 months (five years) for Option 1 and approximately 42 months

(three and half years) for Option 2. In order to provide a proportionate and robust ground conditions and soils assessment, only Option 1 has been considered as this presents the worst case scenario for this assessment. This is because there would be a longer period over which there is the potential for disturbance of ground and soils.

- 17.4.19. As set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, two options for the design of the Carbon Capture Facility are being considered. One option is for individual lines to be connected to the exhaust stacks for Riverside 1 and Riverside 2, with two individual Stack(s) for the Carbon Capture Facility. For the purposes of this assessment, there is considered to be no difference between the two options in terms of predicted effects on ground conditions and soils arising from the Proposed Scheme.
- 17.4.20. As set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, the choice between demolition or retention of the Belvedere Power Station Jetty (disused) is being considered. For the purposes of this assessment, the demolition of the Belvedere Power Station Jetty (disused) has been considered as this is considered to present the worst case scenario for ground conditions. This is because the demolition of the Belvedere Power Station Jetty (disused) has the potential to impact upon controlled waters and ecological receptors identified within this chapter resulting from the potential release of contaminants, in particular contaminated sediments within the riverbed. If the Belvedere Power Station Jetty (disused) is to be retained (with modifications) there would be no change in the assessment of impacts and effects reported within this chapter.

### **Conceptual Site Model**

- 17.4.21. The LCRM Guidance recommends the use of a Conceptual Site Model (CSM) to understand risk, comprising three elements: a source, a pathway, and a receptor. Each element is described below:
- Source – presence of potential contaminants that may cause harm;
  - Pathway – a physical linkage between the source and receptor; and
  - Receptor – those that are identified as being sensitive to the potential contamination (including human health, controlled waters, buildings, services, and ecological systems).
- 17.4.22. Without a source, pathway or receptor being present, there can be no contamination risk. For example, the presence of measurable concentrations of contaminants within the ground/subsurface/soils does not delineate a contamination risk unless pollutant linkages have been defined and there is a risk of harm to receptors.
- 17.4.23. The CSM has been used to identify source, pathway and receptor linkages by integrating the intended end use for the Site, the Site's characteristics and the Site's surroundings. Thereafter, mitigation measures to manage the risks identified in the CSM have been identified.

- 17.4.24. The level of risk has been evaluated in accordance with the methodology set out in CIRIA C552<sup>15</sup>. This methodology involves classification of the consequence and probability associated with each potential contaminant linkage and thereby the corresponding level of risk (risk category).
- 17.4.25. The framework for classifying consequence, presented in full in Table 6.3 of CIRIA C552<sup>15</sup>, is summarised in **Table 17-4** below. The consequence classification does not depend on the probability that the consequence will be realised; thus, for a particular pollutant linkage it may be necessary to classify more than one consequence. For example, ground gases pose a risk to both human health and building structures. Both may have a classification of consequence of severe, but the probability may vary, resulting in different levels of risk.

**Table 17-4: Qualitative Risk Assessment – Classification of Consequence**

Classification	Definition
<b>Severe</b>	<ul style="list-style-type: none"> <li>● Severe short term (acute) risks to human health, likely to result in significant harm.</li> <li>● Short term risk of pollution of sensitive water resource; and</li> <li>● A short term risk to a particular ecosystem, or an organism forming part of such an ecosystem.</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>● Chronic damage to human health (significant harm);</li> <li>● Pollution of sensitive water resource; and</li> <li>● A significant change in a particular ecosystem, or an organism forming part of such an ecosystem.</li> </ul>
<b>Mild</b>	<ul style="list-style-type: none"> <li>● Pollution of non-sensitive water resource;</li> <li>● Significant damage to crops, buildings, structures and services; and</li> <li>● Damage to sensitive buildings/structures/services or to the environment.</li> </ul>
<b>Minor</b>	<ul style="list-style-type: none"> <li>● Harm, not necessarily significant, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health. Easily repairable effects of damage to buildings, structures and services.</li> </ul>

- 17.4.26. The ‘severe’ consequence classification describes acute risk (arising from short term exposure). The ‘medium’ classification describes chronic harm (and may constitute ‘significant harm’ under Part 2A of the Environmental Protection Act 1990<sup>7</sup>).
- 17.4.27. The framework for classifying probability, presented in full in Table 16.4 of CIRIA C552<sup>15</sup> is summarised in **Table 17-5** below.

**Table 17-5: Qualitative Risk Assessment – Classification of Probability**

Classification	Definition
<b>High Likelihood</b>	There is a contaminant linkage and an event that appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
<b>Likely</b>	It is probable that an event will occur. Whilst not inevitable, it is possible in the short term and likely over the long term.
<b>Low Likelihood</b>	Circumstances are possible under which an event could occur, but it is not certain that (even over the long term) such an event would occur.
<b>Unlikely</b>	It is improbable that an event would occur, even in the very long term.

17.4.28. The level of risk (risk category), ranging from 'very high risk' to 'very low risk', is determined by the consequence and probability classifications using the matrix presented in full in Table 6.5 of CIRIA C552<sup>15</sup> and shown in **Table 17-6** below.

**Table 17-6: Qualitative Risk Assessment – Risk Category**

Probability	Consequence			
	Severe	Medium	Mild	Minor
<b>High Likelihood</b>	Very High Risk	High Risk	Moderate Risk	Moderate/ Low Risk
<b>Likely</b>	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
<b>Low Likelihood</b>	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
<b>Unlikely</b>	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

**Temporal Scope**

17.4.29. The temporal scope is detailed in **Section 4.6 of Chapter 4: EIA Methodology (Volume 1)**.



### Significance Criteria

- 17.4.30. The significance of effects for land contamination on human health, controlled waters below ground services and building structures will be assessed by comparing the difference in risk (as described above in **Table 17-5** and **Table 17-6**) for each contaminant linkage for baseline conditions to those at the construction phase of the Proposed Scheme. **Table 17-7**, which is based on Table 3.7 in DMRB LA 104, provides typical descriptions of these significance categories.
- 17.4.31. The significance levels are Very large, Large, Moderate, Slight and Neutral. These levels are determined by assessing the potential magnitude of impacts upon receptors; where a given receptor has a Very High, High, Medium or Low sensitivity.

**Table 17-7: Significance Categories (Effects) and Typical Descriptions**

Significance Category	Typical Description
<b>Very Large</b>	Effects at this level are material in the decision making process.
<b>Large</b>	Effects at this level are likely to be material in the decision making process.
<b>Moderate</b>	Effects at this level can be considered to be material decision making factors.
<b>Slight</b>	Effects at this level are not material in the decision making process.
<b>Neutral</b>	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

- 17.4.32. Where there is shown to be a decrease in contamination risk, the Proposed Scheme is assessed as having a beneficial effect on the environment in the long term.

### **Receptor Value/Sensitivity**

- 17.4.33. Assessment of receptor value (sensitivity) for ground conditions will follow the framework described in **Table 17-8** which is based on LA 109: Geology and Soils<sup>37</sup>. Negligible sensitivity has been removed; it is deemed irrelevant as no receptor (in terms of ground conditions) is classed as negligible. The receptor value (sensitivity) levels are therefore Very High, High, Medium and Low.
- 17.4.34. Factors that may affect the sensitivity of the likely receptor include:
- human health – age, weight, sex, duration onsite and distance from the Site Boundary;
  - controlled waters – distance from the Site and resource potential;
  - third party below ground services and building structures;



- below ground services and building structures – building design including factors such as gas protection measures and depth (below ground level) of services installations; and
- ecological receptors – hydraulic connection with controlled waters.

**Table 17-8: Classification of Value (Sensitivity) of Receptors**

Receptor Value (Sensitivity)	Criteria	Typical Examples	
<b>Very High</b>	Very rare and of international importance with no potential for replacement.	Geology	<ul style="list-style-type: none"> <li>• UNESCO World Heritage Sites, UNESCO, Global Geoparks, SSSI and Geological Conservation where citations indicate features of international importance.</li> <li>• Review sites where citations indicate features of international importance.</li> </ul>
	Human health: very high sensitivity land use.	Contamination	<ul style="list-style-type: none"> <li>• Construction and maintenance staff (where extensive earthworks are proposed).</li> <li>• Residential properties or allotments.</li> </ul>
	Nationally significant attribute of high importance.	Surface water	<ul style="list-style-type: none"> <li>• Watercourses having a WFD classification shown in a River Basin Management Plan (RBMP) and <math>Q95 \geq 1.0 \text{ m}^3/\text{s}</math> where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.</li> </ul>
	Nationally significant attribute of high importance.	Groundwater	<ul style="list-style-type: none"> <li>• Principal aquifer providing a regionally important resource and/or supporting a site protected under European Commission (EC) and UK Biodiversity legislation.</li> <li>• Groundwater locally supports GWDTE. Source Protection Zone (SPZ)<sup>1</sup>.</li> </ul>

Receptor Value (Sensitivity)	Criteria	Typical Examples	
<b>High</b>	Rare and of national importance with little potential for replacement. Geology meeting national designation citation criteria which is not designated as such.	Geology	<ul style="list-style-type: none"> <li>Geological SSSI, National Nature Reserves (NNR).</li> </ul>
	Human Health: high sensitivity land use.	Contamination	<ul style="list-style-type: none"> <li>Construction staff (where limited earthworks are proposed).</li> <li>Public open space.</li> </ul>
	Locally significant attribute of high importance.	Surface water	<ul style="list-style-type: none"> <li>Watercourses having a WFD classification shown in a RBMP and <math>Q95 &lt; 1.0 \text{ m}^3/\text{s}</math> where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.</li> </ul>
	Locally significant attribute of high importance.	Groundwater	<ul style="list-style-type: none"> <li>Principal aquifer providing locally important resource or supporting a river ecosystem.</li> <li>Groundwater supports a GWDTE.</li> <li>SPZ2.</li> </ul>
<b>Medium</b>	Of regional importance with limited potential for replacement. Geology meeting	Geology	<ul style="list-style-type: none"> <li>Regionally Important Geological Sites (RIGS).</li> </ul>

Receptor Value (Sensitivity)	Criteria	Typical Examples	
	regional designation citation criteria which is not designated as such.		
	Human Health: medium sensitivity land use.	Contamination	<ul style="list-style-type: none"> <li>Construction and maintenance staff (minimal disturbance of ground).</li> <li>Commercial or industrial properties.</li> </ul>
	Of moderate quality and rarity	Surface water	<ul style="list-style-type: none"> <li>Watercourses not having a WFD classification shown in a RBMP and Q95 &gt;0.001 m<sup>3</sup>/s where Q95 is the flow in cubic metres per second which was equalled or exceeded for 95% of the surface water feature's flow record.</li> </ul>
	Of moderate quality and rarity	Groundwater	<ul style="list-style-type: none"> <li>Aquifer providing water for agricultural or industrial use with limited connection to surface water.</li> <li>SPZ3.</li> </ul>
<b>Low</b>	Of local importance/ interest with potential for replacement	Geology	<ul style="list-style-type: none"> <li>Non designated geological exposures, former quarries/ mining sites.</li> </ul>
	Low sensitivity land use	Contamination	<ul style="list-style-type: none"> <li>Construction and maintenance staff (where no disturbance of ground proposed).</li> <li>Infrastructure (roads, bridges, railways, buildings and services).</li> </ul>
	Low sensitivity quality	Surface water	<ul style="list-style-type: none"> <li>Watercourses not having a WFD classification shown in a RBMP and Q95 &lt;0.001 m<sup>3</sup>/s where Q95 is the flow in cubic metres per second which was</li> </ul>

Receptor Value (Sensitivity)	Criteria	Typical Examples	
			equalled or exceeded for 95% of the surface water feature's flow record.
	Low sensitivity quality	Groundwater	<ul style="list-style-type: none"> <li>Unproductive strata.</li> </ul>

### Magnitude

17.4.35. The expected magnitude of impact to each identified receptor will be assigned in accordance with the principles established in LA 109: Geology and Soils<sup>21</sup> and LA 104: Environmental Assessment and Monitoring<sup>37</sup> along with professional judgement. The terms used to describe magnitude of impact are defined in LA 104 and LA 109 and directly reproduced in **Table 17-9**.

**Table 17-9: Classification of Magnitude of Impact (Change)**

Magnitude of Impact (Change)		Definition
<b>Major</b>	Adverse	<p><i>“Geology: loss of geological feature/designation and/or quality and integrity, severe damage to key characteristics, features or elements.</i></p> <p><i>Soil: physical removal or permanent sealing of &gt;20ha of agricultural land.</i></p> <p><i>Contamination[relating to] human health: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g., category 4 screening levels) SP1010<sup>38</sup> with potential for significant harm to human health. Contamination heavily restricts future use of land”.</i></p>
	Beneficial	<p><i>“Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality”.</i></p>
<b>Moderate</b>	Adverse	<p><i>“Geology: partial loss of geological feature/designation, potentially adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.</i></p> <p><i>Contamination [relating to] human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g., category 4 screening levels) SP1010 Significant contamination can</i></p>

Magnitude of Impact (Change)		Definition
		<i>be present. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use”.</i>
	Beneficial	<i>“Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality”.</i>
<b>Minor</b>	Adverse	<i>“Geology: minor measurable change in geological feature/designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.  Contamination [relating to] Human health: contaminant concentrations are below relevant screening criteria (e.g., category 4 screening levels) SP1010 Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health”.</i>
	Beneficial	<i>“Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of adverse impact occurring”.</i>
<b>Negligible</b>	Adverse	<i>“Geology: very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature/designation. Overall integrity of resource not affected.  Soils: no discernible loss/reduction of soil function(s) that restrict current or approved future use.  Contamination: [relating to] Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g., category 4 screening levels) SP1010. No requirement for control measures to reduce risks to human health/make land suitable for intended use”.</i>
	Beneficial	<i>Very minor benefit to or positive addition of one or more characteristics, features or elements.</i>
<b>No change</b>		<i>No loss or alteration of characteristics, features or elements; no observable impact in either direction.</i>

### Significance

- 17.4.36. Once the sensitivity of the affected receptor to change and the magnitude of change have been established, the matrix presented in **Table 17-10**, which is based on LA 104: Environmental Assessment and Monitoring<sup>37</sup>, will be used to determine the significance of effect, ranging from ‘Neutral’ to ‘Very Large’. The likely duration of the effect and likelihood of the effect occurring is also considered when assessing each effect.
- 17.4.37. Where a range has been provided, e.g. ‘Moderate or Large’, professional judgement will be used to define the significance. The effects are described as Adverse and Beneficial. An effect would be considered significant if assessed as Moderate or above.

**Table 17-10: Significance of Effects Matrix**

Receptor Value (Sensitivity)	Magnitude of Impact (Change)				
	No Change	Negligible	Minor	Moderate	Major
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or large
High	Neutral	Slight	Slight or Moderate	Moderate or large	Large or very large
Very High	Neutral	Slight	Moderate or large	Large or very large	Very large

## 17.5. STUDY AREA

- 17.5.1. Study Areas have been identified for human health (in respect of impacts arising from contamination matters only), controlled waters, ecological receptors and below ground services and building structures.
- 17.5.2. For the assessment of effects during the construction phase the Study Areas will be limited to:
- Human health – 250m radius of the Site Boundary as per best practice, including Guidance for the Safe Development of Housing on Land Affected by Contamination: R&D Publication<sup>66</sup>. The 250m distance is typical at the hazard identification stage of an assessment based on professional judgement.
  - Controlled waters – 1km radius of the Site Boundary. This is considered appropriate for indirect effects from potential offsite sources of contamination based on the specifics of the Study Area such as the underlying geology, an appreciation of the water environment and previous land use.

- Below ground services and building structures – 250m of the Site Boundary. The 250m distance is considered appropriate at the hazard identification stage of this assessment based on professional judgement.
- Ecological receptors – 1km radius of the Site Boundary. Ecological receptors which are considered are in relation to the connection with the water environment and therefore the same Study Area is considered appropriate.

17.5.3. The above Study Areas will be referred to hereafter as the ‘250m Study Area’ and ‘1 km Study Area’.

17.5.4. The Study Areas are shown in **Figure 17-1: Ground Conditions and Soils Study Areas (Volume 2)**.

## **SENSITIVE RECEPTORS**

17.5.5. The following sensitive receptors have been identified:

### **Human Health**

- site users and staff (excluding construction staff);
- construction staff; and
- third party neighbours (commercial, hospitality, residential and members of the public).

### **Controlled Waters**

- groundwater within the Secondary Undifferentiated Aquifers, Secondary A Aquifers, and Principal Aquifer; and
- surface water features – River Thames and other surface water features (considered in **Chapter 11: Water Environment and Flood Risk (Volume 1)**).

### **Buildings and Services**

- below ground services and building structures; and
- third party below ground services and building structures.

### **Ecological Receptors**

- flood plain associated with Marsh Dykes;
- Inner Thames Marshes SSSI; and
- Crossness LNR.

17.5.6. Further ecological information and the locations of these receptors with respect to the Site is presented in **Chapter 7: Terrestrial Biodiversity (Volume 1)**, **Chapter 8: Marine Biodiversity (Volume 1)** and the **Environmental Features Plans (Document Reference 2.7)**.



## 17.6. BASELINE CONDITIONS AND FUTURE BASELINE

### BASELINE

- 17.6.1. The PRA is included as **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**. **Appendix 17-1: Preliminary Risk Assessment (Volume 3)** details the baseline conditions at the Site and within the Study Areas with respect to ground conditions and soils.
- 17.6.2. **Appendix 17-1: Preliminary Risk Assessment (Volume 3)** includes a CSM of the Proposed Scheme in order to identify potential sources of contamination with regards to the sensitive receptors and potential contaminant pathways.
- 17.6.3. Sources reviewed to produce **Appendix 17-1: Preliminary Risk Assessment (Volume 3)** are listed under **Section 17.4**.
- 17.6.4. A summary of the existing baseline conditions considering the Study Area's historical land use, previous ground investigations, geology, ground stability hazards, mining, hydrology, hydrogeology, water abstractions, ecological designations, radon risk, unexploded ordnance risk, and potential sources of contamination is provided below.

### Site Walkover

- 17.6.5. A site walkover survey was undertaken on the 8<sup>th</sup> February 2023. The following were noted:
- Some hydrocarbon staining on the concrete in the northern most construction area of Riverside 2.
  - WSP was informed that positively identified asbestos present on the Riverside 2 land parcel was being appropriately segregated, tested and managed.
  - The electricity substation located in the southeast of the Gannon land parcel is in good condition.

### Historical Land Use

- 17.6.6. A summary of onsite and offsite historical land use features pertinent to ground conditions and soils is provided in **Table 17-11**. Features that have the potential to affect the sensitive receptors of human health, controlled waters, below ground services and building structures and ecological receptors in the given Study Areas have been identified.

**Table 17-11: Historical Land Use Summary**

Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
<p><b>1864 (1:2,500)</b>  <b>1865 (1:2,500)</b>  <b>1866-1869 (1:10,560)</b>  <b>1867 (1:2,500)</b></p>	<p>The Site mainly comprises agricultural fields.            A manure works is located in the current area of Riverside 1.            Three piers are labelled along the south bank of the River Thames.            Powder magazines are located in the far east and far west of the Site.            Marshland is present in the far west of the Site.</p>	<p>The Erith Marshes are labelled to the southwest.            Marshland is located along the south bank of the River Thames and approximately 350m to the west.            Belvedere Railway station is located 630m to the south.</p>
<p><b>1888 (1:10,560)</b></p>	<p>Development has occurred onsite with the manure works being replaced by Belvedere Mills.            The Thames Fish, Guano and Oil Works is located to the west of Belvedere Mills.</p>	<p>A building labelled 'Orient House' is located 315m to the south of Belvedere Mills.            A candle manufacturing factory is located on the north side of the River Thames, approximately 430m to the north of the Site.            A gasometer is located 610m to the west.</p>
<p><b>1895 (1:10,560)</b>  <b>1895-1899 (1:10,560)</b>  <b>1897 (1:2,500)</b></p>	<p>The 1897 map shows three cranes labelled onsite along the bank of the Thames.            The Belvedere Mills is labelled as being a disused Bovril Mill.</p>	<p>Crabtree Farm is located 500m to the east.            Residential development is occurring outwards of 450m to the south.</p>

Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
		<p>A cement works and associated mineral extraction activities are located 500m to the northeast.</p> <p>A chemical works is located 620m to the northeast.</p> <p>Industrial development is occurring outwards of 750m to the east (at present day Belvedere Industrial Estate) where an oil works and; bitumen, telegraph and waterproof works are located.</p>
<p><b>1907 (1:10,560)</b>  <b>1909 (1:2,500)</b></p>	<p>The 1909 map shows:</p> <ul style="list-style-type: none"> <li>allotment gardens onsite to the southwest of Belvedere Mills; and</li> <li>Belvedere Mills is labelled to be a Borax Mill.</li> </ul>	<p>The 1907 map shows:</p> <ul style="list-style-type: none"> <li>Residential development has expanded to within 200m to the south.</li> <li>Industrial development 750m to the east has expanded and the bitumen, telegraph and waterproof works is now labelled to be a cable construction works.</li> <li>A tramway is located 570m to the south-east within the above industrial development.</li> </ul>
<p><b>1915 (1:10,560)</b>  <b>1916-1920 (1:2,500)</b>  <b>1918-1921(1:10,560)</b>  <b>1920 (1:2,500)</b>  <b>1921 (1:10,560)</b></p>	<p>No significant changes.</p>	<p>Shooting grounds are located 340m to the north (Hornchurch Shoot) and 360m to the northeast (Rainham Shoot).</p> <p>A tank is located 405m to the northeast.</p>

Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
1931 (1:10,560) 1933 (1:2,500)		Mineral extraction and the cement works appear to have ceased as the works is now labelled 'Rainham Caves'.
1938 (1:10,560) 1939 (1:2,500) 1940 (1:2,500)	No significant changes.	A large building (later labelled a motor cars manufacturing factory in the 1948-1950 map) has been constructed 400m to the north.  Two jetties have been constructed 260m to the north and 290m to the north.  Extensive residential development has continued to the south and southeast. Features labelled include football grounds and allotment gardens.  Industrial development has continued to the southeast at Belvedere Industrial Estate.
1948-1950 (1:10,560) 1951 (1:10,560) 1955-1958 (1:10,560) 1957 (1:1,250) 1957-1958 (1:2,500) 1957-1959 (1:1,250) 1957-1962 (1:1,250)	Maps from 1958 show a depot labelled as the former Thames Fish, Guano and Oil Works.  Maps from 1966 show: <ul style="list-style-type: none"> <li>● extensive development has occurred on Site;</li> <li>● unspecified works are located in the south of the Site, to the west of present day Norman Road;</li> </ul>	Development has occurred directly southeast of the Site with unspecified works labelled 250m to the southeast.  Maps from 1958 shows a sand/gravel pit is marked 280m to the southeast.  Maps from 1966 show:

Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
1958 (1:2,500) 1958 (1:1,250) 1958-1959 (1:2,500) 1959-1964 (1:1,250) 1963 (1:1,250) 1963-1964 (1:1,250) 1963-1968 (1:1,250) 1964 (1:1,250) 1964-1966 (1:2,500) 1966 (1:2,500) 1966-1969 (1:10,560) 1966-1970 (1:2,500) 1969 (1:1,250)	<ul style="list-style-type: none"> <li>• four parallel electricity lines with electricity pylons run from the unspecified works across the Site towards the southwest;</li> <li>• two sand/gravel pits are located to the north of the unspecified works;</li> <li>• drains are labelled surrounding the pits and extending offsite towards the west;</li> <li>• a drain runs north-south along the west of the works; and</li> <li>• a pontoon, and two jetties have been constructed, including the present day Middleton Jetty.</li> </ul>	<ul style="list-style-type: none"> <li>• Unspecified works are located 20m to the south-east. This works site includes two chimneys located to the south-east.</li> <li>• An unspecified depot is located 200m to the south.</li> <li>• Sewage works (present day Crossness Sewage Works) are located 370m to the west. The sewage works site includes numerous sewage tanks. An excavation pit is located 120m to the east.</li> </ul>
1970 (1:2,500) 1970-1973 (1:1,250) 1970-1975 (1:1,250) 1973-1974 (1:10,000) 1973-1975 (1:1,250) 1973-1976 (1:1,250)	<p>The 1973-1974 map shows a drain running across the south of the Site. The drain is connected to drains associated with the works and surrounding the sand/gravel pits.</p>	<p>The 1973-1974 map shows:</p> <ul style="list-style-type: none"> <li>• An unspecified depot is located 230m to the south.</li> <li>• Industrial development has continued to the southeast at Belvedere Industrial estate.</li> </ul>

Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
1974-1975 (1:1,250) 1975 (1:1,250) 1976 (1:1,250)		
1982-1983 (1:1,250) 1982-1985 (1:1,250) 1983-1984 (1:1,250) 1983-1985 (1:10,000) 1984 (1:1,250) 1985-1990 (1:1,250) 1990-1992 (1:1,250) 1991 (1:1,250) 1991-1992 (1:1,250) 1992 (1:1,250) 1992-1995 (1:10,000)	No significant changes.	<p>The 1983-1984 map shows sludge lagoons associated with the sewage works are located 160m to the west.</p> <p>The 1983-1985 map shows:</p> <ul style="list-style-type: none"> <li>• Eastern Way Road has been constructed along the Site's southern boundary.</li> <li>• Beyond Eastern Way, further industrial development has occurred where numerous works, warehouses and factory are labelled.</li> <li>• A pumping station is located 136m to the south.</li> <li>• A gasholder station is located 530m to the south.</li> <li>• Horse roundabout has been constructed 190m to the southeast.</li> </ul> <p>The 1985-1990 map shows a tank, associated with unspecified works, is located 375m to the southeast.</p>
06/09/1999 2001 (1:10,000) 2003 (1:10,000)	<p>Activity appears to have ceased at Belvedere Mill/ the Borax Mill.</p> <p>The pits in the centre of the Site appear to have been infilled and left to develop as grassland.</p>	<p>The 2003 map shows:</p> <p>Tanks are located 20m to the east and 260m to the south.</p>

Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
<p><b>October 2003</b>  <b>November 2003</b>  <b>December 2003</b>  <b>29/08/2005</b>  <b>December 2005</b>  <b>December 2006</b></p>	<p>Depots are labelled in the north of the Site.</p> <p>An electricity substation is located in the south of the Site at the unspecified works to the west of Norman Road.</p> <p>The 2003 map shows a tank is located in the north of the Site.</p> <p>Satellite imagery from December 2003 shows that ground within the West Paddock has been excavated where several new ponds and ditches are present.</p>	<p>Electricity substations are located 25m to the east, 35m to the east and 170m to the south.</p> <p>Buildings that are part of the Crossness Sewage Treatment Works are present to the west of the Site.</p>
<p><b>2010 (1:10,000)</b></p>	<p>The 2010 map shows:</p> <ul style="list-style-type: none"> <li>• The parcels of land located at the two former pits in the centre of the Site were used as a construction compound.</li> <li>• The depot building is no longer present in the north of the Site.</li> <li>• Middleton Jetty has been constructed.</li> <li>• Excavation appears to have been undertaken to the southwest of the unspecified works.</li> <li>• Construction of Riverside 1 has been completed and the facility appears operational.</li> </ul>	<p>Extensive development of the industrial estate has continued to the east of the Site.</p>



Historical Map (Scale and Date)/Aerial Photograph (Date)/Satellite Imagery (Date)	Onsite Features	Offsite Features
	<ul style="list-style-type: none"> <li>The unspecified works in the south of the Site have been demolished.</li> <li>A pond is located to the west of this area, where excavation was visible in the 2010 images.</li> </ul>	
<b>20/04/2013</b> <b>July 2013</b> <b>July 2014</b> <b>June 2015</b>	<p>The location of the demolished unspecified works in the south of the Site has been cleared and levelled.</p> <p>The parcels of land in the centre of the Site have been vacated by the construction activities.</p>	<p>Development of the industrial estate has continued to the east of the Site.</p>
<b>April 2017</b> <b>May 2018</b> <b>June 2019</b> <b>26/09/2019</b> <b>March 2020</b> <b>February 2021</b> <b>17/07/2021</b> <b>2023 (1:10,000)</b>	<p>A warehouse building (present day Munster Joinery) including vehicle parking area has been constructed at the site of the former unspecified works in the south of the Site.</p>	<p>Development of the industrial estate has continued to the east of the Site.</p>

## Ground Investigations

17.6.7. Previous ground investigations have targeted various parcels of land within the boundary of the Site. The following reports have been reviewed to inform this assessment:

- Wilkinson Associates; Report Contamination Investigation Greenham Site Waste to Energy Incineration Plant Belvedere for Cory Environmental Limited; ref.: i7-01-02; dated December 1992<sup>39</sup>;
- Applied Environmental Research Centre Limited (AERC); Riverside Resource Recovery (Energy from Waste) Facility, Norman Road, Belvedere, Site Investigation and Remediation Proposals Report; ref.: C3477/R1384; dated September 2003<sup>40</sup>;
- RSA Geotechnics Ltd.; Ground Investigation at Norman Road, Belvedere, Kent Final Report, ref.: 10487/FINAL; dated February 2007<sup>41</sup>;
- Soil Mechanics; Riverside Resource Recovery Facility, Belvedere, Kent Factual Report on Ground Investigation; ref.: A7007; dated April 2007<sup>42</sup>;
- AERC; Letter presenting findings of site investigation at Riverside Resource Recovery Facility, Norman Road, Belvedere; ref.: JRW/C34129/R2397; dated 14 August 2006<sup>43</sup>;
- AERC; Riverside Resource Recovery (Energy from Waste) Facility, Norman Road, Belvedere, Contaminated Land Remediation Method Statement; ref.: C34129/R2489; dated May 2007<sup>44</sup>;
- WSP; Riverside Data Centre Ground Investigation Report Riverside Resource Recovery Ltd.; ref.: 70031031; dated August 2017<sup>45</sup>;
- Gavin & Doherty Geosolutions (UK) Ltd. (GDG); Geotechnical Interpretative Report & Contaminated Land Report; ref.: 21083-R-002-02; dated July 2021<sup>46</sup>; and
- TerraConsult; Riverside EfW; ref.: 3765R001-2; dated July 2018<sup>47</sup>.

17.6.8. The location of each of the previous ground investigations is shown in **Figure 17-2: Previous Ground Investigations (Volume 2)**.

17.6.9. Some remediation work has been completed by Knight Piesold in 2001, targeting the land where the former borax mill was located ; however, data gaps exist for those areas where no ground investigation has been undertaken to date and unknown contamination could be present. Concentrations of concern for metals, metalloids, organics and asbestos could be present, as previously found. Detailed summaries of the previous ground investigations are contained within **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**.

## Geology

- 17.6.10. Based on historical BGS records<sup>25</sup> and previous ground investigations<sup>39-47</sup>, the anticipated geology underlying the Site is summarised in **Table 17-12** below. The historical BGS borehole logs reviewed are summarised in **Table 17-13**.
- 17.6.11. Artificial ground (Made Ground and Infilled Ground) is anticipated across the Site where existing and former infrastructure including Riverside 1, Riverside 2, Munster Joinery, car parking and roads are present. The land at Creekside and Gannon may contain made ground where a former electricity substation was demolished. It is known from the historical land use review and the AERC 2003 Ground Investigation Report<sup>40</sup> that Borax North and Borax South were historically sand/gravel pits, then used as for the deposition of Borax-related chemicals, and subsequently infilled with unknown material.
- 17.6.12. Topsoil will be present across areas of grassland and former agricultural land including West Paddock, Stable Paddock, and East Paddock. These areas may also contain localised areas of infilled ground. As evidenced by satellite imagery, West Paddock historically appears to have undergone excavation resulting in several ponds and ditches. These ponds and ditches are presented on **Figure 11-2: Surface Water Features (Volume 2)**.
- 17.6.13. Superficial geology including alluvium, head deposits and the Taplow Gravel Member is anticipated across the Site.
- 17.6.14. The bedrock geology sequence in the northern half of the Site<sup>a</sup> consists of the London Clay and in sequence is underlain by the Blackheath Member of the Harwich Formation, the Lambeth Group, the Thanet Formation and the Upper Chalk Formation. The Blackheath Member is not continuous and may be encountered at the base of the London Clay Formation or in older parts of the Lambeth Group/cut locally into the Thanet Formation. BGS records indicate that the London Clay is absent in the south of the Site where the Lambeth Group is expected to be encountered underlying the superficial deposits.

**Table 17-12: Anticipated Geology Underlying the Site**

Stratum		Description
Artificial	Topsoil	Topsoil
	Made Ground	Variable including tarmac, ash, concrete and brick rubble.

<sup>a</sup> BGS mapping indicates that the boundary between the Lambeth Group and London Clay runs approximately E-W across the Site cutting through Western Paddock, Stable Paddock, and Eastern Paddock/Borax North.

Stratum		Description
<b>Superficial</b>	Alluvium	Mainly Detrital deposits of silt, sand, clay and gravel.
	Head Deposits	Variable lithologies. Mainly clay and silt.
	Taplow Gravel Member	Sand and gravel, locally with lenses of silt, clay or peat.
<b>Bedrock</b>	London Clay Formation	Bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.
	Blackheath Member of the Harwich Formation	Dominated by black and well-rounded flint gravel in a matrix of sand, with lenses of sand and thin clay layers.
	Lambeth Group	Vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate.
	Thanet Formation	Typically composed of homogeneous, bioturbated, glauconitic silty fine-grained sand, with sandy silt, silt or sandy, silty clay. The deposits are generally pale yellow-brown in colour, typically with a 'peppering' of dark-coloured glauconite grains. Sparse white mica occurs throughout. Rare coarse gravel is present in places in London.
	Chalk Group	White chalks (microporous coccolithic limestone) with beds of flint, nodular chalks, hardgrounds and marl seams.

17.6.15. The following pertinent onsite historical BGS borehole logs<sup>26</sup> have been reviewed and are summarised in **Table 17-13**.

**Table 17-13: Historical BGS Boreholes**

BGS Reference	National Grid Reference	Location
TQ48SE145	TQ 49460 80800	Onsite. Located in the north of the Site, adjacent to the riverbank.

BGS Reference	National Grid Reference	Location
TQ48SE492	TQ 49710 80700	Onsite located within footprint of current Riverside 1 facility.
TQ48SE34	TQ 49510 80490	Onsite. Located in centre of Site.
TQ47NE153	TQ 49530 79870	Onsite. Located adjacent to the southern boundary of the Site.

- 17.6.16. Information obtained from the historical BGS borehole logs has combined with ground conditions information from previous ground investigations<sup>39-47</sup> to provide a summary of likely ground conditions at the Site in **Table 17-14**.

**Table 17-14: Summary of Ground Conditions Obtained from BGS Boreholes and Previous Ground Investigations**

Stratum	Depth to Top of Strata (m bgl)	Thickness (m)
Topsoil	0.00	0.25-0.30
Made Ground	0.00	0-4.00
Alluvium/Head deposits	- 4.20	0.00 – 11.20
Taplow Gravel Member	1.40 – 12.70	2.80-14.63
London Clay Formation	4.80 – 23.60	0.00 – 13.40
Lambeth Group	7.85 – 28.50	10.20-23.95
Thanet Formation	32.30 – 40.54	16.46
Upper Chalk	57.00	Not confirmed.

### **Regionally Important Geodiversity Sites (RIGS)**

- 17.6.17. A review of London’s Geological Sites<sup>48</sup> confirms that there are no RIGS located within the Study Area.

### **Ground Stability Hazards**

- 17.6.18. Information on potential ground stability hazards assessed by the BGS and presented in the Groundsure Report is summarised in **Table 17-15**. The Groundsure Report shows the distribution of ground stability hazards across the Site and is presented within **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**.

**Table 17-15: Ground Stability Hazards on Site (Groundsure Report)**

Feature	Hazard
<b>Shrink Swell Clays</b>	Low risk across the Site.
<b>Running Sands</b>	Very low risk across areas of Made Ground. Low risk across the Site where Made Ground is not present. Moderate risk along the riverbank. Low risk in the area covering the River Thames.
<b>Compressible Deposits</b>	Very low risk across areas of Made Ground. High risk across the Site where Made Ground is not present. Moderate risk along the riverbank. High risk in the area covering the River Thames.
<b>Collapsible Deposits</b>	Negligible risk across the Site.
<b>Landslide Ground Stability</b>	Very low risk across the Site.
<b>Ground Dissolution of Soluble Rocks</b>	Negligible risk across the Site.

- 17.6.19. The very south<sup>b</sup> of the Site is within an area where very significant soluble rocks are likely to be present with a moderate possibility of localised natural subsidence or dissolution-related degradation of bedrock.
- 17.6.20. Borax North and Borax South were historically sand/gravel pits where a potential ground stability risk may be present. The Groundsure Report, presented within **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**, includes 47 records of surface workings within 250m of the Site. These include onsite records of unspecified heaps, unspecified wharfs, refuse heaps, an unspecified pit, and ponds. Offsite records include unspecified ground workings located 3m to the southwest, unspecified heaps located 20m to the southwest, and sludge lagoons located 26m to the northwest.

### Mining

- 17.6.21. As indicated on the Bexley Local Plan Policies Map<sup>49</sup> there are no Minerals Safeguarding Areas on the Site or within 1km of the Site boundary.

<sup>b</sup> Partially extending into the Norman Road Field.

- 17.6.22. The Groundsure Report within **Appendix 17-1: Preliminary Risk Assessment (Volume 3)** includes records of sand mining having potentially occurred 140m and 375m to the south of the Site.

### Hydrology

- 17.6.23. The primary sensitive surface water feature within the Site is the River Thames. There are numerous other surface water features within the Site which are detailed in **Chapter 11: Water Environment and Flood Risk (Volume 1)** and presented on **Figure 11-2: Surface Water Features (Volume 2)**.

### Hydrogeology

- 17.6.24. The Environment Agency classifies that the superficial Alluvium and Head deposits on the Site are designated as Secondary Undifferentiated aquifers. The Taplow Gravel Member is designated a Secondary A aquifer. The bedrock London Clay formation is classified as unproductive; the Blackheath Member (Harwich Formation), Lambeth Group, and Thanet Formation as Secondary A aquifers; and the Chalk Group as a Principal aquifer.
- 17.6.25. Historical BGS borehole logs and previous ground investigations undertaken at the Site indicate that groundwater is likely to be encountered in the Alluvium and Taplow Gravel Member. Further information on hydrogeology is detailed in **Chapter 11: Water Environment and Flood Risk (Volume 1)**.
- 17.6.26. Previous ground investigations to date have identified contaminants of concern in the groundwater within the Proposed Scheme Site boundary. Groundwater present in the Made Ground, Alluvium and Taplow Gravels has previously been found to contain contaminants including arsenic, boron, cadmium, copper, lead, nickel, zinc, PAHs, TPHs, and chromium VI. As presented within **Appendix 17-1: Preliminary Risk Assessment (Volume 3)** detailed Quantitative Risk Assessment conducted by WSP in 2017 found that elevated concentrations of salt within shallow groundwater indicated that there was likely a saline intrusion from the River Thames. Controlled waters risk assessments conducted by WSP in 2017 and PBA in 2018 considered that contamination within the shallow groundwater respectively posed low and very low risk to the River Thames, groundwater and surrounding surface water receptors. These groundwater sampling results are limited to the previous ground investigation site boundaries as shown in **Figure 17-2: Previous Ground Investigations (Volume 2)**. Not all areas of the Proposed Scheme have been investigated and data gaps remain concerning groundwater quality.
- 17.6.27. Further information regarding aquifer designation, groundwater abstractions (public and private) and groundwater quantity and quality is presented in **Chapter 11: Water Environment and Flood Risk (Volume 1)**.



### Water Abstractions

- 17.6.28. Two active licenced surface water abstraction points are located approximately 15m and 30m to the west of the Site boundary. The surface water abstractions are from the Great Breach Dyke North, for use by Thames Water.
- 17.6.29. A dewatering borehole for Riverside 2 under licence number TH/039/0044/030 is currently targeting underground strata comprising sand and gravel.
- 17.6.30. Further information on surface and groundwater abstractions are provided in **Chapter 11: Water Environment and Flood Risk (Volume 1)**.

### Ecological Designations

- 17.6.31. The Crossness LNR extends onsite from the west. Additionally, Rainham Marshes LNR is located within the 1km Study Area, located approximately 900m to the east although is located on the opposite bank of the River Thames estuary.
- 17.6.32. The Site sits within the Marsh Dykes catchment and includes Priority Habitat Inventories including coastal and floodplain grazing marsh, coastal salt marsh, deciduous woodland, good quality semi-improved grassland and mudflats which are present onsite.
- 17.6.33. The Site lies within a designated Site of Special Scientific Interest (SSSI) impact zone due to the Inner Thames Marshes SSSI being located 900m to the east.
- 17.6.34. Further information is presented in **Chapter 7: Terrestrial Biodiversity (Volume 1)**, **Chapter 8: Marine Biodiversity (Volume 1)** and the **Environmental Features Plan (Document Reference 2.7)**. An assessment of sediment quality and impact on ecological receptors is provided in the WFD assessment contained in **Appendix 11-2: Water Framework Directive Impact Assessment (Volume 3)**.

### Radon

- 17.6.35. According to BGS and Public Health England, the Site is within an area where less than 1% of homes are at risk from radon. No radon protection measures are required for new buildings or extensions.

### Unexploded Ordnance

- 17.6.36. The Zetica Bomb Risk Maps<sup>32</sup> (available from the Zetica Limited website) have been reviewed to provide a preliminary assessment of potential Unexploded Ordnance (UXO) risks. The maps indicated that the Site is within a 'High' risk area from UXO.

### Potential Sources of Contamination

- 17.6.37. **Table 17-16** provides a summary of the potential sources of contamination that may be present at the Site, as well as the potential contaminants of concern resulting from such and their distribution across the Site.

**Table 17-16: Potential Sources of Contamination**

Potential Source	Potential Contaminants of Concern	Likely/Anticipated Distribution
<b>Onsite</b>		
<b>Made Ground</b>	A wide range of contaminants including heavy metals, metalloids, organics, inorganics, hazardous gases (methane and carbon dioxide), Total Petroleum Hydrocarbons (TPHs), Polyaromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs) and asbestos.	Site wide
<b>Marshland and Alluvium (including peat deposits)</b>	Ground gases including methane, carbon dioxide and hydrogen sulphide.	Site wide
<b>Current and Historical Dock/ Wharf/Jetty Activities</b>	Metals, metalloids, PAHs, TPHs, solvents, VOCs, SVOCs and asbestos.	Northern area of the Site adjacent and within the River Thames
<b>Historical Manure Works, Bovril Mills, Borax Works, Unspecified Commercial/ Industrial Land and Works</b>	A wide range of contaminants including heavy metals, metalloids, organics, inorganics, hazardous gases (methane, carbon dioxide and hydrogen sulphide), TPHs, PAHs, VOCs, SVOCs, asbestos, pathogens.	Northern and central area of the Site (landside)
<b>Historical Railway Sidings</b>	Hydrocarbons, PAHs	Northeastern area (landside)
<b>Historical Magazine</b>	UXO	Northeastern area (landside)

Potential Source	Potential Contaminants of Concern	Likely/Anticipated Distribution
<b>Historical Sand/Gravel Pits, Unspecified Pits, Heaps and Refuse Heaps</b>	Metals, metalloids, PAHs, TPH, VOCs, SVOCs, asbestos containing materials, ground gases (methane, carbon dioxide, hydrogen sulphide), pathogens.	Site wide
<b>Historical Fish, Guano and Oil Works</b>	Ground gases (methane, carbon dioxide, hydrogen sulphide), hydrocarbons, PAHs, heavy metals, asbestos containing materials, pathogens	Northern area of the Site (landside)
<b>Riverside 1</b>	Metals, metalloids, PAHs, TPH, VOCs, SVOCs, asbestos.	Northern area of the Site (landside)
<b>Electrical Energy Features</b>	Polychlorinated Biphenyls (PCBs), hydrocarbons	Northern and southern areas
<b>Historical Tanks</b>	Hydrocarbons, PAHs	Northern area of the Site (landside)
<b>Contaminated River Channel Deposits/ Licensed Discharge Consents to the River Thames for Trade Discharges – Site Drainage and Historical Sewage</b>	TPHs, heavy metals, metalloids, PAHs, organic compounds, and inorganic compounds, pathogens.	Northern area of the Site (landside)
<b>Fire Fighting Run-off (2005)</b>	Fire fighting agents including perfluoroalkyl and polyfluoroalkyl substances (PFASs) used in firefighting foams.	Site wide
<b>Offsite (within the Study Area)</b>		
<b>Electricity Substations</b>	PCBs, hydrocarbons.	Surrounding land

Potential Source	Potential Contaminants of Concern	Likely/Anticipated Distribution
<b>Made Ground</b>	Ground gases (methane, carbon dioxide, hydrogen sulphide), hydrocarbons, PAHs, VOCs, SVOCs, heavy metals, metalloids and asbestos containing materials.	Surrounding land
<b>Surrounding Industrial/ Commercial activities including Powder Magazine, Railway Sidings, COMAH Site (former agricultural chemical company), Unspecified Works, Unspecified Depot, Chimneys, Marshland, Sewage Works, Tanks.</b>	Heavy metals, metalloids, organics, inorganics, hazardous gases (methane, carbon dioxide, hydrogen sulphide), TPHs, PAHs, VOCs, SVOCs, agrochemicals, asbestos and pathogens.	Surrounding land
<b>Offsite Pollution Incidents</b>	Perfluorooctane sulfonate (PFOS)/ PFASs, VOCs, heavy metals (from sewage treatment chemicals), inorganic compounds, pathogens.	Surrounding land and water
<b>Licensed Emissions of Regulated Substances to Controlled Waters from Thames Water Utilities Ltd (approximately 264m west)</b>	Asbestos, benzo(b)fluoranthene, naphthalene, arsenic, cadmium, mercury, phosphorus, organotin compounds, phenols, halogenated compounds, fluorides, benzo(a)pyrene, zinc, chloroform, chlorides, Brominated diphenylethers - penta-, octa- and deca- BDE, copper, Dichloromethane (DCM) (Methylene chloride), fluoranthene, Nonylphenols and nonylphenol ethoxylates, octylphenols and octylphenol ethoxylates, cyanides, nickel, nitrogen, anthracene, dioxins and furans, indeno(1,2,3-cd)pyrene, chromium, di(2-ethylhexyl)phthalate (DEHP), lead.	River Thames

### Future Baseline

17.6.38. Other than the above potential site conditions, in the absence of the Proposed Scheme, it is likely that the site conditions would remain as they are reported within the baseline. It is considered that the construction and operation of Riverside 2 are in accordance with industry guidance and standard good practice. Consequently, there will be no new sources of contamination and no significant changes to the baseline for ground conditions and soils are anticipated.

## 17.7. EMBEDDED DESIGN, MITIGATION AND ENHANCEMENT MEASURES

17.7.1. This section sets out the embedded design, mitigation and enhancement measures relevant to the construction phase of the ground conditions and soils assessment. The operation phase has been scoped out of the assessment, as detailed in **Section 17.4**. The **Design Principles and Design Code (Document Reference 5.7)** are commitments which will govern the design of the Proposed Scheme during the detailed design stage. The **Design Principles and Design Code (Document Reference 5.7)** are considered to be embedded mitigation for the purposes of the assessment presented in this chapter.

17.7.2. **Figure 17-3: Connections between the Ground Conditions and Soils Mitigation Tasks and Design** diagrammatically shows the measures undertaken throughout the ground conditions and soils assessment in the context of the design of the Proposed Scheme. The figure also depicts the relevant information from the Ground Conditions mitigation that is applicable to:

- **Chapter 9: Historic Environment (Volume 1)** – provision of the ground investigation logs to input into the development of the Archaeological Deposit Model;
- **Chapter 11: Water Environment and Flood Risk (Volume 1)** – hydrogeological information obtained from the ground investigation, and environmental surface water and groundwater quality laboratory testing results; and
- **Chapter 16: Materials and Waste (Volume 1)** – development of the Materials Management Plan.

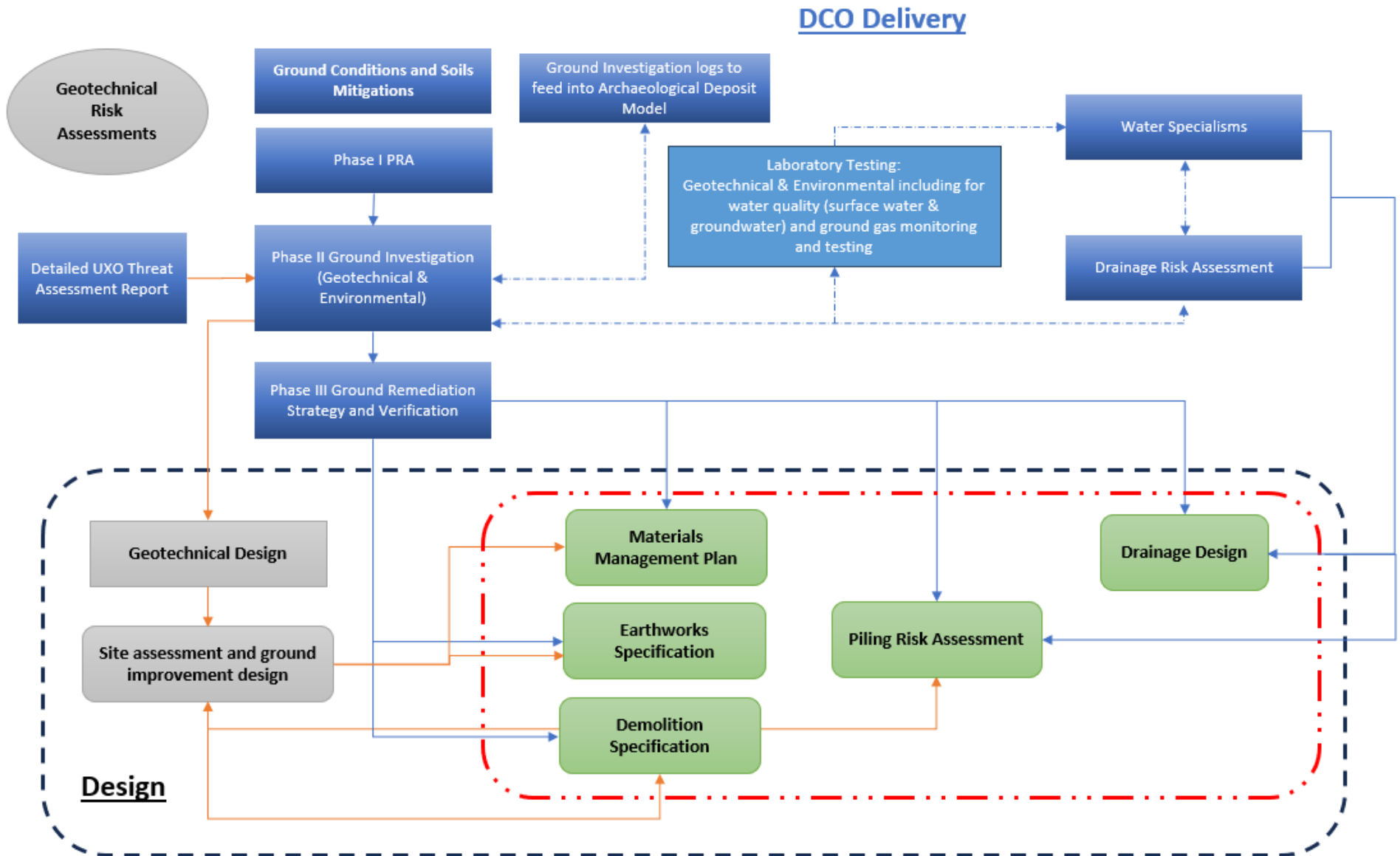


Figure 17-3: Connections between the Ground Conditions and Soils Mitigation Tasks and Design

## DESIGN

- 17.7.3. As shown in **Figure 17-3: Connections between the Ground Conditions and Soils Mitigation Tasks and Design**, geotechnical risk assessments will be completed as part of the detailed design of the Proposed Scheme. Geotechnical risk assessments will include a Geotechnical Risk Register to assess ground stability hazards.
- 17.7.4. The Phase 1 Contaminated Land Preliminary Risk Assessment (see **Appendix: 17-1 Preliminary Risk Assessment (Volume 3)**) summarises potential ground stability hazards that have been identified at the Site.

## MITIGATION

### Outline CoCP

- 17.7.5. The **Outline CoCP (Document Reference 7.4)** will include the following measures which would be implemented to mitigate risks to human health (site users, staff, construction staff and third party neighbours), controlled waters, below ground services and building structures and ecological receptors:
- General good construction working practices would be implemented such as dust suppression, including potentially contaminated dust, (damping down), windbreak netting around excavations and/or perimeter fencing, covering stockpiles with tarpaulins, wheel washing and road sweeping to prevent local residents and employees in the vicinity of the earthworks from being exposed to windblown dusts, vapours and asbestos fibres.
  - Appropriate stockpile segregation, locations and containment measures would be implemented to minimise the exposure of surface water and groundwater from contaminated run-off and local neighbours from windblown dusts, vapours and asbestos fibres.
  - A protocol for managing unexpected ground contamination that may be encountered during construction would be implemented.
  - Construction staff would be required to wear PPE such as gloves and face masks (where appropriate) to prevent dermal contact and inhalation or ingestion.
  - Appropriate site hygiene facilities will be put in place and the presence of contaminants, and the associated risks will be explained to construction staff undertaking groundworks before they begin work.
  - Fuel storage onsite would be carried out under best practice i.e. integrally banded containers. Plant refuelling would be carried out using best practice techniques and any spills to be controlled with spill kit.
  - Management of water that collects onsite or within excavations.
  - Appropriate management measures for polluting substances that are being brought on site and used as part of the construction process.



- Appropriate management measures for sediments in surface water runoff generated in construction and laydown areas.
- Appropriate management measures for accidental leakage and/or spillage incidents of oils/hazardous substances.
- Incorporation of hydrocarbon interceptors into the Site drainage system at high-risk areas, such as parking, unloading and refuelling areas, to remove hydrocarbons and oils from surface water prior to discharge. The **Outline Drainage Strategy (Document Reference 7.2)** details how new drainage will capture surface run-off once operational.

### Ground Investigation

- 17.7.6. Ground investigation would be undertaken prior to the construction phase as secured by DCO requirement within the **Draft DCO (Document Reference 3.1)** and set out in the **Outline CoCP (Document Reference 7.4)**. As shown in **Figure 17-3: Connections between the Ground Conditions and Soils Mitigation Tasks and Design**, this is likely to be led by geotechnical requirements but would include geo-environmental sampling of terrestrial soils, marine sediments, groundwater and surface water. The scope of the geo-environmental investigation would be underpinned by the CSM presented in **Appendix 17-1: Preliminary Risk Assessment (Volume 3)**. The analytical data obtained from the ground investigation would be screened for risks to human health and controlled waters and the results used to refine the contaminant linkages identified. The soils will also be analysed to determine suitability for the reuse of soils onsite.
- 17.7.7. The ground investigation would also confirm preliminary hydrogeological conditions and will obtain information associated with ground aggressivity, including sulphates, sulphides (especially in pyritic ground), water-soluble magnesium and acids (indicators are pH, chloride and nitrate ions). The results will be used to determine an appropriate concrete specification for the detailed design stage.
- 17.7.8. The ground investigation would be undertaken in accordance with BS 10175:2011+A2:2017<sup>50</sup> and LCRM<sup>18</sup>.
- 17.7.9. As the Site is within a 'High' risk area from UXO, a detailed UXO assessment will be undertaken in accordance with CIRIA guidelines<sup>51</sup>, prior to the ground investigation. The detailed UXO assessment would provide a comprehensive, in-depth desk study to determine the risk level of potentially encountering UXO thereafter informing the proposed construction and allowing selection of the appropriate mitigation for the Proposed Scheme. The requirement for a detailed UXO assessment is included in the **Outline CoCP (Document Reference 7.4)**.
- 17.7.10. The results of the ground investigation would be interpreted and assessed within a Generic Quantitative Risk Assessment (GQRA).
- 17.7.11. If the ground investigation identifies contaminant linkages a Remediation Strategy would be produced which would specify protective measures during construction.

These measures would be agreed with the regulators prior to implementation. The Remediation Strategy would include measures to remove or decommission any below ground services, tanks, structures and/or pipework encountered during construction to ensure that contaminants do not enter the ground nor migrate to controlled waters and no preferential pathways remain.

- 17.7.12. Any remediation undertaken would be validated and report on within a Verification Report to provide confidence that it has been undertaken with the agreed Remediation Strategy.
- 17.7.13. A Piling Risk Assessment would be produced to outline measures to protect the underlying aquifers during the construction phase and mitigate risk of creating preferential pathways for potential contamination. The Piling Risk Assessment would be undertaken in accordance with the Environment Agency document titled Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (NGWCL Centre Project NC/99/73)<sup>23</sup>.
- 17.7.14. An Earthworks Specification would be produced that would include protocols for testing and limiting values to ensure that imported materials are suitable for their intended use in terms of their chemical and geotechnical quality.
- 17.7.15. Contaminated ground materials that cannot be reused would be suitably managed to prevent mobilisation to the environment and to minimise the potential to impact sensitive receptors, prior to disposal. The **Outline CoCP (Document Reference 7.4)** requires that a Materials Management Plan (MMP) would be prepared prior to construction commencing (post-consent) by the Contractor(s) to monitor the maximum reuse of both natural soil and made ground (contaminated or otherwise). The MMP would be undertaken in accordance with the CL:AIRE 'Definition of Waste: Development Industry Code of Practice'<sup>52</sup> to ensure that soil reuse and imported materials are suitable for their intended use and will not significantly affect human health or the environment.

### **Dredged Arisings**

- 17.7.16. As set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, the dredged arisings associated with the Proposed Scheme (during both capital dredging and maintenance dredging) will be managed in accordance with relevant legislation and will be disposed of offsite (via vessel and only if dredged arisings are deemed suitable for this disposal method and conform with the permits for disposal sites). The removal of the dredged arisings will be undertaken by an appropriately licenced waste carrier.
- 17.7.17. As set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, periodic maintenance dredging will be required during the operation of the Proposed Scheme. The maintenance dredged arisings will be managed in accordance with relevant legislation and will be disposed of offsite (via vessel and only if dredged arisings are deemed suitable for this disposal method and conform with the permits

for disposal sites). The removal of the dredged arisings will be undertaken by an appropriately licenced waste carrier.

## 17.8. ASSESSMENT OF LIKELY IMPACTS AND EFFECTS

17.8.1. This section details the assessment of impacts and effects for the Proposed Scheme during the construction phase, taking into account the embedded design, mitigation and enhancement measures detailed in **Section 17.7**.

### RECEPTOR VALUE/SENSITIVITY

17.8.2. The attribute importance (sensitivity) assigned to environmental attributes and contaminated land receptors along with the value is shown in **Table 17-17**.

**Table 17-17: Attribute Importance (Sensitivity)**

Sensitive Receptor	Justification	Value/Sensitivity
<b>Site users and staff</b>	Site users and staff, although present, are unlikely to be present within areas of earthworks and construction and therefore less likely to come into contact with potentially contaminated soils and groundwater. Additionally, it is assumed that Riverside 1 and Riverside 2 (once operational) are operated in accordance with all relevant legislation, guidance and best practice, which will mitigate occupational risks to waste management personnel.	Medium
<b>Construction staff</b>	Earthworks will be required as part of the Proposed Scheme which may bring construction works into contact with potentially contaminated soils and groundwater. However, it is assumed that the construction phase will be undertaken in accordance with all relevant legislation, guidance and best practice, which will mitigate occupational risks to construction staff during works on the Proposed Scheme.	Medium
<b>Third party neighbours</b>	Third party neighbours are those present at adjacent PROW and Accessible Open Land, commercial properties (not including Munster Joinery which will be demolished), surrounding roads and Crossness Sewage Treatment Works. They are unlikely to be within areas of construction which include significant disturbance of ground during construction. Additionally, it is assumed that the construction phase will be undertaken in accordance with all relevant legislation,	Low

Sensitive Receptor	Justification	Value/Sensitivity
	guidance and best practice, which will mitigate risks to third party neighbours during construction of the Proposed Scheme.	
<b>Groundwater within the Secondary Undifferentiated Aquifers and Secondary A Aquifers</b>	The superficial Alluvium and Head deposits are Secondary Undifferentiated aquifers. The Taplow Gravel Member, Blackheath Member (Harwich Formation), Lambeth Group, and Thanet Formation are Secondary A aquifers.	Medium
<b>Groundwater within the Principal Aquifer</b>	The Chalk Group is a principal aquifer. Groundwater stored in aquifers is a principal source of drinking water in the area. The leaching potential of overlying soils is intermediate or high.	High
<b>Surface water features</b>	The River Thames is a Main River as defined by the Environment Agency.	High
<b>Below ground services and building structures</b>	This includes utility services and structures associated with Riverside 1 and Riverside 2, and other buildings, services and foundations, as well as proposed structures/installations. Except for the new potable water connection, utility services are not adversely affected by contamination.	Medium
<b>Third party below ground services and building structures</b>	Utility services and structures located offsite but within the 250m Study Area including those associated with adjacent commercial properties, surrounding roads and Crossness Sewage Treatment Works.	Low

Sensitive Receptor	Justification	Value/Sensitivity
<b>Ecological receptors</b>	Crossness LNR, Erith Marshes SINC, Inner Thames Marshes SSSI and the flood plain associated with Marsh Dykes are considered to be in hydraulic continuity with the groundwater underlying the Proposed Scheme. Although not considered to be Groundwater Dependant Terrestrial Ecosystems they may be impacted by potential contaminants which may be present within the groundwater.	Medium

## CONSTRUCTION PHASE

### Site Users, Staff and Construction Staff

- 17.8.3. There is a potential for hazardous substances to be present within underlying soils and groundwater due to historical land uses. Site users, staff and construction staff, including those at Riverside 1 and Riverside 2, could be exposed to any contaminants that are present in the Made Ground, including asbestos fibres during construction. They would be affected by inhalation of dusts, gases or vapours, dermal contact with soil and groundwater and ingestion of soil and dust. However, the length of direct exposure would be limited to the duration of works in which they are directly involved, and thus the effect would be short term. Any health effects from the potentially contaminated soil and groundwater could have a medium to long term effect.
- 17.8.4. The sensitivity of site users, staff and construction staff is medium and the magnitude of impact, following embedded mitigation (see **Section 17.7**) is no change. Therefore, there is likely to be a direct, temporary/permanent, medium to long term **Neutral (Not Significant)** effect on site users, staff and construction staff with the implementation of embedded mitigation measures.

### Third Party Neighbours

- 17.8.5. Excavation of potentially contaminated soils could pose a health risk to third party neighbours present at properties in the immediate vicinity of the Proposed Scheme, through inhalation of contaminated dusts and particulate matter generated by excavation/ activities that involve the disturbance of Made Ground. Third party neighbours may be exposed to contaminants that are present in the Made Ground, or that are present in the ground (i.e. after migrating from offsite sources) during any earthworks or activities that involves the disturbance of Made Ground. Previous ground investigation has targeted various parcels of land within the boundary of the Proposed Scheme. Some remediation work has been completed; however, data gaps exist for those areas where no ground investigation has been undertaken to date and unknown contamination could be present. Elevated concentrations of metals, metalloids, organics and asbestos could be present as previously found.
- 17.8.6. Should contaminants be present within soil and groundwater within these areas third party neighbours may also be exposed to contaminants that may be present in the Made Ground, or that are present in the ground (i.e. after migrating from offsite sources) during any earthworks or activities that involves the disturbance of Made Ground. These works may facilitate exposure to asbestos or other by the inhalation of dusts, gases or vapours, dermal contact with soil and groundwater and ingestion of soil and dust.
- 17.8.7. The impact to third party neighbours would be dependent on the type and nature of contamination (if present) and the characteristics of receptor and duration of exposure (i.e. vulnerable child or elderly person). Exposure/impact to third party neighbours



would mostly likely be indirect (i.e. inhalation of windblown dusts in ambient air). If these receptors are exposed to contaminants above threshold concentrations, there is potential for both short (temporary) and long term (permanent) health problems to arise dependent on the nature of the contaminants encountered.

- 17.8.8. The sensitivity of third party neighbours is considered to be medium, and the magnitude of impact, following embedded mitigation (see **Section 17.7**) is no change. Therefore, there is likely to be an indirect, temporary/permanent, short to long term **Neutral (Not Significant)** effect on third party neighbours with the implementation of embedded mitigation measures.

### Controlled Waters

- 17.8.9. There is the potential for soils and groundwater impacted by contaminants to be present within the Site due to the nature of historical site use. Construction phase activities (such as drilling, piling, excavation and dredging) have the potential to create new migratory pathways through which contaminants could migrate into underlying aquifers, surface waters (ordinary water ways and ponds) and ultimately the River Thames (which is likely to be in hydraulic connection with the groundwater and surface waters). Dredging activities proposed for the construction of the Proposed Jetty have the potential to mobilise contaminants present in the River Thames river bed sediments impacted the River Thames. Impacts to the River Thames are further assessed in **Appendix 11-2: Water Framework Directive Impact Assessment (Volume 3)**.
- 17.8.10. There is also potential for construction phase activity to introduce contaminants to the Study Area (for example, due to ineffective control of fuel). This could result in adverse impacts to groundwater during the construction phase, particularly if new migratory pathways have been created, but these impacts are less likely to persist beyond the construction phase.
- 17.8.11. The risks to controlled waters from the Proposed Scheme will be considered and mitigated via ground investigation and remediation work where required. The Piling Risk Assessment, Earthworks Specification and MMP would set out mitigation measures for preferential pathways to controlled waters.
- 17.8.12. The sensitivity of controlled waters is considered to be low to high, and the magnitude of change, following embedded mitigation (see **Section 17.7**) is no change. Therefore, there is likely to be a direct, temporary, long term **Neutral (Not Significant)** effect on controlled waters with the implementation of embedded mitigation measures.

## Onsite and Third Party Below Ground Services and Building Structures

- 17.8.13. Risks to below ground services, building structures and foundations may be present in the construction phase during open trench excavation for new installations. However, they are not considered likely to be adversely affected by contamination during construction as the construction phase for the Proposed Scheme will be undertaken in accordance with all relevant legislation, guidance and best practice, which will mitigate the migration of potential contamination to the receptors.
- 17.8.14. Potable water supply pipes have the potential to be impacted by contamination, however no significant contamination of soils or groundwater was identified during the site investigations undertaken to date. Therefore, there is not considered to be a significant risk to the installation of the new potable water supply at this stage.
- 17.8.15. Chemical data will be obtained at the detailed design stage and used to ensure appropriate construction materials (such as concrete classification) are selected for new installations.
- 17.8.16. The sensitivity of below ground services and building structures is medium and the magnitude of impact, following embedded mitigation (see **Section 17.7**) is no change. Therefore, there is likely to be a direct, temporary/permanent, short term **Neutral (Not Significant)** effect on below ground services and building structures with the implementation of embedded mitigation measures.

## Ecological Receptors

- 17.8.17. There is the potential for soils and groundwater impacted by contaminants to be present within the Site Boundary due to the nature of historical site use. Construction phase activities (such as drilling, piling, and excavation) have the potential to create new migratory pathways through which contaminants could migrate into underlying aquifers, surface waters (ordinary water ways and ponds) and ultimately ecological receptors dependent upon groundwaters such as Crossness LNR and the Marsh Dykes floodplain.
- 17.8.18. There is also potential for construction phase activity to introduce contaminants to the Study Area (for example, due to ineffective control of fuel), this is assessed within **Chapter 7: Terrestrial Biodiversity (Volume 1), Chapter 8: Marine Biodiversity (Volume 1)**.
- 17.8.19. The sensitivity of ecological receptors is considered to be medium, and the magnitude of change, following embedded mitigation (see **Section 17.7**) is considered to be no change. Therefore, there is likely to be a direct, temporary, long term **Neutral (Not Significant)** effect on ecological receptors with the implementation of embedded mitigation measures.

## 17.9. ADDITIONAL DESIGN, MITIGATION AND ENHANCEMENT MEASURES

- 17.9.1. As detailed in **Section 17.7** a ground investigation would be undertaken to inform detailed design. Depending on information gathered through this ground investigation, monitoring of groundwater and surface water may be recommended before construction commences, during construction works and post-construction. Should contamination be identified which is considered to pose a risk to sensitive receptors then remediation will be undertaken, pursuant to a DCO requirement.
- 17.9.2. Beyond this it is not considered that there are further opportunities for environmental enhancements in relation to ground conditions for the Proposed Scheme.
- 17.9.3. No further additional design, mitigation or enhancement measures are proposed for ground conditions and soils.

## 17.10. MONITORING

- 17.10.1. Whilst monitoring would be carried out in accordance with the Piling Risk Assessment, Materials Management Plan, Earthworks Specification and/or Remediation Strategy (as appropriate) no further monitoring of ground conditions and soils effects is considered to be proportionate or to be required.

## 17.11. RESIDUAL EFFECTS

- 17.11.1. **Table 17-18** below summarises the residual effects associated with the Proposed Scheme.

**Table 17-18: Ground Conditions and Soils - Summary of Residual Effects**

Description of the Effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement Measure	Residual Effect
<b>Construction Phase</b>				
<b>Effects on Site users, staff and construction staff from potential contamination within the underlying soils/groundwater</b>	Site users and staff (excluding construction staff)	<b>Neutral (Not Significant)</b>	None required.	<b>Neutral (Not Significant)</b>
	Construction staff			
<b>Potential effects on adjacent third party neighbours from potential contamination within the underlying soils during construction activities</b>	Third party neighbours	<b>Neutral (Not Significant)</b>	None required.	<b>Neutral (Not Significant)</b>
<b>Potential effects on controlled waters from contamination within the underlying soils/groundwater</b>	Groundwater within the Secondary Undifferentiated Aquifers and Secondary A Aquifers	<b>Neutral (Not Significant)</b>	None required.	<b>Neutral (Not Significant)</b>
	Groundwater within the Principal Aquifer	<b>Neutral (Not Significant)</b>	None required.	<b>Neutral (Not Significant)</b>
	Surface waters	<b>Neutral (Not Significant)</b>	None required.	<b>Neutral (not significant)</b>

Description of the Effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement Measure	Residual Effect
Potential effects associated with construction activities impacting below ground services and building structures	Below ground services and building materials	Neutral (not significant)	None required.	Neutral (not significant)
Potential effects on ecological receptors from contamination within the underlying soils/groundwater	Ecological receptors	Neutral (not significant)	None required.	Neutral (not significant)

## 17.12. LIMITATIONS AND ASSUMPTIONS

17.12.1. The following limitations and assumptions have been identified:

- This assessment has been undertaken using publicly available information presented in the desk-based Phase 1 Preliminary Risk Assessment report (**Appendix 17-1: Preliminary Risk Assessment (Volume 3)**). It has been assumed that the information provided in the Phase 1 Preliminary Risk Assessment represents existing ground conditions.
- This assessment has relied, in part, on data provided by third parties (e.g., Groundsure, BGS, MAGIC, Public Health England, Zetica UXO) which are the most up-to-date data available at the time of writing. No significant changes or limitations in these datasets have been identified that would affect the robustness of the assessment.
- It is assumed that activities undertaken during the construction phase that have the potential to affect ground conditions and soils will be undertaken in accordance with the mitigation measures set out in **Section 17.7**. Piling, demolition, excavation and site level raising will be undertaken with the implementation of an appropriate Piling Risk Assessment, Demolition Specification, Materials Management Plan, and Earthworks Specification.
- Dredging will be managed pursuant to the provisions of the Deemed Marine Licence, contained within the **Draft DCO (Document Reference 3.1)**.

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