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# London Luton Airport Expansion

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**5.01 ENVIRONMENTAL STATEMENT CHAPTER 17: SOILS AND  
GEOLOGY**

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## 17 SOILS AND GEOLOGY

### 17.1 Introduction

- 17.1.1 This chapter describes the assessment of the likely significant effects of the Proposed Development on Soils and geology. It presents an assessment of impacts from potentially contaminated soils on human health, the environment, buildings, buried infrastructure and those arising from disturbance from the construction of the Proposed Development and its operation.
- 17.1.2 This chapter also considers impacts to mineral resources, specifically whether the Proposed Development falls within future mineral extraction areas and potentially impacts to future exploitation of the mineral.
- 17.1.3 Impacts associated with geological and geomorphological features of scientific interest and Off-site Planting have both been scoped out of this assessment, see **Section 17.30** for further details.
- 17.1.4 This assessment does not cover risks to groundwater from contaminants, this is covered in full in **Chapter 20** Water Resources of this Environmental Statement (ES) [TR020001/APP/5.01]. However, this assessment does provide a description of the contamination sources which are relevant to that chapter.
- 17.1.5 The impacts of off-site disposal of material on waste management infrastructure is assessed in **Chapter 19** Waste and Resources of this ES [TR020001/APP/5.01], along with potential impact on natural resources.
- 17.1.6 Other issues associated with likely significant effects from vehicle movements due to disposal of excavated material off-site i.e. impacts on air quality, noise and traffic are described in the following chapters: **Chapter 7** Air Quality, **Chapter 16** Noise and Vibration, and **Chapter 18** Traffic and Transport of this ES [TR020001/APP/5.01].
- 17.1.7 **Chapter 6** Agricultural Land Quality and Farm Holdings of this ES [TR020001/APP/5.01] includes an assessment in relation to topsoil management and other aspects of soils specifically related to agriculture. An Outline Soil Management Plan (OSMP) has been produced and is provided as **Appendix 6.6** of this ES [TR020001/APP/5.02]. The OSMP describes measures to manage topsoil and subsoil resources which are present on land owned by the Applicant and currently under agricultural use. Matters relating to geotechnical and geo-environmental issues are not included in the OSMP.
- 17.1.8 This chapter includes an assessment of potential human health effects from contamination in soils and groundwater. **Chapter 13** Health and Community of this ES [TR020001/APP/5.01] should be referred to for an assessment of health effects arising from impacts on environmental, social or economic factors (e.g. access to recreational facilities, housing, aircraft noise) and impacts on community resources and the people using those resources (e.g. community facilities, public rights of way (PROW), schools).

- 17.1.9 This assessment is based on detailed assessments contained within the following reports which are provided as Appendices of this ES [TR020001/APP/5.02] and should be referred to:
- a. Preliminary Risk Assessment (PRA) of Land Contamination (**Appendix 17.1**).
  - b. Land Contamination Generic Quantitative Risk Assessment (GQRA) Report. (**Appendix 17.2**).
  - c. Detailed Quantitative Risk Assessment Report (DQRA): Human Health and Ground Gases (**Appendix 17.3**).
  - d. Detailed Quantitative Risk Assessment (DQRA) Report: Controlled Waters (**Appendix 17.4**).
  - e. Outline Remediation Strategy for Former Eaton Green Landfill (**Appendix 17.5**).
  - f. Foundation Works Risk Assessment (FWRA) (**Appendix 17.6**).
  - g. Outline Strategy Report for Groundwater, Ground Gas and Leachate Monitoring (**Appendix 17.7**).
- 17.1.10 The remainder of this chapter consists of:
- a. **Section 17.2** Legislation, policy and guidance relevant to the scope and methodology of the Soils and geology assessment;
  - b. **Section 17.3** Scope of the assessment;
  - c. **Section 17.4** Stakeholder engagement and consultation, undertaken to inform the assessment;
  - d. **Section 17.5** Methodology applied to the assessment;
  - e. **Section 17.6** Assumptions and limitations;
  - f. **Section 17.7** Baseline conditions;
  - g. **Section 17.8** Embedded and good practice mitigation measures;
  - h. **Section 17.9** Assessment;
  - i. **Section 17.10** Additional mitigation;
  - j. **Section 17.11** Residual effects;
  - k. **Section 17.12** In-combination climate change effects;
  - l. **Section 17.13** Monitoring; and
  - m. **Section 17.14** Assessment summary.

## 17.2 Legislation, policy and guidance

17.2.1 This section identifies the key legislation, policy and guidance relevant to the scope and methodology for the Soils and geology assessment which may influence the type of mitigation measures that could be incorporated into the Proposed Development during construction or operation. **Table 17.1** to **Table 17.3** provide a description of relevant legislation, policy and guidance, and where each of these have been addressed in this ES.

### Legislation

Table 17.1: Soils and geology legislation

Legislation	How and where addressed in ES
<p>The Environmental Protection Act (EPA) 1990: Part IIA (Ref. 17.1). This is the primary environmental legislation it provides a means of dealing with unacceptable risks posed by land contamination to human health, controlled waters and the environment. Any site affected by contamination which is redeveloped under planning should be done in such a manner that the site does not meet the requirements of “contaminated land” under Part 2A of the Act.</p>	<p>The embedded mitigation provided in <b>Section 17.8</b> and the assessment in <b>Section 17.9</b> has been undertaken consistent with these regulations and to ensure the site is not defined as “contaminated land” in the future.</p>
<p>Waste (England and Wales) Regulations 2011 (Ref. 17.2) The waste regulations set out the waste hierarchy, where waste management options are ranked according to what is best for the environment.</p>	<p>The waste hierarchy has been applied in the development of the Outline Remediation Strategy provided in <b>Appendix 17.5</b> of the ES <b>[TR020001/APP/5.02]</b> and detailed in the embedded mitigation provided in <b>Section 17.8</b>.</p>

Legislation	How and where addressed in ES
<p>Environmental Permitting (England and Wales) Regulations 2016 (Ref. 17.3).</p>	<p>The Environment Agency has advised that a Deposit for Recovery (DfR) permit will be required for the processing and reuse of landfill materials on site. The intention is to obtain an agreement in principle prior to the application for development consent with the permit to be obtained by the lead contractor, following granting of the DCO. It is described in further detail in the Outline Remediation Strategy (<b>Appendix 17.5</b> of this ES [TR020001/APP/5.02]). Full detail of permits, consents and licenses required for the Proposed Development are provided in the <b>Consents and Agreements Position Statement</b> provided as part of the application for development consent [TR020001/APP/2.03].</p>

### Policy

Table 17.2: Soils and geology policy

Policy	How and where addressed in ES
<p>The Airports National Planning Policy Statement (ANPS), June 2018 (Ref. 17.4)</p>	<p>See <b>Table 17.4</b>.</p>
<p>National Planning Policy Framework (NPPF), July 2021 (Ref. 17.5) requires Local Planning Authorities (LPAs) to ensure that the condition of land is suitable for the proposed new development, in order to prevent unacceptable risks from pollution and ground instability. The NPPF also states that land should not be determined as “contaminated land” as defined under Part IIA of the EPA 1990 (17.1) after remediation. Adequate site investigation, prepared by a competent person, should be available to inform contamination assessments.</p>	<p>The risk assessments completed to support this chapter to address this requirement are listed in <b>Section 17.1</b> and provided in <b>Appendices 17.1 to 17.4</b> of this ES [TR020001/APP5/5.02].</p>



Policy	How and where addressed in ES
<p>National Policy Statement for National Networks – December 2014 (NPSNN) (Ref. 17.6).</p> <p>The NPSNN sets out the need for, and Government’s policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects (NSIP) on the road and rail networks. The provisions of the NPSNN relevant to environmental assessment broadly mirror those as outlined in the ANPS.</p>	<p>There are no elements of the Proposed Development on the national road or rail network that would be classified as a NSIP in their own right. However, the NPSNN remains an important and relevant consideration, particularly as works are proposed on the Strategic Road Network (SRN) at Junction 10 of the M1 as part of the Proposed Development. The relevant policies of the NPSNN are consistent with the relevant policies of the ANPS and have not, therefore, been repeated here and accordingly the ANPS compliance <b>Table 17.4</b> provides the necessary policy response.</p>
<p>Luton Borough Council (LBC) Local Plan 2011-2031 (adopted November 2017) (Ref. 17.7)</p> <p>Policy LLP38 - Pollution and Contamination Pollution. The council require evidence to be provided to demonstrate <i>“whether the scheme (individually or cumulatively with other proposals) will result in any significantly adverse effects with regard to air, land or water on neighbouring development, adjoining land, or wider environment. Where adverse impacts are identified, appropriate mitigation will be required.”</i></p>	<p>The Soils and geology assessment described in <b>Section 17.9</b> and cumulative assessment in <b>Chapter 21</b> of the ES <b>[TR020001/APP5/5.01]</b> address the requirements of this policy.</p>
<p>Central Bedfordshire Council (CBC) Local Plan 2015-2035 (2021) (Ref. 17.8)</p> <p>Policy CC8: Pollution and Land Instability. The Council will only permit development proposals likely to cause pollution or land instability where it is demonstrated amongst other related factors that <i>“measures can be implemented to minimise the impacts of pollution and land instability to an acceptable level without compromising the quality of life for users and occupiers which protects health, natural and historic environment, water quality, property, infrastructure and amenity; and the conditions of the site can be suitably mitigated or land remediated</i></p>	<p>The Soils and geology assessment of land quality described in <b>Section 17.7</b> addresses the requirements of this policy, and remediation, embedded mitigation, design measures and good practice which ensure the site can be suitably remediated are presented in <b>Section 17.8</b>. The significance of the effects are assessed in <b>Section 17.9</b>.</p>

Policy	How and where addressed in ES
<p><i>for the proposed end use and cause no adverse effects.”</i></p>	
<p>North Hertfordshire District Council (NHDC) Local Plan 2011-2031 was adopted on 8 November 2022 (Ref. 17.9) The plan includes the strategic policy; Policy SP11: Natural resources and sustainability, notes the objectives to protect and enhance the water environment and support proposal that involve the remediation of contaminated land. The following relevant development management policies are also addressed in this chapter: Policy NE4: Designated biodiversity and geological sites includes requirements which must be met as part of planning permission to protect, enhance and manage designated and non-designated ecological and geological sites. Policy NE11: Contaminated land sets out requirements for development affecting contaminated land including preparation of contaminated land study and risk assessment, investigation and remediation to ensure the site is suitable for use.</p>	<p>The assessment of Soils and geology described in <b>Section 17.7</b>, and remediation, embedded mitigation, design measures and good practice which ensure the site can be suitably remediated are presented in <b>Section 17.8</b> address the requirements of these policies SP11 and NE11. <b>Section 17.3</b> addresses Policy NE6 and details the basis on which sites of geological and geomorphological features of scientific interest have been scoped out of this assessment.</p>
<p>Dacorum Borough Council (DBC) Core Strategy 2006-2030 (Adopted 25 September 2013) (Ref. 17.10) The plan includes Policy CS32: Air, Soil and Water Quality with a specific requirement for development to “<i>maintain soil quality standards and remediate contaminated land in line with Environment Agency, Defra<sup>1</sup> and Natural England guidance</i>” any developments which would cause harm from a significant increase in pollution into air, soils and water would not be permitted.</p>	<p>The assessment of Soils and geology baseline is described in <b>Section 17.7</b>, and remediation, embedded mitigation, design measures and good practice which ensure the site can be suitably remediated are presented in <b>Section 17.8</b>. An assessment of effects is reported in <b>Section 17.9</b>. These address the requirements of this policy to maintain soil quality standards and ensure the development would not cause harm due to significant increase in pollution.</p>
<p>Bedford Borough, Central Bedfordshire and Luton Borough Councils. The Minerals and Waste Local Plan: Strategic Sites and</p>	<p>These documents have been used to identify Mineral Safeguarding Areas (MSA) within the study area which could be</p>

<sup>1</sup> Department for Environment Food and Rural Affairs.

Policy	How and where addressed in ES
Policies (Adopted January 2014) (Ref. 17.11)	impacted by the Proposed Development, see <b>Section 17.7</b> .
Bedfordshire and Luton Minerals and Waste Local Plan 2000-2015 – saved policies (Adopted 2005) (Ref. 17.12)	
Hertfordshire County Council Minerals Local Plan Review, 2002 - 2016 (Adopted March 2007) (Ref. 17.13)	
Hertfordshire County Council. Hertfordshire Minerals Local Plan 2016-2031. Consultation Draft 2017 (Ref. 17.14)	
Hertfordshire County Council. Proposed Submission Minerals Local Plan (2019) (planned adoption in 2022) (Ref. 17.15)	

## Guidance

Table 17.3: Soils and geology guidance

Guidance	How and where addressed in ES
British Standard (BS) Investigation of Potentially Contaminated Sites – Code of Practice (2017) BS10175 (Ref. 17.16)	Geotechnical and geoenvironmental ground investigations (GIs) including soil and groundwater testing were undertaken in accordance with BS10175 guidance. This has identified land contamination issues requiring assessment, see <b>Section 17.7</b> .
Environment Agency, Land Contamination Risk Management (LCRM) (2020) (Ref. 17.17)	The assessments and proposed remediation and verification works described in the baseline data and embedded mitigation have been completed in accordance with this guidance, which reflects current best practice. See <b>Sections 17.7</b> and <b>17.8</b> .
Environment Agency, Contaminated Land Report 11 (CLR 11). Model Procedures for the Management of Land Contamination. (withdrawn) (Ref. 17.18)	This guidance was replaced by LCRM and was used in earlier reports which have been referenced for the baseline information.
Environment Agency, Guiding Principles for Land Contamination (GPLC2) (2010) (Ref. 17.19). This guidance is written for developers/landowners, advisors and consultants on management of land	The guidance advises on the scope of land contamination reports and references further guidance to be used for the investigation and assessment of potential contamination sources, see <b>Section 17.7</b> .

Guidance	How and where addressed in ES
<p>contamination. It highlights main principles, important points, advice and key guidance with means to fulfilling legal obligations and reducing risks.</p>	
<p>Rudland, D J; Lancefield, R M; Mayell, P N. Contaminated land risk assessment. A guide to good practice (2001) (C552) Construction Industry Research and Information Association (CIRIA) (Ref. 17.20)</p>	<p>Assessment of the potential impact of each of the identified pollutant linkages and ‘ranking’ according to both the probability and severity of any likely impact, in accordance with CIRIA C552 guidance, is presented in <b>Section 17.5</b>.</p>
<p>Wilson, S; Oliver, S; Mallett, H; Hutchings, H; Card G (2007). Assessing risks posed by hazardous ground gases to buildings (C665) CIRIA (Ref. 17.21)</p>	<p>Assessment of the gassing regime was completed in accordance with CIRIA C665 guidance. The assessment was completed to identify mitigation measures required to protect proposed buildings and occupants from ground gases, see <b>Section 17.8</b>. The assessment is presented in full in the DQRA (see <b>Appendix 17.3</b> of this ES [<b>TR020001/APP5.02</b>]).</p>
<p>Nathanail, CP, Jones, A, Ogden, R, Robertson, A (2014). Asbestos in soil and made ground: a guide to understanding and managing risks (C733) CIRIA. (Ref.17.22)</p>	<p>CIRIA C773 was used to guide the assessment of risk from the Asbestos Containing Materials (ACMs) and asbestos fibres identified at various locations within the Proposed Development and the management controls required during the groundworks, provided in <b>Section 17.8</b>. Full detail of the approach to asbestos management is described in the Outline Remediation Strategy provided in <b>Appendix 17.5</b> of this ES [<b>TR020001/APP5.02</b>]).</p>
<p>Ministry of Housing Communities and Local Government (MHCLG), Planning Practice Guidance (2014) updated 2019 (Ref. 17.23)</p> <p>This document sets out guiding principles on how planning can deal with land affected by contamination. It describes the role of planning authorities and the approach to development on land that could be affected by land contamination. It refers to relevant legislation and regulations applicable to land contamination and the approach to establish if there is contamination and the</p>	<p>The supporting documentation appended to this chapter in <b>Appendices 17.1 to 17.5</b> of this ES [<b>TR020001/APP5.02</b>] meet the requirements for planning as set out in this guidance.</p>

Guidance	How and where addressed in ES
assessment of risk. It identifies requirements to be met for planning applications on potentially contaminated land.	
National House Building Council (NHBC) and Environment Agency (2008) Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66:2008 Volume 1 (Ref. 17.24)	This guidance has been used to determine sensitivity of receptors and the study zone defined in <b>Section 17.3</b> .
Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 4 Environmental Assessment and Monitoring (Ref. 17.25) <sup>2</sup>	The DMRB guidance has informed development of the methodology described in <b>Section 17.5</b> .
Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 11 Geology and Soils (Ref. 17.26) <sup>3</sup>	The DMRB guidance has informed development of the assessment methodology described in <b>Section 17.5</b> .

- 17.2.2 The ANPS (Ref. 17.4) does not have effect in relation to an application for development consent for an airport development not comprised of an application relating to the Heathrow Northwest Runway. Nevertheless, as set out within paragraph 1.41 of the ANPS, the Secretary of State considers that the contents of the ANPS will be both important and relevant considerations in the determination of such an application, particularly where it relates to London or the south east of England. In particular, the ANPS makes clear that, alongside the provision of a new Northwest Runway at Heathrow, the government supports other airports making best use of their existing runways as set out in Beyond the Horizon: Making best use of existing runways (MBU) (Ref. 17.27), which is the specific policy context for this application.
- 17.2.3 In addition, whilst the ANPS does not have effect in relation to the Proposed Development, it sets out a number of principles for environmental impact assessment and compliance and these will be an important and relevant consideration in the determination of the application for development consent. A summary of the relevant provisions for the Soils and geology assessment and how these have been addressed in this ES is provided within **Table 17.4**.

Table 17.4: How relevant Soils and geology requirements of ANPS are addressed in the ES

ANPS Section	How and where addressed in ES
Paragraphs 5.226-5.229 sets out the land stability policy. Where necessary, land stability should be considered in respect of	Geotechnical assessment has been undertaken which takes into account potential land stability issues. <b>Section 17.8</b>

<sup>2</sup> Superseded by Highways England. LA 104 Environmental Assessment and Monitoring, 2020. Revision 1.

<sup>3</sup> Superseded by Highways England. LA 109 Sustainability and environment. Appraisal. Geology and soils, 2019.

ANPS Section	How and where addressed in ES
<p>new development, as set out in the National Planning Policy Framework and supporting planning guidance. A preliminary assessment of ground instability should be carried out at the earliest possible stage before a detailed application for development consent is prepared. The applicant should ensure that any necessary investigations are undertaken to confirm that their sites are and will remain stable or can be made so as part of the development.</p>	<p>summarises how land stability risks would be mitigated and minimised.</p>
<p>Paragraphs 5.109 – 5.127 set out policies concerned with land contamination. For developments where land may be affected by contamination, or existing mitigation is in place in respect of historical contamination, the applicant should have regard to the statutory regime contained in Part IIA of the Environmental Protection Act 1990 and relevant Government guidance relating to or dealing with contaminated land. Where the development is subject to an Environmental Impact Assessment (EIA), the applicant should undertake an assessment of any likely significant land quality effects and describe them in the ES. How they have been avoided/minimised/addressed should be documented. The objective is to ensure that the site is suitable for its intended use.</p>	<p>A land contamination PRA, GQRA and DQRAs for human health and controlled waters provided as <b>Appendices 17.1 to 17.4</b> of this ES [TR020001/APP5.02] have been undertaken for the Proposed Development in accordance with the required statutory guidance and best practice. A summary of the findings is presented in <b>Section 17.7</b> of this report.</p> <p>An Outline Remediation Strategy (<b>Appendix 17.5</b> of this ES [TR020001/APP5.02]) has been produced which identifies mitigation measures to address land contamination. These measures are summarised in <b>Section 17.8</b> as embedded and best practice mitigation.</p>
<p>Paragraph 5.117 states that the applicant should safeguard any mineral resources on the proposed site for the preferred scheme as far as possible.</p>	<p>The Mineral Safe Guarding Areas (MSAs) which are relevant to the Proposed Development are discussed in <b>Section 17.7</b>.</p>



### 17.3 Scope of the assessment

17.3.1 This section describes the scope of the Soils and geology assessment, including how the assessment has responded to the Scoping Opinion. The temporal and spatial scope, the relevant receptors, and matters scoped in and out, are identified. A description of engagement undertaken with relevant technical stakeholders to develop and agree this scope is provided in **Section 17.4**.

#### Scoping Opinion

17.3.2 The EIA Scoping Report, published in two volumes, sets out the proposed scope and assessment methodologies to be employed in the EIA and is provided in **Appendices 1.1 and 1.2** of this ES [TR020001/APP5.05].

17.3.3 In response to the Scoping Report, a Scoping Opinion was received from the Planning Inspectorate on 9 May 2019 and is provided in **Appendix 1.3** of this ES [TR020001/APP5.05].

17.3.4 **Table 17.5** describes the main matters highlighted by the Planning Inspectorate in the Scoping Opinion and how these have been addressed in the ES. Responses to all comments received during scoping are presented in **Appendix 1.4** of this ES [TR020001/APP/5.02].

Table 17.5: Soils and geology main matters raised by Planning Inspectorate

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
4.6.1	Groundwater assessment to be undertaken as part of Chapter 20 Water Resources - "The Inspectorate agrees that this is a logical approach; however, would expect to see clear cross-referencing between the two aspect chapters to ensure a full and robust assessment, particularly as data collated for the Soils and geology assessment will likely inform the Water Resources assessment."	Noted. Clear cross-referencing to interrelated chapters is included throughout the document.
4.6.3	The Scoping Report acknowledges that the location, nature and extent of the proposed off-site Highway Interventions are not yet known. It also does not provide sufficient certainty that there would be no impacts to sensitive/valued Soil and geology receptors or details of the likely proposed measures to be included in the Code of Construction Practice (CoCP) to manage potential	An assessment of the Offsite Highway Interventions is included in the PRA in <b>Appendix 17.1</b> of this ES and <b>Section 17.7</b> . A Code of Construction Practice (CoCP) has been produced and is provided as <b>Appendix 4.2</b> of this ES [TR020001/APP5.02]. The CoCP describes the key

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
	risks. In the absence of this information, the Inspectorate is unable to agree that matters of soil and geology associated with the Off-site Highway Interventions can be scoped out at this stage. The ES should include an assessment of such matters where likely significant effects could occur.	principles that would be followed to avoid, reduce or manage the construction effects related to land contamination, including vapours, dust, and asbestos fibres.
4.6.4	On the basis that the management of off-site disposal of material on waste management infrastructure is to be assessed in Chapter 13 Waste and Resources of the ES, the Inspectorate agrees this matter can be scoped out of the Soil and Geology aspect chapter. The ES should however include clear and appropriate cross-referencing between relevant aspect chapters, such as Waste and Resources, and Traffic and Transport.	Clear cross-referencing to interrelated chapters has been included throughout the document particularly later in this <b>Section 17.3</b> .
4.6.5	The Scoping Report identifies a Zone of Influence (ZOI) of 250m from the Main Application Site, extending to 1km for an assessment of landfills, based on guidance contained within the following: National House-Building Council and the Environment Agency (2008) Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 Volume 1 (Ref. 17.24). The ES should clearly justify why this distance is deemed an appropriate ZOI for the Proposed Development with reference to likely source receptor-pathways. Due to the soils being predominantly clay above chalk, as stated in the Scoping Report, the Applicant should consider the potential for contamination further than 250m especially where waterbodies are present. The ES should ensure adequate cross-referencing between other aspect chapters, such as the Water Resources and Health chapters.	The assessment study area for groundwater, surface water and potable water abstraction as potential receptors to land contamination has been addressed and the study area has been extended to 2km, see Study Area in this <b>Section 17.3</b> , this is assessed further in <b>Chapter 20</b> Water Resources and Flood Risk of the ES <b>[TR020001/APP/5.01]</b> . For all other receptors such as human health and the built environment the study area remains 250m from the Proposed Development boundary as deemed appropriate. Cross referencing to relevant chapters has been included.
4.6.7	The Scoping Report states that ‘The existing baseline assessment of the	The geographical extents of the study area to inform the impact



Scoping Opinion ID	Scoping Opinion comment	How this is addressed
	landfill area will be supplemented to consider the wider geoenvironmental setting and ground conditions within the area of the Proposed Development.’ It is not clear from this statement as to whether this relates to an area within and/or beyond the boundary of the Proposed Development. The geographical extent of the studies used to inform the impact assessment should be clearly stated in the ES.	assessment has been updated and is clearly stated under Study Area in this <b>Section 17.3</b> .
4.6.8	The Scoping Report references the potential for ‘significant quantities of excess material’ and cross refers to Chapter 13: Waste and Resources for an assessment of the impact from disposal of off-site material on existing waste management infrastructure. The Inspectorate would also expect effects associated with the removal off-site of excavated material to be factored into the assessment of traffic and transport and air quality aspect chapters. The ES should include clear and appropriate cross-referencing between aspect chapters to ensure a robust assessment.	Clear and appropriate cross referencing is included throughout in particular in this <b>Section 17.3</b> .
4.6.9	This aspect chapter does not refer to the production of a Soils Management Plan (SMP); however, it is noted to have been referenced in <b>Chapter 6</b> Agricultural Land Quality and Farm Holdings. The Inspectorate considers that a SMP is equally applicable to this aspect chapter and would therefore expect measures within a SMP to be referenced in the ES. It is recommended that an outline SMP be included with the ES, with the final SMP appropriately secured through the Applicant’s DCO or other suitably robust method.	The Outline SMP has been included in <b>Appendix 6.6</b> of this ES [ <b>TR020001/APP/5.02</b> ]. Cross reference is made to <b>Chapter 6</b> and the OSMP in <b>Sections 17.1</b> and <b>17.8</b> .
4.6.1	Groundwater assessment to be undertaken as part of Chapter 20 Water Resources - "The Inspectorate agrees that this is a logical approach; however, would expect to see clear cross-	Noted. Clear cross-referencing to interrelated chapters is included throughout the document.

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
	referencing between the two aspect chapters to ensure a full and robust assessment, particularly as data collated for the Soils and geology assessment will likely inform the Water Resources assessment."	

**Spatial scope**

- 17.3.5 The spatial scope for this Soils and geology assessment includes the following areas as defined in **Chapter 2 Site and Surroundings** of this ES **[TR020001/APP/5.01]** and buffer zones described in the following paragraphs:
- a. Main Application Site including the Airport Access Road;
  - b. Off-site Car Parks;
  - c. Off-site Highways Interventions; and
  - d. Off-site Planting.

**Study area**

- 17.3.6 Guidance contained within R&D Publication 66 (Ref. 17.24) states that off-site features typically within an area up to 250m from the indicative development boundary should be considered within the hazard identification stage of site assessment. However, features of greater distances should be considered if they have the potential to affect a greater distance (dependent on the form of potential contamination). The study area has been defined to enable the identification of:
- a. Potential sources of contamination which could impact the soils and geology within the Proposed Development boundary.
  - b. Potential receptors which may experience a change as a result of soils and geology (human health, natural environment and built environment, including infrastructure).
  - c. Potential pathways which currently exist or could arise due to earthworks, construction and future land use associated with the Proposed Development.
  - d. Potential impacts arising from construction activities (such as excavation and piling etc.) and during operation.
- 17.3.7 Therefore, the study area shown on **Figure 17.1** of the ES **[TR020001/APP/5.03]** encompasses all areas within the Proposed Development boundary plus the buffers as stated in this section summarised in **Table 17.6**.

Table 17.6: Study area buffers for Proposed Development

Proposed Development area	Dataset		
	Environmental permits/pollution incidents	Historical and current landfills and waste management sites	Ecological significance, aquifers, groundwater abstractions, surface water features
Main Application Site and Off-Site Car Parks	250m	1km	2km
Off-Site Highway Interventions and Off-Site Planting	250m	250m	-

17.3.8 The study area for ecological, groundwater and surface water receptors was set at 2km, this was considered appropriate based on professional judgment. As the pathways such as lateral flow of groundwater could allow migration of contamination over this distance. For controlled water the potable abstraction at King’s Walden is approximately 1.5km from the Main Application Site boundary and could potentially be impacted by contamination in soils on site.

17.3.9 The study area for the Off-Site Planting and Off-Site Highway Intervention areas is limited to 250m for current and historical land uses and current and historical waste management facilities/landfills. Due to the nature of the proposed works, it is likely only shallow soils would be disturbed in these areas by the works and there would be no potential for pathways to be formed over distances greater than 250m.

17.3.10 The study areas and Zone of Influence (ZOI) were presented and agreed at a stakeholder meeting on 26 July 2021 (see **Table 17.7**) which was attended by the Environment Agency and Host Authorities.

17.3.11 Receptors within this study area are described in the baseline **Section 17.7** of this chapter. A detailed assessment of the risks to groundwater, surface water and groundwater abstractions is included in **Chapter 20** Water Resources and Flood Risk of this ES [TR020001/APP/5.01].

**Zone of Influence**

17.3.12 The ZOI to be applied for the cumulative assessment for soil and geology receptors is 2km from the boundary of the Proposed Development, as shown in **Figure 17.1** of this ES [TR020001/APP/5.03]. The full cumulative effects assessment is provided in **Chapter 21** In-Combination and Cumulative Effects Assessment of this ES [TR020001/APP/5.01].

## Temporal scope

- 17.3.13 The Proposed Development would be delivered incrementally in response to forecast passenger demand. However, due to the long timeframe for the construction of the Proposed Development, three assessment phases are considered, within which construction and operation may take place simultaneously. Assessment years for each assessment phase are described in **Chapter 5 Approach to the Assessment of this ES [TR020001/APP/5.01]**.
- 17.3.14 The Soils and geology assessment considers the construction and operational effects for each assessment phase of the Proposed Development. The maximum effects are anticipated in assessment Phase 2a construction activities (2033 to 2036), with the creation of the earthworks platform and excavation of a substantial volume of landfill to allow construction of the new terminal on the former landfill.

## Receptors

- 17.3.15 Receptors within this study area are described in the baseline **Section 17.7** of this chapter. A detailed assessment of the risks to groundwater, surface water and groundwater abstractions is included in **Chapter 20 Water Resources and Flood Risk** of this ES [TR020001/APP/5.01].

## Matters scoped in

- 17.3.16 The EIA Scoping Report set out the proposed scope for the assessment of Soils and geology scoping in the assessment of the impacts of the Proposed Development on human health, buildings and buried infrastructure and mineral resources.
- 17.3.17 The Planning Inspectorate response in the Scoping Opinion noted that Off-site Highway Interventions were scoped into the assessment.

## Matters scoped out

- 17.3.18 All Off-site Planting comprises hedgerow enhancements or new hedgerows along field boundaries, these areas were considered in the PRA provided as **Appendix 17.1** of this ES [TR020001/APP/5.02]. These areas are located in agricultural land and the proposed works would only disturb shallow soils. No potential contamination issues were identified; therefore these areas have been scoped-out of the assessment.
- 17.3.19 Geological and geomorphological features of scientific interest and importance were scoped out at the scoping opinion stage, on the basis that there are none located within (or immediately adjacent to) the Proposed Development. The Planning Inspectorate's Scoping Opinion agreed this was appropriate. Although a watching brief would be undertaken during earthworks and a record would be made if any features of geological importance are identified.

## 17.4 Stakeholder engagement and consultation

- 17.4.1 Engagement in relation to Soils and geology has been undertaken with a number of prescribed and non-prescribed stakeholders.
- 17.4.2 A contaminated land EIA working group was formed comprising representatives from Host Authorities, the Environment Agency and London Luton Airport Operator Limited (LLAOL, the operator of the airport) as follows:
- a. LBC – represented by an independent consultant for Environmental Health
  - b. North Hertfordshire District Council - Contaminated Land Officer;
  - c. Central Bedfordshire – Environmental Health Officer;
  - d. Environment Agency – Account Manager;
  - e. Environment Agency – Technical Specialist Groundwater and Land Quality;
  - f. Environment Agency – Technical Specialist – Waste and Geotechnical Specialist; and
  - g. LLAOL – Capital Expansion Programme Director.
- 17.4.3 The **Consultation Report** submitted as part of the application for development consent (**[TR020001/APP/6.01]** and **[TR020001/APP/6.02]**) contains a full account of the statutory consultation process and issues raised in feedback. Matters raised regarding the scope, method, mitigation or compensation being considered as part of the Soils and geology assessment were then subject to further discussions directly with stakeholders during working group meetings. The main matters/themes raised during consultation and in subsequent engagement considered relevant to the Soils and geology assessment are:
- a. study area and assessment methodology;
  - b. baseline data;
  - c. mitigation and monitoring; and
  - d. environmental permitting.
- 17.4.4 **Table 17.7** provides a summary of engagement with relevant stakeholders, undertaken to inform the EIA, including the date and time of meetings and a summary of discussions to resolve matters raised.

Table 17.7: Stakeholder engagement relating to Soils and geology

Meeting name and date	Attendees (organisation)	Summary of discussion
Introduction to the Proposed Development (26 February 2018)	Host Authorities (CBC, NHDC, LBC) and Environment Agency	The Environment Agency Planning Officer raised the importance of protecting groundwater from pollution, particularly in relation to the landfill. It was also noted that

Meeting name and date	Attendees (organisation)	Summary of discussion
		“proposals for Green Horizons Park (formerly New Century Park) have not raised any objection from the EA”.
EIA scoping and GI (26 March 2018)	Environment Agency	Meeting discussed content of EIA scoping and GI – the Environment Agency were in agreement with proposed approach to EIA scoping and that the GI would meet expectations with regard to data requirements.
EIA scoping (12 April 2018)	Environmental Health Officers (EHO), NHDC and CBC	The meeting discussed EIA scoping relating to air quality, noise and contaminated land. Further and ongoing consultation was welcomed by the Local Planning Authorities (LPAs) and it was suggested that discipline specific meetings would be preferable.
Update on GI and Landside Drainage (1 August 2018)	Environment Agency	Meeting to provide an update on the GI and landside drainage strategy. Environment Agency were updated on the GI completed to date summary of findings and investigation works to be completed. The Environment Agency indicated they were satisfied with the work undertaken to date and were invited to attend during remaining GI works to observe.
Initial strategy (10 October 2018)	Environment Agency	Meeting was held to discuss initial strategy with regards to re-engineering the landfill waste. Strategy was presented to Environment Agency and the regulatory mechanisms discussed. Environment Agency advised that a Waste Recovery Permit is likely to be required for the works.
Detailed risk assessment (1 July 2019)	Environment Agency	Meeting to update the Environment Agency on findings of the 2018/2019 GI, progress of risk assessments and next steps for assessment. The Environment

Meeting name and date	Attendees (organisation)	Summary of discussion
		<p>Agency advised that Foundation Works Risk Assessment (FWRA) to identify an appropriate piling technique would be acceptable. The Environment Agency advised on what they would be looking for in GW DQRA to include flow, levels and contaminant transport in the assessment, also expect to see GW flow modelling with potential impact of development on groundwater regime considered. This is included in <b>Chapter 20</b> Water Resources and Flood Risk of this ES <b>[TR020001/APP/5.01]</b>. The Environment Agency highlighted risk from leachate being mobilised by loading of the landfill as a concern to be addressed. The Environment Agency advised that agreement in principle to be obtained for use of waste recovery permit pre application for development consent.</p>
<p>Water supply/demand and discharges (16 March 2020)</p>	<p>Affinity Water</p>	<p>Sources of contamination were discussed which may impact quality of water discharged to infiltration tanks.</p> <p>The results of Landfill GI, GQRA and DQRA were presented. Modelling indicates Affinity potable water abstraction is not currently being impacted by contamination in the landfill, but that careful controls would be required during earthworks to ensure contamination is not mobilised. Affinity Water satisfied with conclusions as presented, requested reports to allow a detailed review.</p>
<p>Contaminated Land Working Group (CLWG) Meeting 1 (26 July 2021)</p>	<p>Environment Agency and Host Authorities</p>	<p>This meeting presented details of the Proposed Development including changes, agreed outstanding issues from the scoping stage and provided an overview of</p>



Meeting name and date	Attendees (organisation)	Summary of discussion
		<p>the EIA work to date. The GI and detailed risk assessment work was presented along with an outline of the draft Remediation Strategy. It was noted that the Remediation Strategy was being updated with scheme changes and would be presented at a future meeting for agreement. No objections to the approaches presented were raised. Next steps were also outlined and actions agreed. It was stated that re-use of landfill waste is to be via a DfR permit. It was stated that the intention is to obtain an agreement in principle prior to the application for development consent and the permit would be obtained by the contractor following granting of the DCO. The Environment Agency advised the application to be progressed in parallel with the application for development consent.</p>
<p>CLWG Meeting 2 (9 February 2022)</p>	<p>Environment Agency and LBC</p>	<p>The purpose of the meeting was to discuss the proposed groundwater, leachate and ground gas monitoring strategy through to DCO submission. The proposed monitoring strategy up to DCO submission was provided for review to the attendees prior to the meeting, the strategy was broadly agreed and noted to be robust. It was noted that a minimum of 12 months monitoring would be required prior to submitting the recovery permit application and monitoring during construction would need to be at monthly intervals. It was highlighted that more data is to be collected on per- and poly-fluoroalkyl substances (PFAS) contaminants to identify areas of concern. It was agreed that</p>



<b>Meeting name and date</b>	<b>Attendees (organisation)</b>	<b>Summary of discussion</b>
		<p>a continuation of baseline monitoring post DCO through to construction would be the best approach. It was recommended that LR attend future meetings so they are fully aware of the issues / challenges around obtaining the environmental permit.</p>
<p>CLWG Meeting 3 (12 July 2022)</p>	<p>Environment Agency, Host Authorities and LLAOL</p>	<p>The comments on the 2022 PEIR by Host Authorities and the Environment Agency were reviewed with proposed responses from LR presented and discussed.</p> <p>The key issues raised were: landfill gas migration and control measures, framework for reusing landfill waste, Made Ground and natural soils, to include use of environmental permit and Definition of Waste Code of Practice (DoWCoP), updates to the Outline Remediation Strategy, securing of proposed mitigation, content of the foundation works risk assessment (FWRA) which would be provided to CLWG for review prior to submission of application for development consent and groundwater monitoring for PFAS.</p>

## 17.5 Methodology

### Overview

17.5.1 This section outlines the methodology employed for assessing the likely significant effects on Soils and geology from the construction and operation of the Proposed Development.

### Baseline methodology

17.5.2 The collation and assessment of the baseline data has been undertaken in line with current guidance: Land Contamination: Risk Management (Ref. 17.17) which advocates a tiered, risk-based approach.

17.5.3 The Proposed Development covers a large area of approximately 474ha. with a substantial amount of information available. For the purposes of describing the baseline and assessment, the Proposed Development has been subdivided as shown on **Figure 17.1** of this ES [TR020001/APP/5.03] and described as:

- a. The Main Application Site has been split into, Existing Airport Land, LLAOL Contractor's Compound, Areas A, B, C and the Airport Access Road (previously referred to as the Century Park Access Road (CPAR));
- b. Off-site Car Parks are Area D – Off-site Car Park North, and Area E – Off-site Car Park South;
- c. Off-site Highway Interventions around the Main Application Site and three junctions in Hitchin; and
- d. Off-site Planting.

17.5.4 The approach to defining future baseline is described in **Section 5.4** of **Chapter 5** Approach to the Assessment of this ES [TR020001/APP/5.01]. The future baseline considered for Soils and geology is described in **Section 17.7** of this Chapter.

### Published available information

17.5.5 The following published available information sources have been reviewed:

- a. Geological Survey of England and Wales 1:50,000 Geological Map (Leighton Buzzard) (Ref. 17.28);
- b. Geological survey of Great Britain (England and Wales) Geological Map (Hitchin) (Ref. 17.29);
- c. Geological Memoir of the country around Hitchin (Ref. 17.30);
- d. Multi Agency Geographical Information for the Countryside (MAGIC) maps (Ref. 17.31);
- e. Groundsure Data viewer (Ref. 17.32);
- f. Groundsure reports obtained for the study area between 2018 and 2020 (Ref. 17.33, Ref. 17.34, Ref. 17.35, Ref. 17.36); and
- g. Department of Environment (DoE) Industry Profiles (Ref. 17.37).

## Records from organisations and regulatory bodies

- 17.5.6 A number of organisations and regulatory bodies were contacted to inform this assessment. Full details of the information obtained is presented in Appendix C in the PRA provided as **Appendix 17.1** of this ES [TR020001/APP/5.02].

## Site walkovers

- 17.5.7 Site walkovers and visits have also been undertaken between October 2015 and June 2019. The purpose of the walkovers was to assess the visible ground conditions for any sign of contamination. As the site areas are controlled and monitored, the risk of baseline conditions changing is considered to be low and therefore further site visits are not required at this time. If the DCO is granted there would be further phases of site investigation and monitoring which would confirm visible ground conditions. The full details are provided in the PRA, **Appendix 17.1** of this ES [TR020001/APP/5.02].

## Site investigation and risk assessment reports

- 17.5.8 There are a large number of previous site investigations and assessments relating to the existing airport and surrounding area. There are also a number of more recent reports relating to the GIs within the Main Application Site, undertaken for the Green Horizons Park development, the Luton Direct Air-Rail Transit (Luton DART) and the Proposed Development. These reports have been reviewed in detail in the PRA and are listed in **Appendix 17.1** of this ES [APP020001/APP/5.02].
- 17.5.9 In addition, a GQRA, DQRA in two volumes; human health and controlled waters, Outline Remediation Strategy, FWRA, and Outline Strategy Report for Groundwater, Ground Gas and Leachate Monitoring have all been prepared for Area A, see **Appendices 17.2 to 17.7** of this ES [TR020001/APP/5.02].

## Assessment methodology

- 17.5.10 The assessment methodology outlined below applies to both construction and operational phases of the Proposed Development.
- 17.5.11 The assessment was undertaken in general accordance with the following:
- a. DMRB Volume 11, Section 2, Part 5 Environmental Assessment and Monitoring (Ref. 17.38); and
  - b. DMRB Volume 11, Section 3, Part 11 (Ref. 17.39) and Part 6 Geology and Soils (Ref. 17.40).
- 17.5.12 This methodology was set out on in the Scoping Opinion and since then it has been superseded by new National Highways guidance, see **Table 17.3**. Comments from the Host Authorities during statutory consultation of the PEIR in 2019 indicated it was considered appropriate to continue with this methodology, although it was recommended confirmation be sought from the relevant consultees. This matter was raised during the CLWG meeting on 26 July 2021, and there was no objection raised to use of this guidance from any of the attendees.

- 17.5.13 There is no specific methodology for determining the significance of effects to soils and geology. The assessment method for identifying significant effects from land contamination has been undertaken in line with LCRM (Ref. 17.17). A Conceptual Site Model (CSM) has been produced based on the baseline information to establish the presence of 'contaminant linkages', for a potential risk to be identified, a source of risk, a receptor and a pathway between the two need to be identified. The potential impact of each of the identified potential contaminant linkages have been assessed based on the general EIA assessment methodology as detailed in **Chapter 5** Approach to the Assessment in the ES [TR020001/APP/5.01], the criteria defined below, and professional judgement.
- 17.5.14 Receptors likely to be affected by construction and operation of the Proposed Development have been identified. The values and/or sensitivities of receptors identified have been classified using the criteria defined in **Table 17.8**.

Table 17.8: Value and sensitivity of resources and receptors for soils<sup>4</sup> and geology

Sensitivity/Value	Resources and Receptors
High	Human health: Residential areas, hospitals, schools and playing fields Construction workers: Extensive earthworks and demolition of buildings Geodiversity sites designated at a national level e.g. SSSI within close proximity (less than 250m) Major strategic mineral resource areas Built environment: Buildings, services and essential infrastructure e.g. strategic underground storage space
Medium	Human health: Public and work places such as retail and business parks, allotments and market gardens Construction workers: Limited earthworks Sites designated at a regional level e.g. Local Nature Reserves (LNRs) or Regionally Important Geological Sites (RIGS), within 500m Regionally or locally important mineral resource areas Built environment: Buildings, structures and infrastructure susceptible to potential gas accumulation.
Low	Human health: Adjacent commercial or industrial development Construction workers: minimal disturbance of ground Forestry areas, or ornamental plant nurseries
Very Low	Minimal economic or social uses of land

- 17.5.15 Short to medium term impacts are considered to be those associated with the earthworks and construction elements of the Proposed Development which have the potential to disturb soils and groundwater. The short to medium term

<sup>4</sup> The sensitivity of soils in terms of agricultural land quality is discussed in **Chapter 6** Agricultural land quality and farm holdings of the ES [TR020001/APP/5.01]

impacts could occur during each of the assessment phases (Phases 1 to 2b) when soils are likely to be disturbed and last for a period of between 1 to 5 years.

17.5.16 Long-term impacts relate to those issues that would have a lasting effect on the site and surrounding area once the Proposed Development is complete and would require mitigation/management for the operational lifetime of the Proposed Development.

17.5.17 Temporary effects are considered to be reversible, whereas permanent effects are considered to be irreversible.

17.5.18 **Table 17.9** describes the criteria used to categorise the magnitude of an impact.

Table 17.9: Magnitude of impact for Soils and geology receptors

Magnitude of Impact	Criteria Definition
High (adverse)	<p>Short-term acute damage to human health affecting both Site users and users of sites in the vicinity, arising from contamination on the Proposed Development, or chronic damage to human health affecting users of both the site and other sites in the vicinity arising from contamination on the Proposed Development.</p> <p>Long-term, irreversible detrimental impact on animal or plant populations from contaminated soils.</p> <p>Irreversible detrimental impact on a nationally important geological feature.</p> <p>Irreversible impact to proven economically extractable mineral resource.</p> <p>Severe, irreversible damage to buildings or property on or in the vicinity of the Proposed Development arising from contamination on the Proposed Development.</p>
Medium (adverse)	<p>Chronic damage to human health of users of the Proposed Development.</p> <p>Medium-term, reversible detrimental impact on animal or plant populations from contaminated soils.</p> <p>Medium-term, reversible detrimental impact on a nationally important geological feature.</p> <p>Medium-term, reversible detrimental impact to a proven economically extractable mineral resource.</p> <p>Detrimental impact to building structure requiring remedial engineering works arising from contamination on the Proposed Development.</p>
Low (adverse)	<p>Non-permanent impacts to human health e.g. short-term intermittent nuisance such as odours not hazardous to human health.</p> <p>Short-term, reversible detrimental impact on animal or plant populations from contaminated soils.</p> <p>Short-term, reversible detrimental impact to nationally important geological feature.</p>

Magnitude of Impact	Criteria Definition
	Short-term, reversible detrimental impact to a proven economically extractable mineral resource. Detrimental impact to building structures not requiring remedial engineering works arising from contamination on the Proposed Development.
Very low (adverse and beneficial)	No appreciable impact on human health, animal health, plant health, geological features, mineral resources or building structures.
Low (beneficial)	Minor reduction of risk to human health, animal health and plant health arising from removal of contamination. Short term temporary exposure/enhancement of nationally/locally important feature. Slight gain of mineral resource. Prevention of damage to services not sufficient to impair their function or result in them being unsafe for occupation.
Medium (beneficial)	Moderate reduction of risk to human health, animal health and plant health arising from removal of contamination. Medium-term temporary exposure/enhancement of nationally important feature. Partial creation of new mineral resource. Mitigation of significant damage to a building or structure including the services infrastructure impairing their function.
High (beneficial)	Major reduction of risk to human health, animal health and plant health arising from removal of contamination. Permanent exposure/enhancement of nationally important feature. Gain of a major (by extent, duration or magnitude) mineral resource. Mitigation of complete failure of a building or structure including the services infrastructure.

17.5.19 The significance of the effects is determined based on **Table 17.10** This considers the value/sensitivity of receptor as described in **Table 17.8** and magnitude of the impact in **Table 17.9**.

Table 17.10: Generic effects matrix for Soils and geology

Magnitude	Value and sensitivity of receptor			
	High	Medium	Low	Very Low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Very Low	Minor	Minor	Negligible	Negligible

17.5.20 An effect determined as moderate or greater is typically considered **significant** under the EIA Regulations; however, professional judgment can be applied, e.g. where application of the methodology produces an assessment of effect which, when considering all factors, over or underestimates the issue based on the competent expert’s experience, then the assessment would be adjusted. Minor and negligible effects are considered to be **not significant**. Effects can be either adverse or beneficial.

**Key considerations in assessment**

17.5.21 The nature and extent of earthworks within each of the areas is important in assessing the potential impact to receptors. A description of the Proposed Development and the likely associated earthworks is described below in **Table 17.11** and areas are shown on **Figure 17.1** of this ES [TR020001/APP/5.03].

Table 17.11: Summary of Proposed Development and likely associated earthworks

Development Area	Proposed Development	Likely earthworks work required
<b>Main Application Site</b>		
Existing Airport Land	Improvement of existing terminal area including refurbishment of Terminal 1, departure lounge extension, extension to baggage hall, south pier and canopy and a new apron and stands. A section of the Luton DART extension will also be constructed by cut and cover. Relocation of the fire training ground with its associated facilities to the south of the runway. Relocation of staff car park. New 33kV substation SMR tower	Earthworks include excavation of Made Ground and natural soils for the extension of Luton DART. Construction of decked car park. Foundation works for the new pier and canopy, extensions to the terminal, 33kV substation and SMR tower. Relocation of the fire training ground is likely to require minor earthworks for construction of the closed drainage system.
LLAOL Contractor’s Compound	Apron, piers, stands taxiways, Engine Run Up Bay and attenuation tank.	Earthworks would be required to create an aviation platform to tie-in with the existing airport levels and piling for the new piers for Terminal 2. Soils to be excavated and relocated to southern end of Area A to surcharge the landfill prior to development.



Development Area	Proposed Development	Likely earthworks work required
		<p>Creation of temporary stockpiles of materials suitable for reuse in construction and landscaping.</p> <p>Construction of the airside platform with engineering fill (chalk) excavated from Area B for the platform.</p>
<p>Airport Access Road</p>	<p>Construction of new carriageway / duelling of existing carriageway to create a new link road from Airport Way to Terminal 2 (T2) with connections to a series of new access and on-airport distributor roads for T2 and Green Horizons Park.</p>	<p>Earthworks would be required to create the new link road including excavation to create cuttings and construction of reinforced earth embankment.</p> <p>Excavation of landfill material where road is located in Area A.</p>
<p>A – Wigmore Valley Park (WVP) and Former Landfill</p>	<p><u>North</u> Airport infrastructure, car parking, new road infrastructure including eastern section of Airport Access Road. Energy centre, coach station, drainage including attenuation tank and landscaping.</p>	<p>Excavation of landfill material for provision of the Airport Access Road and minor access roads and to create development platform.</p> <p>Piling through the landfill into underlying chalk for foundations to proposed buildings.</p>
	<p><u>South</u> New terminal building. Piers, apron, stands and taxiways. Extension to the Luton DART to the new terminal and new station. Energy centre, coach station and car parking.</p>	<p>Major earthworks to create a development platform to tie-in with the existing airport levels – excavation, processing and relocation of landfill wastes/Made Ground to extend landside platform east of landfill and for the Luton DART tunnel and station.</p> <p>Import of engineering fill (chalk) from Area B for development platform.</p> <p>Surcharging of landfill with stockpiled soils excavated from LLAOL Contractor’s compound.</p> <p>Piling through the landfill into underlying chalk for foundations.</p>
<p>B – Land West of Winch Hill Lane</p>	<p>Ancillary airport buildings. Aprons and stands.</p>	<p>Major excavation of clay and chalk to provide site-won engineering materials for the airside development platform.</p>



Development Area	Proposed Development	Likely earthworks work required
	Fuel Storage Facility and pipeline. Car parking. Water treatment plant Attenuation tank and infiltration tank for drainage. WVP community centre, allotment gardens and parkland will be retained. Relocated public parkland.	Piling into underlying chalk for foundations. Excavation of natural ground for provision of access road and car parks. Excavation for installation of the pipeline connection to the existing fuel delivery pipeline. Some landscaping works would be required for preparing the land to be suitable for re-provision of public parkland. Creation of temporary stockpiles of materials suitable for reuse in construction and landscaping.
C – Land East of Winch Hill Lane	Creation of infiltration tank (below ground infiltration tank).	Creation of temporary stockpiles of materials suitable for reuse in construction and landscaping. Excavation for infiltration tank. Excavation and connection to existing fuel delivery pipeline.
Off-site areas		
D – Off-site Car Park North	Car park.	Potential for resurfacing, re-levelling.
E – Off-site Car Park South	Car park.	Construction of a multi-storey car park would require earthworks and potentially piled foundations.
Off-site Highway Interventions	Junction improvements.	Low potential for minor level change, widening of carriageway, signalisation at junctions. Further details are provided in the PRA, <b>Appendix 17.1</b> of this ES [TR020001/APP/5.02].

## 17.6 Assumptions and limitations

17.6.1 The assumptions and limitations of the Soils and geology assessment are detailed below:

- a. Information provided by third parties, including publicly available information and databases are correct and complete at the time of publication. These sources have been used to define baseline conditions and to identify contaminants sources, likely pollutant pathways and sensitivity of receptors.
- b. No environmental incidents have occurred since procurement of baseline data/site walkover surveys which could have caused gross contamination of soils.
- c. Baseline conditions have been assumed to be accurate at the time of the GIs and surveys, however owing to the dynamic nature of the environment, conditions may change during the construction and operational phases. This is to be verified by continued monitoring of ground gas, groundwater and leachates.
- d. As part of the site investigation works, site walkover visits were completed between October 2015 and June 2019, to make an assessment of signs of visible contamination. As the site areas are controlled and monitored, the risk to baseline conditions are considered to be low and therefore further site visits are not required at this time. After DCO submission there would be further phases of site investigation and monitoring which would identify any potential pollution issues. Details of the site walk over visits are provided in the PRA, **Appendix 17.1** of the ES [TR020001/APP/5.02].
- e. The investigations have focussed on Area A, the former landfill, because this is a major contamination source and is the location of the main and sensitive features of the Proposed Development. The potential for difficult ground conditions or contamination is lower within other areas of the Proposed Development such as the Off-site Car Parks and Off-site Highway Interventions. The existing fire station training ground would also be subject to investigation in particular with regard to potential for PFAS contamination. These areas can be addressed prior to construction to verify existing mitigation requirements and design measures. The ES is considered to be a robust assessment based on reasonable worst-case assumptions of conditions.
- f. Notwithstanding the efforts made by the professional team by undertaking the assessment and preparing the reports on which this assessment is based, it is possible that other ground contamination or conditions as yet undetected may exist and, consequently, reliance on the reports must be limited accordingly. The data in the reports was used to identify the relevant pollutant linkages the potential effects of which have been assessed in this chapter.

- g. The approach adopted for the assessment of contamination at the site within the reports was based on current guidance at the time of writing noting that CLR 11 was replaced by LCRM in 2020.
- h. The identification of possible future receptors is based on the Proposed Development design and construction information available. Detailed method statements and/or work plans for the construction activities are not available as a lead contractor has not yet been appointed. The proposed demolition and construction activities will follow industry best practice and relevant guidance and comply with current applicable legislation. It is assumed standard construction techniques will be used, unless otherwise specified in the CoCP, **Appendix 4.2** of the ES [TR020001/APP/5.02] or the Construction Method Statement and Programme Report **Appendix 4.1** of the ES [TR020001/APP/5.02].
- i. It is assumed all remediation/mitigation works will be carried out in accordance with industry standards current at the time of the works and all necessary permits will have been obtained prior to commencement of works. This would apply to the effectiveness of mitigation works and therefore the ultimate significance of the effect.
- j. It is assumed that stakeholder engagement would continue throughout the construction and operation phases of the Proposed Development and that updated requirements would be incorporated as appropriate by the responsible party (e.g. Contractors during construction or the airport operator during operation).

### Reasonable worst case

17.6.2 The Soils and geology assessment has incorporated the following considerations which ensure that it represents a reasonable worst-case scenario where appropriate:

- a. The risk assessments on which this impact assessment has been based were completed using conservative assessment criteria and parameters within the modelling works; GQRA and DQRA provided in **Appendices 17.2, 17.3 and 17.4** of this ES [TR020001/APP/5.02];
- b. maximum concentrations of contaminants were used in the assessments;
- c. the most sensitive receptors for human receptors have been identified and used in the assessment process in line with current guidance, and the appropriate assessment criteria applied, see GQRA **Appendix 17.2** of this ES [TR020001/APP/5.02] for further detail; and
- d. there is a potential for undiscovered contamination to be encountered during construction works and approaches to dealing with this have been included in the Outline Remediation Strategy **Appendix 17.5** of this ES [TR020001/APP/5.02].

## 17.7 Baseline conditions

17.7.1 This section provides a description of the existing conditions in the study area as shown in **Figure 17.1** of this ES [TR020001/APP/5.03]. Baseline information is presented in relation to current ground conditions (soil, groundwater, leachate, ground gas and vapours) and assessments have been completed in relation to human health, ground gas and groundwater to identify potential contaminant linkages (PCL) and therefore likely significant effects.

### Existing conditions

17.7.2 Existing conditions within the study area describe the site setting (topography, geology, hydrogeology, hydrology) and identify potential contamination sources based on current and historical land uses from mapped and regulatory information, summarised in **Table 17.12** to **Table 17.16**.

### Current site use

17.7.3 A detailed description of the current land use within the Proposed Development boundary is provided in the PRA provided in **Appendix 17.1** of this ES [TR020001/APP/5.02]. A summary is provided in **Table 17.12**, refer to **Figure 17.1** of this ES [TR020001/APP/5.03] for details of the site areas.

Table 17.12: Current land use

Development Area	Current Land Use
<b>Main Application Site</b>	
Existing Airport Land	The existing airport infrastructure consists of a terminal building, runway with associated taxiways, stands, aprons and hangars, maintenance facilities and airport related offices. A fire station is located in the southwest of the terminal building. The associated business park to the north and west of the main airport area also accommodates a range of businesses including aircraft and airport maintenance, two fuel depots and a number of car parks for short-, mid- and long-term stay.
LLAOL Contractor's Compound	The western area is a compound used by the operator's contractors for storage of various items including construction arisings from Terminal 1 improvements. In the east is the fire training ground. South of this are two existing airport soakaways (known as the central soakaway). The north east balancing pond is on the boundary with Area B (see below). As part of planning permission 17/02219/FUL secured by LLAOL, soils arising from other airport developments have been reused across much of this area, in accordance with DoWCoP and a Materials Management Plan (MMP).
Airport Access Road	Parts of the eastern section is existing carriageways: President's Way and Percival Way, the remainder is on the landfill and is part of WVP, see Area A below. Industrial/commercial land use

Development Area	Current Land Use
<b>Main Application Site</b>	
	are located on the central section of proposed carriageway and undeveloped land along the western section along Dairyborn escarpment.
A – WVP and Former Landfill	This area comprises public open space, known as WVP. Sports pitches are present in the north eastern part of the area. The long-stay car park for the airport is present in the west of the area. In the north west is another car park. The central and southern part of the site are a County Wildlife Site (CWS).
B – Land West of Winch Hill	The northwest part of this area forms part of WVP. Within this area is a community centre, skateboard park, children’s playground and allotment gardens as well as public open space, scrub and woodland areas. The rest of the area comprises agricultural land with a coppice and small woodland in the south, designated as ancient woodland. Winch Hill Farm and New Winch Hill Cottages are located on the eastern boundary on Winch Hill Lane.
C – Land East of Winch Hill	Predominately arable land with some hedgerows/trees. There is a woodland area present which bisects the site. Two agricultural barns are located at the western boundary and a large residential property ‘Winch Hill House’ to the south of these. The existing fuel delivery pipeline passes underground through Area C.
<b>Off-site car parks</b>	
D – Off-site Car Park North	Currently partly occupied by a trailer park for storage of heavy goods vehicle (HGV) trailers on the central and south eastern areas and an area of car parking and vehicle servicing area along the north western area.
E – Off-site Car Park South	The site is currently vacant with no activities taking place on-site. Part of the site is covered with hardstanding and two unidentified structures are also present.
Off-Site Highway Interventions	Asphalt carriage-way and landscaping to road verges, see PRA ( <b>Appendix 17.1</b> of this ES [TR020001/APP/5.02]).

## Site walkover findings

17.7.4 A number of site walkovers and visits were carried out as part of previous work and investigations between 2015 and 2019, in support of the application for development consent. The full details are provided in Appendix D of the PRA, **Appendix 17.1** of this ES [TR020001/APP/5.02]. A summary of the key points relating to areas within the Proposed Development:

- a. Existing airport land and LLAOL Contractor’s Compound – access to all parts of the area which forms the existing airport was not possible, due to

security and health and safety reasons. Observations of note were chemical storage tanks adjacent to the fire station and a large amount of soil stockpiled in a contractor's compound to the south of the long stay car park. A fire training ground was noted to the east of the contractor's compound, which contained an airplane fuselage and tanks.

- b. Area A (WVP and former landfill) – on the north eastern slope, yellowing of the grass was noted, no other signs of vegetation stress or die back was observed. Evidence of capping material was noted in the form of clayey soils at the surface and some fly tipping including tyres, glass bottles, oil drums and car parts. Indications of settlement were noted around manhole covers and refuse bins in the north of approximately 0.5m to 1.0m and undulations in the surface of the car park to the south also indications of settlement.
- c. Area B and Area C were noted to principally be agricultural land. Agricultural sheds were located in Area C with evidence of asbestos containing materials (ACMs).
- d. Area D was noted to comprise a large earthworks platform with earth embankments to southern, western and northern extents which is currently occupied by a trailer park. Fly tipping was observed at the northern boundary to the trailer park.
- e. Area E was noted to comprise an area of car parking and at the time of the site visit was being used as a construction contractor's compound for storage of materials. The site is located across four levels with ground level rising up toward the southeast boundary. The site was being used by adjacent Vauxhall car showroom and a small building was noted to have been a vehicle inspection shed. Fly tipping including car seats, possible paint tins, wooden cable reel, litter, Made Ground/earth was noted to the north eastern boundary.
- f. No observations of visual or olfactory contamination were noted in any of the areas of the Application Site which were accessed for site walkovers.

## Site history

- 17.7.5 A detailed review of the historical ordnance survey (OS) maps and aerial photography of the study area was undertaken as part of the PRA provided as **Appendix 17.1** of this ES [TR020001/APP/5.02]. A summary of this review identifying potentially contaminative activities is provided in **Table 17.13**.

Table 17.13: Summary of historical potentially contaminative activities within the Development Area

Area	Summary
<b>Main Application Site</b>	
Existing Airport Land	<p>Earliest mapping (1880) shows the area to have been agricultural land occupied by Eaton Green Farm within the north western area and Falcon Hall within the central area. There is limited coverage of this area, likely due to the use as an RAF base during the second world war. By the 1960s the western extent of the area was occupied with an expansive engineering works, refuelling facilities and substantial earthworks.</p> <p>Luton Airport is formally shown on 1970s mapping although is indicated to have been present since 1933 and officially opened in 1938, according to several online sources. Small modifications to the airport are shown in 1980s mapping including changes to building footprints into the present day layout.</p> <p><b><u>LLAOL Contractor’s Compound</u></b></p> <p>Earliest mapping (1880s) shows the area as agricultural land until 1960 where it is denoted as airport land. Soakaway ponds were present in the centre of the area in 1971, later labelled as tanks in 1993 mapping. In 1971, a drain is shown on mapping and in 1975 earthworks associated with the runway are shown. By 1972 an area known to be an Engine Run Up Bay is present in the southwest corner of the site. Additionally, by 1972 the fire training ground present on the northern boundary of the site, adjacent to Area A and B in 1990.</p>
The Airport Access Road	<p>A brick and tile works were present within 100m to the north west from 1880 to 1901. By 1922 the south western extent bounds Luton Corporation Sewage Farm. By 1961 Spittlesea Hospital has expanded along the proposed alignment. The sewage works have been redeveloped into settling ponds.</p>



Area	Summary
A – WVP and Former Landfill	The earliest available map (1879) indicates the site was predominately agricultural land. The landfill was present from 1941 in the southwest of the site and expanded by 1960 with several vertical pipe structures in the line of the valley floor, potentially connected to a culvert in the base of the valley by 1969. During and after WWII the landfill appeared to be connected with the former Percival Works (aircraft manufacturing) located offsite to the west. A scrap yard present on the western boundary of the site from approximately 1969-1976 (current location of Tidy Tip (formally called the Eaton Green Civic Amenity Site)). The majority of the site was landfilled by 1975. The site was landscaped between 2000 and 2002 to resemble its current condition.
B – Land West of Winch Hill Lane	Earliest available maps (1879), indicates this area was agricultural land divided into field blocks. Winch Hill Farm and associated buildings, were located in the east either side of Winch Hill Lane. The woodland in the south of the area are the remains of Winch Hill Wood, which was reduced in size following construction of the airport shown on 1975 mapping along with earthworks associated with the runway off-site, to the south. By 2002 the Wigmore Valley Park Community Centre, car park and playground had been developed in the north eastern area alongside the allotment gardens .
C – Land East of Winch Hill Lane	The historical mapping indicates this area has been agricultural land from the earliest maps, with minor changes to field boundaries.
<b>Off-Site Car Parks</b>	
D – Off-site Car Park North	The south of the site was used as a rifle range from 1900 to 1962. The 1924 mapping shows the site as partly used by the Vauxhall Motor Works In 1947 it was shown as used for parking. 1955 mapping shows a significant earthworks platform constructed. This was modified and extended in 1961 and reduced in size and reprofiled in 2002. Buildings are shown in the north of the site on 2010 mapping. Adjacent site uses have included a rail line, roads, sewage farm and depots.
E – Off-site Car Park South	The site was not shown as developed until 1941 when earthwork mounds were recorded on-site, although the purpose of these is unknown. Several structures are present on the 1947 mapping, with the earthwork platforms shown on 1960s mapping. Adjacent site uses have included a rail line, sewage farm, allotments and roads.



Area	Summary
<b>Off-Site Highway Interventions</b>	
Eaton Green Road/ Lalleford Road	Earliest mapping (1880) shows the site to comprise of a road surrounded by agricultural land. The 1960s mapping shows development has occurred within the surrounding area including the presence of Percival Aircraft Works which were located adjacent to the site until 1993.
Eaton Green Road/Wigmore Lane	Earliest mapping (1880) shows the site to comprise a crossroads surrounded by open fields. No substantial development occurs until the 1940s when Eaton Green Landfill is shown to be present off site. The 1970s mapping indicates the landfill has expanded and is adjacent and along the border of the site. By 1980 the mapping shows the Thames water storage pond to the south and residential housing to the west. Light commercial buildings including a petrol station are shown to have been developed adjacent and to the north.
Eaton Green Road Roundabout	Earliest mapping (1880) indicates the site was agricultural land with Eaton Green Road at the south west boundary. The roundabout was constructed by 1985, no other potentially contaminative activities have occurred on site. The motor works and a sewage farm (redeveloped with car parking by 1980s) were located within 250m to the south west and south respectively.
Wigmore Lane/Crawley Green Road	A chalk pit is present on 1901 mapping and by 1960 mapping a small building has been constructed within the area of the former pit. The 1970s editions show a small filter bed to have been constructed adjacent to the north west.
Crawley Green Road/Lalleford Road	No potentially contaminative activities recorded on site or surrounding area.
Windmill Road / Kimpton Road	Earliest mapping (1880) shows the site to comprise of a road and underpass beneath a rail embankment which intersects the site in the east. Off-site land uses include a sewage works 110m to the west and a brass and iron foundry 150m north which expands to the south and adjacent to the site by 1901. Additional land adjacent and east of the site is designated as a sewage farm. A dyeing and bleaching works is present 200m to the north. The 1960 mapping shows the development of Vauxhall Motor Works adjacent to the east. The sewage works are no longer present, and a non-descript depot and an abattoir are present. The dyeing and bleaching works are shown as a depot and laundry building. By 1970 the site has been raised slightly to accommodate a large motor vehicle works to the west, replacing the abattoir and depot. The most southern rail line has been dismantled and converted to a dedicated bus route by 2002.

Area	Summary
Windmill Road / Manor Road / St Mary's Road / Crawley Green Road	<p>Earliest mapping (1880) shows the site to be situated on open fields. A boiler engineering works is present 130m to the north and two rail lines are present trending from a north west to south east direction 95m to the north east. A cemetery is present beyond the rail lines 220m to the east and a brass and iron foundry is present 105m east. A sewage works is present 200m to the south.</p> <p>The site was developed with residential properties by 1901, the south eastern extent of the site is shown to overlap a dyeing and bleaching works. The 1920 mapping shows additional residential properties within the site boundary. An electricity station, a yard and fire station are present 60m to the north west.</p> <p>By the 1960s some of the residential properties have been replaced by car parks. The dyeing and bleaching works are denoted as a depot. The electricity station and boiler engineering works are shown as works. A hat factory is shown adjacent to the south west in the 1970s.</p> <p>By the 1980s the existing roundabout is shown to have been constructed. The electricity generating station and hat factory are no longer present.</p>
A1081/London Road (north)	<p>Earliest mapping (1880) shows the site to consist of open fields with London Road and Kidney Wood forming the north eastern boundary. Limited development is shown to occur until the 1960s when a roundabout has been constructed within the northern extent of the site linking the A1091 and M1 link road through the centre of the site. 2015 aerial imagery shows the roundabout to have been reconfigured into the current road alignment.</p>
A1081/London Road (south)	<p>On earliest mapping (1879), the site is undeveloped agricultural land, London Road, is approximately 100m to the east, Newlands Farm at the south west boundary and a small chalk pit approximately 50m south. By 1960 the A1081 connection from the M1 to London Road was constructed approximately 180m north. Most recent mapping (2020) records the A1081/London Road (south) junction to have been constructed and north junction to link to A1081. The previous alignment of London Road to west is now local access road.</p>
M1 J10	<p>Earliest mapping (1879) shows the site to largely comprise of open fields. A small unnamed road intersects the north western extent of the site. A graveyard is present 150m north of the site at St Andrews church yard. The M1 motorway and link road is shown to have been constructed by the 1960s. The 2015 aerial imagery shows the M1 link road in the east to have been replaced by A1081 Airport Way.</p>

Area	Summary
<b>Hitchin Junctions</b>	
A602 Park Way/A505 Upper Tilehouse Street	Earliest mapping (1880) show the site to consist of a road junction lined with residential and commercial properties. Potentially contaminated land present within 50m to 100m of the site between 1880s and 2013 were an iron foundry, three garages all of which have been redeveloped, only residential developments have been present on-site. The 1990s mapping shows the road has been modified to its current alignment.
A505 Moormead Hill Offley Road/B655 Pirton Road/Upper Tilehouse Street	Earliest mapping (1880) shows the site to consist of Tilehouse Street and two unnamed roads. The site is lined with residential properties along the southern boundary and a timber yard along the northern boundary. The surrounding land use is largely open fields to the north, west and south with residential areas to the east. The 1920s mapping shows the timber yard to have been replaced by allotment gardens, which were later developed with residential properties in the 1960s. A garage was present adjacent the site to the east between 1960 and 2007, it was developed with residential properties in 2015.
B656 Hitchin Hill / A602 Park Way / Gosmore Road Roundabout	<p>Earliest mapping (1879) shows the north eastern extent of the site to comprise of London road and one other unnamed road which is bordered by allotment gardens. The remainder of the site comprises open fields. Clay pits and a Brick Field with kilns are present 130m to the north east. By the 1920s a single building is shown to have been constructed in the centre of the site.</p> <p>The 1960 mapping shows additional residential properties to have been developed throughout the site. London Road and Stevenage Road are shown to have been realigned and widened. The Brick Fields are shown to have been infilled and indicated as recreation ground. The 1990 mapping shows the residential properties to have been demolished and the current roundabout to have been constructed linking London Road, Stevenage Road, Gosmore Road and Park Way.</p>

17.7.6 In summary, the main historical/development activities identified from the historical mapping and aerial photography within the Proposed Development area are:

- a. Former Eaton Green Landfill (Area A – WVP and Landfill, Existing Airport – long stay car park, Airport Access Road);
- b. Percival Works aircraft manufacturing (Existing Airport, Airport Access Road);
- c. airport and associated activities including fuel depots, hangars, fire training ground;
- d. sewage works (Airport Access Road);

- e. car parks/roads (all areas);
- f. service garage (D – Off-site Car Park North);
- g. rifle range (D – Off-site Car Park North); and
- h. earthwork platforms (which could include a significant depth of Made Ground) (Existing Airport, Off-site Car Parks (D, E)).

17.7.7 The potential or identified contaminants of concern based on the current and historical use of the study area and surrounding areas are detailed in **Table 17.14**. Potential sources of contamination are shown on **Figure 17.2** of this ES [TR020001/APP/5.03].

Table 17.14: Potential contaminants within the Order Limits based on historical/current activities.

Source	Areas Affected	Potential Contaminants
Former landfill	A	Landfill gas (mainly methane and carbon dioxide) Volatile organic contaminants (VOCs) Putrescible and biodegradable matter Asbestos Metal, metalloids and their compounds Leachate (metals and inorganic compounds) Chlorinated solvents Hydrocarbons Inorganic compounds Formaldehyde Radionuclides
Car Park – potential spillages	Existing Airport, A, D and E	Fuels (petrol, diesel): naphthalene, tetraethyl lead, methyl tertiary butyl ether (MTBE), tetramethyl lead, Total Petroleum Hydrocarbons (TPH), benzene, Polyaromatic Hydrocarbons (PAHs). Heavy metals, metals and metal compounds. Anti-freeze: ethylene glycol.
General – Made Ground	A, B, Existing Airport, Airport Access Road, Highway Interventions	Petroleum Hydrocarbons (TPH), oils, benzene, PAHs. Heavy metals, metals and metal compounds, Asbestos
Allotments	B	Ash, metals, pesticides/herbicides, PAHs
Agricultural land	B, C	Metal, metalloids and their compounds. Herbicides and Pesticides. Asbestos

Source	Areas Affected	Potential Contaminants
Airport activities - Asphalt and cement works	LLAOL Contractor's Compound	Metals, metalloids, inorganics, asbestos, solvents, PAHs, phenols, PCBs, hydrocarbons
Airport activities - Fire training ground		<p>Firefighting agents: allophanates, carbamates, hydrolysed proteins, glycols, ether alcohols.</p> <p>Perfluorinated compounds (PFAS) -perfluorooctanic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)</p> <p>Fuel storage:</p> <p>Hydrocarbons including fuels and oils, TPH, PAHs, benzene, toluene, ethylbenzene and xylenes (BTEX) and metals.</p>
Airport activities – Engine Run Up Bay		Hydrocarbons, metals, phenols
Electrical substations		Hydrocarbons, metals, Polychlorinated Biphenyls (PCBs)
Airport activities (including tanks)	Existing Airport	<p>Anti-freeze and de-icing agents:</p> <p>Monoethylene glycols, diethylene glycols, propylene glycols, urea, calcium acetates, magnesium acetates.</p> <p>Organic solvents: ketones, methanol, aliphatic and aromatic hydrocarbons, esters, chlorinated compounds.</p> <p>Paints and associated solvents and thinners: polyurethanes, xylene, toluene, methyl ethyl ketone, methyl isobutyl ketone.</p> <p>Hydrocarbons i.e. Jet fuel, diesel (operating plant)</p> <p>Acids/bases, PAHs, PCBs and inorganic compounds</p>
Scrap yard		<p>Fuels (petrol, diesel): naphthalene, tetraethyl lead, methyl tertiary butyl ether (MTBE), tetramethyl lead, TPHs, benzene, PAHs.</p> <p>Heavy metals, metals and metal compounds.</p> <p>Anti-freeze: ethylene glycol.</p> <p>Asbestos</p>
Aircraft manufacturing (Percival works)	Existing Airport and Airport Access Road	Organic solvents chlorinated (i.e. trichloroethene) and non-chlorinated (i.e. alcohols, benzene, ketones, toluene), metals and metal compounds, fuels and other oils (i.e. aviation fuels, fuel oil, hydraulic fluids, lubricating oil), PCBs, cyanides, acids, asbestos, radionuclides (tritium and radium) which may have been used in the dials

Source	Areas Affected	Potential Contaminants
Depot		Dependent on use and type of depot, may include fuel and other oils
Sewage farm	Airport Access Road	Metals, metalloids, inorganic compounds, acids/alkalis, organic compounds, PCBs, micro-organisms (pathogens), methane, carbon dioxide, hydrogen sulphide, asbestos
Motor Works	D – Off-site Car Park North	Metals, metalloids, acids/alkalis, PAHs, fuels and oils, solvents, chlorinated solvents, asbestos, hydrocarbon, PCBs, organics, chlorinate and non-chlorinated solvents
Rifle Range		Metals, in particular lead
Imported earthwork fill	D – Off-site Car Park North E – Off-site Car Park South	Dependent on material source – potential contaminants could include asbestos, metals, organic compounds, PAHs and hydrocarbons.

Table 17.15: Potential contaminants off-site based on historical/current activities within 250m of the Order Limits.

Source	Potential Contaminants
Motor Works	Metals, metalloids, acids/alkalis, PAHs, fuels and oils, solvents, chlorinated solvents, asbestos, hydrocarbon, PCBs, organics, chlorinate and non-chlorinated solvents.
Railway	Ash ballast, fuel oils/lubricating, antifreeze liquids (ethylene glycol), metals, PCBs, greases, organic solvents, asbestos, creosote, inorganic compounds.
Sewage farm	Metals, metalloids, inorganic compounds, acids/alkalis, organic compounds, PCBs, micro-organisms (pathogens), methane, carbon dioxide, hydrogen sulphide, asbestos.
Service Garage / Fuelling Station	Hydrocarbons including fuels and oils (TPH, PAHs and BTEX compounds).
Engineering Works (various non-descript,)	Metals, metalloids, inorganic compounds, acids/alkalis, fuels and oils, solvents, chlorinated solvents, asbestos.
Foundry (metal works)	Metals, metalloids, acids/alkalis, fuels and oil (TPH and BTEX), PAHs, solvents and chlorinated solvents,
Dyeing and Bleaching Works	Metals, metalloids, acids/alkalis, fuels and oil (TPH and BTEX), solvents and dioxin.
Cemetery / Burial Grounds / Abattoir	Micro-organisms, Pathogens.



Source	Potential Contaminants
Allotments	Ash, metals, pesticides/herbicides, PAHs.
Electrical substations / Electricity Generation Station	Hydrocarbons, metals, Polychlorinated Biphenyls (PCBs).

### Environmental setting

17.7.8 The environmental setting is important to understand as it determines the sensitivity of the site to potential sources of contamination and potential for contaminant linkages to be present. A summary of the environmental setting of the study area is compiled below in **Table 17.16** based on information contained within Groundsure reports (included in Appendix B of the PRA, **Appendix 17.1** of this ES [TR020001/APP/5.02]) and publicly available registers (see **Section 17.5**).

Table 17.16: Summary of environmental setting of the study area

Environmental data set	Environmental feature	Details
Mining and natural Cavities	Mining	Not in an area affected by coal mining or shallow mining hazards. Non-coal mining areas are identified across the site for extraction of chalk. Area A – one unspecified workings which relates to the former landfill area
	Ground workings	Area A – the whole of Area A is identified as the location of a refuse heap. Area B – A small unspecified quarry is recorded in the centre of this area. The Airport Access Road – former landfill (Area A) located within the eastern extent. Eaton Green Road/Wigmore Lane – Former landfill is present adjacent to the south east. Made Ground (undivided) noted across the area. Windmill Road – Made Ground (undivided) recorded within the eastern area. A602 Park Way – Infilled ground noted 60m northeast coinciding with Fynesford Court Landfill.
	Natural Cavities	15 solution pipes are located 100 m north of Area A. 3 solution pipes noted in the north eastern part of Area D.
Radon	-	The site is not within a radon affected area (less than 1% above action level), and therefore radon protection measures are not required.



Environmental data set	Environmental feature	Details
Hydrogeology	Aquifer designation <sup>1</sup>	<p>Clay with Flints – not designated as an aquifer.                      Head Deposits and Till – secondary undifferentiated                      Gault Formation – not classified as an aquifer                      Glaciofluvial Deposits – Secondary A                      Lambeth Group – Secondary A aquifer.                      Chalk groups (Lewes Nodular, Seaford, Holywell Nodular and New Pit Chalk formations) – Principal Aquifers</p> <p>The airport lies within the Lea groundwater catchment (as defined by the Environment Agency). The south east area of the airport, Areas A, B, C and Off-site Planting areas, east of the groundwater divide, are within the Mimram groundwater catchment.</p>
	Source Protection Zones (SPZ)	<p>SPZ are shown on <b>Figure 20.2</b> of this ES <b>[TR02001/APP1/5.03]</b>. The Main Application Site is within an SPZ3 (Total catchment) (apart from a small area in the south west).</p> <p>Areas D and E and the Gipsy Lane/Airport Way Off-site Highway Intervention are not located within an SPZ.</p> <p>The Off-site Highways Interventions are all in SPZ3 apart from; Windmill Road/Crawley Green Road – SPZ1 (Inner zone) and Windmill Road/Kimpton Road - SPZ 2 (Outer zone).</p>
	Groundwater	<p>The regional groundwater flow direction is anticipated to be south easterly, however, the nearest potable water supply at Kings Walden (approximately 3km north east of the landfill) and a second potable water supply (Nine Wells) at Whitwell, (approximately 5.3km east of the former landfill) appear to be influencing a more easterly flow direction (east north east). A flow divide is located to the south and west of the landfill site (area A) beyond which groundwater flows in a south westerly direction beneath the airport toward the River Lea. The maximum groundwater levels are estimated to range from 134m AOD in the centre of the divide to 112m AOD in the dry valleys to the east. Further information on hydrogeological conditions is provided in <b>Appendix 20.3</b> Hydrogeological Characterisation Report of this ES <b>[APP020001/APP/5.02]</b>.</p>
Hydrology	Watercourses	<p>There are no watercourses within Main Application Site. In the wider Proposed Development the River Lea flows in culvert beneath a Highway Intervention</p>

Environmental data set	Environmental feature	Details
		<p>area; (Windmill Road) in a southerly direction, it is also within 80m of Windmill Rd/Kimpton Road in culvert and approximately 200m south west of Area E.</p> <p>Other surface water features on-site include:</p> <p>Area A – North soakaway (Thames Water asset) and Thames Valley Drain (TVD) (also referred to as the Thames Water overflow pipe) which takes overflow from the north soakaway. The discharge point is unknown.</p> <p>Area B – Eastern Soakaway, Existing Airport Land (LLAOL contractor’s compound) – central soakaway (comprising 2 ponds), north east storage pond, fire training ground storage pond, Existing Airport Land – north east balancing pond (at Eaton Green Road boundary) and south east soakaway (south of runway)</p> <p>Surface water features off-site:</p> <p>A small filter bed adjacent to the north west boundary of Wigmore Lane/Crawley Road and an unnamed drain 50m north of A1081 (north), along London Road. Further detail on surface water features, drainage and existing soakaway features is provided in <b>Appendix 20.1 Flood Risk Assessment (FRA) [TR020001/APP/5.07]</b> and <b>Appendix 20.4 Drainage Design Strategy of this ES [TR020001/APP/5.02]</b>.</p>
Abstraction	Groundwater	<p>Two active abstraction licences within 2km of the Main Application Site are recorded; 1.5km west for general use relating to secondary category (medium loss) operated by IBC Limited, and 1.5km north east, a potable water supply operated by Affinity Water Limited.</p> <p>A search of private water supplies was also completed which identified further groundwater abstractions within the search area, this is covered by <b>Chapter 20 Water Resources and Flood Risk of this ES [TR020001/APP/5.01]</b>.</p>
	Surface water	<p>No water abstractions within 2km of the Main Application Site.</p>
Environmental Permits	Licensed Industrial Activities	<p>Three environmental permits are recorded to the Main Application Site: Part A(1), London Luton Airport medium combustion plant , Part A(2)/B; GKN Aerospace: Coating Process (Part B) and Airline Services: Dry Cleaning (Part B).</p>

Environmental data set	Environmental feature	Details
		<p>Three environmental permits are recorded off-site from the Main Application Site; 91m west Kez’s Dry Cleaners (Part B), 132m north west Shell Luton Airport: Unloading of petrol into storage at service stations and 140m north at Asda: Unloading of petrol into storage at service stations.</p>
	<p>Dangerous or Hazardous Sites</p>	<p>None within Areas A to E, Off-site Highway Interventions or Off-site Planting. Two are recorded to the Existing Airport Land; a Control of Major Accident Hazards (COMAH) lower tier site licenced to Shell UK Oil Products Ltd for storage of Jet A-1 fuel within 4 storage tanks and a Regulated Explosive Site, GKN Aerospace Transparency Systems (King’s Norton) – licensed under Manufacture and Storage of Explosives Regulations 2005 (MSER).</p>
	<p>Discharge consents</p>	<p>Twelve discharge consents to groundwater have been identified within the study area, for a variety of purposes including domestic properties, the existing airport (soakaways) and commercial activities. Further detail is provided in <b>Chapter 20</b> Water Resources and Flood Risk of this ES [TR020001/APP/5.01].</p>
<p>Waste Disposal</p>	<p>Historical</p>	<p>Landfills on-site:                      Eaton Green landfill (Area A) operated by Luton County Borough Council<sup>2</sup> 1937- 1978. The landfill is no longer under a permit. Aerial photography and historical mapping suggest it was in use until early 1990s. Waste types: inert, industrial, commercial, household and liquid sludge. A detailed review of the records pertaining to the landfill was undertaken previously for the proposed Century Park development in 2017 (Ref. 17.41). This indicated the landfill does not appear to be as extensive as the recorded Environment Agency boundary. The extent of the former landfill is shown on <b>Figure 17.2</b> of this ES [TR020001/APP/5.03].</p> <p>Landfills off-site include:                      Wandon End Farm (400m north of Area A), operational between 5 August 1991 and 31 January 1993, accepting inert waste. Fynesford Court (near to Hitchin junctions, closest is A602/Stevenage Road 130m southeast), brick and clay pit, redeveloped as recreation ground in 1960s and part of the area developed as a community care centre by the 1990s.</p>

Environmental data set	Environmental feature	Details
	Current	<p>On-site: Existing Airport Land – ‘Eaton green road tip’ (Tidy Tip) and recycling centre a local authority refuse and recycling facility, permitted under Environmental Permitting Regulations (England and Wales) Regulations 2016.</p> <p>Off-site: A landfill is recorded 31m west of the Main Application Site, Vauxhall Airport Way (Kimpton Lane).</p>
Pollution Incidents	-	None recorded within the Main Application Site which caused an <i>impact</i> , and no significant incidents recorded in the study area within the last 5 years to land or water.
Ecology/ Environment	Nitrate vulnerable zones (NVZ)	The site is within a NVZ as designated by DEFRA.
	Designations	<p>On-site: Area A – County Wildlife Site (CWS) is located within south east area of WVP. Area B – an ancient and semi-natural woodland designation in the south east.</p> <p>Within 2 km of the site: Off-site Planting – ancient replanted woodland – 500m east.</p> <p>No further ecological or geological designations have been identified.</p>
Unexploded Ordnance (UXO)	-	<p>Various UXO reports have been obtained, the findings are described in the PRA (<b>Appendix 17.1</b> of this ES <b>[TR020001/APP/5.02]</b>) the overall risk is summarised below:</p> <p>Existing Airport, LLAOL Contractor’s Compound and Area A - Very High. However, it should be noted that where works are to be undertaken within post war fill material/Made Ground this is considered Low Risk.</p> <p>The Airport Access Road – Low to Medium risk Area B – Low Risk Area C – not covered, by existing reports but likely to be Low Risk Areas D and E – Low to Moderate risk Off-site Planting – Low risk Off-Site Highways Interventions – all Low to Moderate or Moderate Risk except for Hitchin junctions which are all Low Risk.</p>

Environmental data set	Environmental feature	Details
<p>Notes:</p> <p><sup>1</sup> Definition of aquifer designations:</p> <p>Principal aquifers – these are the most important aquifers. They are layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.</p> <p>Secondary A – permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.</p> <p>Secondary B – predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.</p> <p>Secondary Undifferentiated – where it has not been possible to attribute either category A or B to a rock type.</p> <p><sup>2</sup>Luton County Borough Council was abolished in 1974 and succeeded by LBC and CBC who are unitary authorities</p>		

### Ground conditions

- 17.7.9 The study area topography is characterised by a series of dry valleys formed during the last glaciation period. There are two dry valleys that cross the study area. The area between the valleys is relatively flat, this is the ‘plateau’ between the valleys. The airport is located on the plateau area.
- 17.7.10 The geology underlying the study area has been reviewed using publicly available information, the findings are summarised in **Table 17.17**.

Table 17.17: Published Geology beneath the study area

Strata Type	Details
Made Ground	Made Ground is known to be present or anticipated in all areas of the site apart from Off-site Planting and agricultural land in Areas B and C
Superficial	Head Deposits – Existing Airport (LLAOL Contractor’s Compound), Airport Access Road, Areas B, C and Off-site Planting. Clay with Flints – Existing Airport, Airport Access Road, Areas B and C. Lowestoft Formation (Till) – Area B Glaciofluvial deposits – Off-site Highway Interventions – Hitchin Junctions Note: superficial deposits are absent in Areas D and E – Off-site Car Parks.
Bedrock	The Proposed Development is underlain by: Lewes Nodular and Seaford Chalk Formation. There are isolated bands of the Holywell Nodular and New Pit Chalk Formation underlying the Lewes Nodular and Seaford Chalk Formation.

Strata Type	Details
	<p>In addition, the following bedrock strata are also present at these locations:</p> <p>Gault Formation – mudstone underlies A602 Park Way junction.</p> <p>Lambeth Group (sand silt and clay) overlying Chalk Group – southwestern area of M1 Jcn10.</p>

- 17.7.11 The study area is predominately underlain by the Upper Chalk Group, typically the Seaford Chalk Formation and the Lewes Nodular Chalk Formation. The Chalk comprises predominantly soft white to off-white very fine-grained limestone with harder clasts of flint and occasionally softer fragments of low density chalk. The formation is reasonably thick, typically 60 to 70 m.
- 17.7.12 Clay with Flints overlies the chalk group. It is a residual soil formed by the solution weathering of the chalk. The Clay with Flints varies in thickness across the study area. It is mainly present on the plateau and valley sides and absent from the base of the valley.
- 17.7.13 The GI work undertaken to date, including the most recent GI, broadly confirm the published geology but also provide further detail regarding the landfill waste material. A summary of the generalised stratigraphic sequence is presented in **Table 17.18**.

Table 17.18: Summary of ground conditions encountered beneath the Main Application Site

Material Name	Description	Typical Thickness (m)
Topsoil	Generally stiff gravelly sandy clay. The gravel comprises flint, chalk, brick, concrete and clinker.	Average of 0.3m in 'undeveloped' areas (B and C)
Made Ground (General)	Typically, arisings from past airport projects, but also includes the construction of car parks, aprons, taxiways, yard areas.	<p>Generally, &lt;1.0m but locally thicker:</p> <p>Up to 6 m to the immediate south of the landfill.</p> <p>20m at western end of Airport Access Road on the top of the slope to the Dairyborn escarpment.</p> <p>Other localised areas up to 15m thick.</p>
Made Ground (Landfill)	Approximately 4.5 million m <sup>3</sup> mixed domestic, commercial and construction/demolition waste deposited between the 1930s and 1980s, directly on underlying chalk.	Between 4m at the edges and 20m at the centre.



Material Name	Description	Typical Thickness (m)
	Surface soils on the landfill were noted to be slightly clayey in places, which may represent capping material placed on the landfill but it does not appear to be an engineered cap consistent with current standards.	
Dry valley deposits	Clay associated with the weathering of material in the valley sides and floor.	2m within the valley bottom.
Head deposits	Clay associated with the weathering of material in the valley sides and floor.	2 m (up to 5 m in places) in the valleys.
Clay with flints	Highly plastic clay containing flint gravel	3m on the valley sides and crest (up to 16.5m in places). Absent in the valley areas.
Chalk	Chalk – weathered near the surface.	Full thickness not proven.

17.7.14 Each strata beneath the Main Application Site is described in further detail in the GQRA report provided in **Appendix 17.2** of this ES [TR020001/APP/5.02].

### Solution features

17.7.15 Solution features are formed by the dissolution of the Chalk as a result of chemical weathering, during the Quaternary period (2.5 million years ago to present). These features are present at the interface between the Clay with Flints formation and the Chalk, predominately to the plateau and valley side. Solution features are present at the interface between the Clay with Flints formation and the Chalk but less frequent in the base of the valley.

17.7.16 There are fifteen recorded solution pipes recorded in the Groundsure report located 100m north of Area A and three recorded solution pipes located in the north eastern part of Area D.

17.7.17 It is difficult to detect solution features via GI, as they are discrete features. GI and observations from local construction projects suggest that fretting (a shallow dissolution feature at the top of the chalk) and solution pipes are a common feature of the top of the chalk.

17.7.18 It is also likely that sinkholes are present in the area. The recent GI undertaken did not find any evidence of sinkholes but solution pipes and infilled fissures were found to be present beneath Area A (former landfill) and Area B. These features are important when considering potential pathways for contaminants to the groundwater, however, they are difficult to detect through GI and predict in terms of both location and frequency.

### Mineral extraction

17.7.19 The study area comes within three Mineral Local Plan areas: the majority of the site is covered by NHDC, LBC and CBC Local Plan (Ref. 17.11) and Bedfordshire Council and Luton Minerals and Waste Local Plan (Ref. 17.12),



the eastern area falls within Hertfordshire County Council Local Plan (Ref. 17.13) and Proposed Submission (17.15). The plans set out future mineral extraction activities in their areas. The Hitchin Highway Intervention areas fall within a sand and gravel MSA noted in Hertfordshire Council’s plan. The proposed works however are minor and are likely to fall within the excluded development list which includes application on land already built upon<sup>5</sup>, whereby consultation is not required. No other parts of the Proposed Development fall within a MSA. Therefore, future mineral extraction is not considered further in this ES in terms of MSA.

### Site investigation and risk assessment reports

17.7.20 Many site investigation and assessment reports have been undertaken within the study area between 2003 and 2020. The findings of the site investigations have been discussed in detail in the PRA, GQRA and DQRA provided in **Appendices 17.1 to 17.4** of this ES [TR020001/APP/5.02].

17.7.21 A summary of the GI data available and the findings of the risk assessment reports are presented in **Table 17.19**.

Table 17.19: GI data and summary of risk assessments for each of the Proposed Development areas

Area	GI data and summary of assessments
A – WVP and Former Landfill	<p>The PRA (<b>Appendix 17.1</b> of this ES [TR020001/APP/5.02]) identified the former landfill as the principal contamination source in the study area. Multiple GIs have been undertaken within this area, with the most recent investigation completed in 2019.</p> <p>A GQRA and subsequent DQRA for human health and controlled waters was completed based on recent site investigation data. The assessments indicated the following:</p> <ol style="list-style-type: none"> <li>a. Human health was assessed for both acute (short term – during construction) and chronic (long term – after completion) risks. The risks from radionuclides, asbestos and groundwater vapours were all considered. The assessments indicated the chemistry of the landfill presents a low risk to future site users, assuming hardstanding which cover much of the development, however measures would be required in landscaping areas to prevent direct contact.</li> <li>b. Soil vapours were not detected at levels which would present a risk to human health, although further monitoring was recommended prior to and during construction works.</li> <li>c. No asbestos caches were identified, although ACMs and asbestos fibres were present throughout the landfill and in the area of the former scrapyard (Tidy Tip). The greatest potential risk was identified to be to construction workers, it was recommended that a strategy be developed for managing ACMs</li> </ol>

<sup>5</sup> Hertfordshire County Council. Supplementary Planning Document: mineral consultation areas in Hertfordshire. Section 3 Excluded development.

Area	GI data and summary of assessments
	<p>during the works, to ensure all necessary control measures are in place. Risk to future users was concluded to be low due to presence of hardstanding across much of the development. Measures would be required in areas of landscaping to prevent exposure to landfill materials.</p> <ul style="list-style-type: none"> <li>d. Detailed assessment of gas monitoring data and GasSim<sup>6</sup> modelling identified that gas is still being produced by the landfill but it is past the stage of peak gas generation. Gas protection measures were identified as being required to protect the future development.</li> <li>e. In its current state there is no evidence of significant landfill gas migration beyond the landfill which could be considered to pose a risk to other receptors. However, it was noted that the earthworks and changes to the landfill and surface have the potential to alter the gas regime. Therefore, in order to mitigate any potential risks to off-site properties, mitigation measures along the boundaries of the landfill would need to be incorporated into the Proposed Development.</li> <li>f. Limited evidence was noted that the landfill is currently causing contamination to the underlying groundwater. A ‘hotspot’ location of free product was noted, and it was recommended to be removed for protection of controlled water purposes. The risks to controlled water are discussed in <b>Chapter 20</b> Water Resources and Flood Risk to the ES [TR020001/APP/5.01].</li> <li>g. DQRA recommended a Remediation Strategy be prepared, an Outline Remediation Strategy is provided as <b>Appendix 17.5</b> of this ES [TR020001/APP/5.02].</li> </ul>
B – Land West of Winch Hill Lane	<p>This area has no history of contaminative use based on the available information assessed for the PRA <b>Appendix 17.1</b> of this ES [TR020001/APP/5.02].</p> <ul style="list-style-type: none"> <li>a. Two GIs have been undertaken within this area, the results suggested low levels of contaminants in the Made Ground across Area B (Ref. 17.41) which present low risk to future site users/buried structures and utilities.</li> <li>b. The PRA presented the gas risk assessment results of an earlier report, which indicated no elevated ground gases were recorded in this area, suggesting the migration of gases from the former landfill to this area is not occurring and there are no sources of ground gas in Area B.</li> <li>c. Area B is a key area for site won materials for the Proposed Development. The sampling undertaken to date, as reviewed in the PRA is considered sufficient to broadly characterise the soil</li> </ul>

<sup>6</sup> GasSim 2.5 Model developed by Golder Associates on behalf of the Environment Agency to model landfill gas generation.

Area	GI data and summary of assessments
	<p>and groundwater conditions to inform the excavation and reuse of the material.</p> <p>Based on the above, the PRA concluded no further GI or assessment is required for Area B.</p>
<p>C- Land East of Winch Hill Lane</p>	<p>This area has no history of contaminative use based on the available information assessed for the PRA (<b>Appendix 17.1</b> of this ES <b>[TR020001/APP/5.02]</b>).</p> <p>The PRA concluded the site is considered greenfield and has only ever been agricultural land. On this basis it was unlikely there would be any sources of contamination and therefore, no GI for geoenvironmental purposes or further risk assessment is considered necessary.</p>
<p>LLAOL Contractor's Compound</p>	<p>Two GIs have been undertaken within this area. The PRA reviewed these reports and the subsequent risk assessment report based on the GI findings, see <b>Appendix 17.1</b> of this ES <b>[TR020001/APP/5.02]</b>.</p> <p>The assessment indicates the following:</p> <ol style="list-style-type: none"> <li>a. Low levels of contaminants are present in the soils which are assessed as low risk to future site users.</li> <li>b. Some ACMs within stockpiled materials which will require management during earthworks and included in the asbestos strategy prepared by the contractor.</li> <li>c. Slightly elevated concentrations of ground gases were noted within this area, where a substantial thickness of Made Ground was present. These concentrations were not considered to present a risk to future development. This material is to be excavated for reuse and unsuitable materials i.e. wood would be removed from the stockpiles during excavation works.</li> </ol> <p>The PRA concluded no further GI for geoenvironmental purposes is considered required in this area, however, further testing of the Made Ground and natural soils (clays with flint) excavated for the aviation platform would be required, for verification purposes, see Outline Remediation Strategy <b>Appendix 17.5</b> of this ES <b>[TR020001/APP/5.02]</b>.</p>
<p>Existing Airport Land</p>	<p>Several GIs at the existing airport have been designed to address previous developments. There has not been complete coverage of the airport. These were reviewed for the PRA (<b>Appendix 17.1</b> of this ES <b>[TR020001/APP/5.02]</b>) from which the following summary is taken:</p> <ol style="list-style-type: none"> <li>a. Site investigations have not identified accumulations of contamination that might act as sources for a contaminant linkage and no remediation works have been undertaken.</li> <li>b. Overall the GI results show low levels of contaminants in the Made Ground soils which present low risk to future site users.</li> <li>c. GI data does not indicate any elevated ground gases within this area suggesting that migration of gases from the former landfill to this area is not occurring.</li> <li>d. Elevated concentrations of hydrocarbons, metals and pesticides above groundwater standards were noted beneath the airport.</li> </ol>

Area	GI data and summary of assessments
	<p>The Proposed Development includes relocation of the existing fire training ground, to a new location south of the airport runway and taxiways. No previous GIs have been undertaken in the area of the proposed new fire training ground. However, the PRA (<b>Appendix 17.1</b> of this ES [TR020001/APP/5.02]) identified the overall risk of contamination in the area to be low, and therefore detailed assessment of contamination risks is not required for early design and assessment. GI would be required to obtain geotechnical information for the Proposed Development in these areas, this would be coupled with a geoenvironmental investigation to verify proposed mitigation requirements and design measures prior to construction.</p>
<p>Airport Access Road</p>	<p>The sections of the Airport Access Road in Areas A and B have been covered by the assessments for these areas.</p> <p>The PRA (<b>Appendix 17.1</b> of this ES [TR020001/APP/5.02]) notes that the areas of the new road off the landfill, see <b>Figure 17.1</b>, has been subject to GI but no formal assessment of the data had been undertaken, this was therefore completed in the GQR ( <b>Appendix 17.2</b> of this ES [TR020001/APP/5.02]).</p> <p>The assessment did not record any risk to human health or controlled waters; however, the following omissions were noted in the data:</p> <ol style="list-style-type: none"> <li>a. Although a former sewage farm was recorded at the western end of the proposed road alignment as a potential contamination source, analysis of bacteriological pathogens was not included in the previous GI.</li> <li>b. A tank area was also proposed for investigation; however, the scheduled exploratory holes were not completed.</li> <li>c. A gap in GI data was also noted toward the centre of the proposed route.</li> <li>d. Soil leachate testing was not undertaken.</li> </ol> <p>It was therefore recommended in the GQR that some additional GI and assessment of results be undertaken to address these issues prior to construction.</p>
<p>D – Off-site car Park North</p>	<p>There is no GI data available for this area, see <b>Figure 17.1</b>, but the PRA (<b>Appendix 17.1</b> of the ES [TR020001/APP/5.02]) concluded the following based on other information sources consulted:</p> <ol style="list-style-type: none"> <li>a. Ground conditions are likely to be similar to those encountered in nearby Napier Park and Stirling Place developments, which were part of the former Vauxhall Motor Works.</li> <li>b. Area D did not form a main part of the Vauxhall Motor Works manufacturing area and no tanks are shown on the historical maps.</li> <li>c. Occasional areas of localised contamination from the historical uses of the site and its current use as a trailer park, car parking and garage are anticipated.</li> </ol>

Area	GI data and summary of assessments
	<ul style="list-style-type: none"> <li>d. The overall risk of contamination is considered low, and therefore detailed assessment of contamination risks is not required to inform early design or this robust assessment.</li> <li>e. GI will be required to obtain geotechnical information for the Proposed Development in these areas, this would be coupled with a geoenvironmental investigation to confirm assumed land quality. Further GI will be undertaken prior to construction to verify existing mitigation requirements and design measures.</li> </ul>
E – Off-site Car Park South	<p>Although GI has not been undertaken within this area to date, see <b>Figure 17.1</b>, a review of the desk study information in the PRA (<b>Appendix 17.1</b> of this ES [TR020001/APP/5.02]) suggests that ground conditions may be similar to those in the surrounding area as follows:</p> <ul style="list-style-type: none"> <li>a. No major contamination sources are likely to be present within these areas, however an earthworks platform was constructed during the 1940s from material of unknown origin or quality. There is, therefore, the potential for this material to be a source of contamination.</li> <li>b. The overall risk of contamination is considered to be low. Detailed assessment of contamination risks is not required to further inform early design or robust assessment. GI will be required to obtain geotechnical information for the Proposed Development in these areas, prior to construction. This would be coupled with a geoenvironmental investigation to verify existing mitigation requirements and design measures.</li> </ul>
Off-site Highway Interventions	<p>Although no GI has been completed within the areas of proposed Highway Interventions, the overall risk has been determined by the PRA as very low to low to future site users/infrastructure as the majority of the sites have shown limited potential for historical contaminative uses.</p> <p>Any risks associated with contamination can be mitigated during construction by use of site management procedures and personal protective equipment (PPE).</p>

### Conceptual site model (CSM)

- 17.7.22 A CSM identifying PCLs from the baseline information is provided in **Table 17.20**. PCLs relating to controlled waters receptors are discussed in **Chapter 20** Water Resources and Flood Risk of this ES [TR020001/APP/5.01].
- 17.7.23 The assessments described in **Table 17.19** above indicated that only Area A has PCLs present which require remedial action. An Outline Remediation Strategy including a remediation options appraisal has been developed to address these PCLs, this would be secured through Requirement of the DCO, and is provided as **Appendix 17.5** of this ES [TR020001/APP/5.02].
- 17.7.24 No potential contaminative sources were identified in Areas B and C, as such no PCLs are present. Therefore, no likely significant effects are associated with

these areas and they have been scoped out from further assessment within this ES Chapter.

17.7.25 The remaining areas of the Proposed Development do not require specific remedial measures to address PCLs based on the assessments undertaken. However, mitigation measures are required to ensure the PCLs are appropriately managed during construction. These measures are discussed in **Section 17.8.**

Table 17.20: Conceptual Site Model for Proposed Development

Source	Potential (including detected) contaminants	Credible pathway(s)	Receptors	Areas of Proposed Development where PCLs are present
Contaminated landfill waste and leachate from landfill waste	Heavy metals Asbestos Microorganisms Various organic contaminants including PAHs, PCBs and TPHs Radionuclides such as radium, Carbon-14 or Caesium 13	<ul style="list-style-type: none"> <li>a. Direct contact/accidental ingestion of contamination within landfill material/leachate.</li> <li>b. Direct or indirect contact with radionuclides in landfill material.</li> <li>c. Dermal contact with exposed landfill materials/leachate.</li> <li>d. Inhalation of dusts derived from exposed landfill materials.</li> <li>e. Aggressive ground conditions in direct contact with built structures.</li> </ul>	<p>Construction : Human Health-construction workers and adjacent site users (e.g. residential housing and other buildings on Airport).</p> <p>Operation: Human Health-Users of Proposed Development and future maintenance workers.</p>	Area A
Gases and vapours from landfill waste	Methane, carbon dioxide and various volatile organic compounds	<ul style="list-style-type: none"> <li>a. Migration into future buildings and build-up of gases.</li> <li>b. Migration of gases off-site to adjacent properties via migration through</li> </ul>	Built environment -building, structures and services.	



Source	Potential (including detected) contaminants	Credible pathway(s)	Receptors	Areas of Proposed Development where PCLs are present
		permeable strata and conduits.		
Contaminated soils (Made Ground) from historical activities	Heavy metals Asbestos Various organic contaminants including PAHs, PCBs, PFAS and TPHs	<ul style="list-style-type: none"> <li>a. Direct contact/ accidental ingestion of contamination within soils.</li> <li>b. Dermal contact with contamination in exposed soils.</li> <li>c. Inhalation of dusts derived from exposed soils.</li> <li>d. Aggressive ground conditions in direct contact with built structures.</li> </ul>	<p>Construction : Human Health-construction workers and adjacent site users.</p> <p>Operation: Human Health-Users of Proposed development and future maintenance workers.</p>	Existing Airport Land, LLAOL Contractors' Compound, The Airport Access Road, Area D Area E Off-site Highway Interventions.
Ground gases within the Made Ground	Methane and carbon dioxide	<ul style="list-style-type: none"> <li>a. Migration into future buildings and build-up of gases.</li> <li>b. Migration of gases off-site to adjacent properties via migration through permeable strata and conduits.</li> </ul>	Built environment -building, structures and services.	

### Future baseline

17.7.26 In the absence of the Proposed Development, there is likely to be a change to the future baseline conditions as a result of other factors and developments in proximity to and at the airport. These are the conditions that would prevail 'Without Development' in place. The 'Without Development' scenario is used, where appropriate, as a comparator for the assessed case, to show the effect of the Proposed Development against an appropriate reference point. The approach to defining future baseline and the developments identified for consideration are described in **Section 5.4 of Chapter 5** Approach to the Assessment of the ES [TR020001/APP/5.01]. Other developments planned during delivery of the Proposed Development are considered in **Chapter 21** In-



combination and Cumulative Effects Assessment of the ES  
**[TR020001/APP/5.01]**.

- 17.7.27 The Airport spoil planning application (17/02219/FUL) was consented in March 2018 and covered the movement and reuse of up to 331,400 cubic metres (m<sup>3</sup>) of spoil material from Luton DART extension and Project Curium (as described in **Chapter 2** of this ES **[TR020001/APP/5.01]**). The works included permanent placement of the spoil material on six sites within the airport and diversion of the airside perimeter road, including within the LLAOL Contractor's Compound. The material placement was subject to a Materials Management Plan (MMP) in accordance with CL:AIRE Definition of Waste Code of Practice (DoW CoP). The material has been reused to reprofile the slopes surrounding the runway to improve maintenance operations. The requirements of DoW CoP mean that any material reused has to be risk assessed as not causing potential contamination risk to the environment or human health. Therefore, any contaminative material encountered would be removed or treated, prior to reuse.
- 17.7.28 One of the areas where the airport spoil material will be reused is within the footprint of the aviation platform for the Proposed Development. The implementation of the above application and anticipated discharge of the associated planning conditions would ensure that potential contaminative sources associated with the material have been removed. Therefore the quality of the material reused would be confirmed as suitable for use and these areas of fill are not considered to be potential sources of contamination. The material was placed in accordance with DoWCoP and is therefore a "non-waste" for purposes of future re-use.

## 17.8 Embedded and good practice mitigation measures

- 17.8.1 This section describes the embedded and good practice mitigation for soils and geology that have been incorporated into the Proposed Development design or assumed to be in place before undertaking the assessment. A definition of these classifications of mitigation and how they are considered in the EIA is provided in **Chapter 5 Approach to the Assessment of the ES [TR020001/APP/5.01]**.
- 17.8.2 The LCRM guidance (Ref. 17.17) requires that where potential contaminant linkages are identified associated with unacceptable risk that remedial options are explored to manage the risk and a Remediation Strategy prepared detailing the plans to carry out and verify the proposed remediation works. Most of these measures (embedded and good practice) relate to the redevelopment of the former landfill area, as this is the most notable source of contamination within the Proposed Development.
- 17.8.3 The Remediation Strategy is a key document to secure different types of mitigation measures and the Outline Remediation Strategy prepared to support this application is provided as **Appendix 17.5** of this ES **[TR020001/APP/5.02]** details the following:
- a. the remedial actions that would be undertaken;
  - b. details of how the remediation would be implemented;
  - c. details of how the remediation would be verified that it is successful;
  - d. details of monitoring and maintenance pre-construction, during and post construction;
  - e. monitoring objectives and criteria; and
  - f. details of any regulatory controls that need to be in place, such as environmental permits.
- 17.8.4 A requirement for the lead contractor to develop a Remediation Strategy, in accordance with the Outline Remediation Strategy provided as **Appendix 17.5** of this ES **[TR020001/APP/5.02]**, and comply with it, is secured as part of the DCO.

### Embedded

- 17.8.5 The embedded mitigation works included in the Outline Remediation Strategy in **Appendix 17.5** of this ES **[TR020001/APP/5.02]** have been designed to enable the safe delivery of the Proposed Development on a former landfill site. They are summarised as:
- a. Creation of an engineered cover system which includes protection of drainage and other services.
  - b. Built in gas protection measures in all buildings over the former landfill. The level of gas protection would be derived based on CIRIA C552 (Ref. 17.20) and the detailed design would be in accordance with BS8485 (Ref. 17.42). The Approach would be a multi-element protection to

prevent landfill gases from entering buildings and to provide a “pressure relief pathway” for gases to discharge safely beyond the edges of the building. Illustrative details are provided in the Outline Remediation Strategy.

- c. Gas and leachate control systems for external areas including the new stands and apron constructed on the landfill.
- d. Gas management for the Luton DART tunnel through appropriate structural design, external gas membrane and high level of internal ventilation.
- e. Landfill boundary gas protection measures would be incorporated into the Proposed Development to mitigate against any potential risks from lateral migration. The options currently identified include installation of a virtual gas barrier and or low permeability gas barrier. However, the feasibility and efficacy of the options would be considered during the detailed design stage. Additional gas monitoring results would be available to inform the design and identify the best option, which achieves the objectives for gas control, this would be confirmed by the lead contractor.
- f. Gas monitoring would be continued post-construction to monitor the efficacy of the control measures and confirm no risk to off-site receptors.
- g. The service corridors would be lined with concrete and a gas membrane and backfilled with clean fill to prevent landfill gas ingress and potential for migration off-site.
- h. Existing services including the TVD overflow sewer (also referred to as Thames Water overflow pipe elsewhere), which runs along the base of the landfill, would be diverted and old structures grouted to prevent potential pathways for landfill gas to migrate off-site.
- i. Gas protection measures would be adopted in hard paved or landscaped areas proposed within areas located over the former landfill.
- j. Leachate sumps would be installed to reduce the risk of leachate breakout and potential impact to groundwaters.

17.8.6 The gas management measures would be integrated with the geotechnical and structural design of the buildings and pavements. These would be designed with the requirement to minimise surface water infiltration into the underlying waste, to prevent generation of future landfill leachate.

17.8.7 Throughout the design, implementation and verification stages an operating and maintenance manual would be collated for the site. To include regular inspection and maintenance of the gas and leachate management system and the groundwater monitoring wells.

17.8.8 Further descriptions of gas protection for buildings and illustrative details are provided in the Outline Remediation Strategy (**Appendix 17.5** of this ES [TR020001/APP/5.02]), the gas protection measures installed would be independently verified.

17.8.9 In addition to the landfill, other areas of the Proposed Development (Areas D and E, the Airport Access Road (AAR) and the current fire training ground) have been identified as requiring additional GI and this would form part of the embedded mitigation for these areas. The information obtained from the GIs would be used to verify mitigation requirements and design measures.

### ***Design***

17.8.10 The design of the landform has been through several iterations, and a primary aim has been to minimise disturbance to the former landfill thereby reducing risks associated with excavation and reuse of waste. The cut and fill balance for the Proposed Development has been optimised to minimise the amount of landfill material that would require excavation, including building the apron on the landfill, and thereby reducing potential exposure of construction workers and adjacent site users to contaminants within the waste during construction. Information on the generation and management of waste during construction is found in **Chapter 19** Waste and Resources of the ES [TR020001/APP/5.01].

17.8.11 The geotechnical design takes into account issues which may affect the stability, settlement and integrity of the platform to ensure they do not impact the Proposed Development, mitigation for these issues include:

- a. Ground improvement works may be required during construction to prevent settlement and ensure structural stability which could occur due to the presence of solution features<sup>7</sup> beneath the Proposed Development.
- b. Appropriate concrete class for foundations based on site conditions to allow for any aggressive ground conditions within the landfill.
- c. Settlement and slope stability analysis and design on airside earthworks platform. Permanent slopes would be designed to Eurocode 7 (Ref. 17.43).
- d. Surcharging by placement of excavated materials on the southern end of the landfill to accelerate settlement processes and reduce the magnitude of settlement during the operational period.
- e. Dynamic compaction would also be used across the former landfill area to induce the same effect prior to construction of infrastructure and buildings.
- f. Service connections would be modified to accommodate the likelihood of future settlement of the landfill and reduce the risk of damage to services.
- g. Use of flexible asphalt with placement of a granular layer reinforced with geogrid in pavement construction to control acute local settlement for the apron (where constructed over the landfill).

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<sup>7</sup> Solution features are formed by the dissolution of the Chalk as a result of chemical weathering.

- h. Continuous monitoring of the performance of the landfill with regard to settlement would be undertaken to inform design of mitigation measures Proposed Development constructed over the landfill.
- i. Use of either rotary bored or CFA piling in accordance with the findings of a piling risk assessment (see **Appendix 17.6** of this ES **[TR020001/APP/5.02]** and detailed hydrogeological risk assessment which considers the conditions in the landfill, appropriate design and adoption of mitigations during the piling works, as required. Pilot trials would also be undertaken to assess the pile performance and monitor concrete bleed. On-going monitoring of groundwater and ground gas would confirm any short term fluctuations or impacts on the baseline regime.

### **Good practice**

- 17.8.12 Good practice measures required during the remediation works are also described in the Outline Remediation Strategy (**Appendix 17.5** of this ES **[TR020001/APP/5.02]**), the main elements relating to environmental management are noted below.

### ***Environmental management***

- 17.8.13 The Outline Remediation Strategy addresses the design requirement for the landfill waste to be reused to construct an earthworks platform. Landfill materials would be processed to remove hazardous components, then undergo primary treatment (i.e. screening, crushing), secondary treatment, verification testing and selective blending. This would ensure it meets both chemical quality and the required geotechnical specification.
- 17.8.14 The processed materials would be treated and placed in such a way that they do not pose a risk from gas or leachate generation to protect site users and groundwater.
- 17.8.15 It is assumed approximately 10% of unprocessed materials would be unsuitable for reuse due to presence of contaminants which exceed the remedial criteria and therefore would be disposed off-site or it may be suitable for recycling.
- 17.8.16 The Environment Agency has advised that an Environmental Permit will be required for the reuse of landfill materials within the Proposed Development and other materials classed as waste in accordance with waste legislation. An agreement in principle for the operation to be undertaken under a deposit for recovery Environmental Permit would be sought from the Environment Agency. The Environmental Permit will be obtained by the lead contractor after development consent has been granted and prior to earthworks commencing. The lead contractor would therefore be required to comply with all conditions of the permit including environmental monitoring and reporting.
- 17.8.17 Following remediation works Verification Reports would be produced and submitted to the relevant planning authority for approval, in accordance with best practice guidance (Ref. 17.17). The reports would provide a complete record of all remediation activities on site, verification and monitoring works and demonstrates compliance with the agreed remediation objectives and criteria.

The Verification Report is established as a requirement in both the Outline Remediation Strategy and will be a requirement of the Environmental Permit. It would also identify the long-term monitoring and maintenance requirements, for example there may be a requirement for ongoing maintenance and upkeep of the gas management measures.

- 17.8.18 An Outline Site Waste Management Plan (SWMP) has been prepared which identifies the specific quantities and types of waste estimated to arise during the construction operations. This OSWMP is provided as **Appendix 19.1** of this ES [TR020001/APP/5.02]. The identified waste would be classified in accordance with the statutory controls governing the management of inert, non-hazardous and hazardous wastes.
- 17.8.19 The new water treatment plant and fuel storage facility in Area B would be installed and operated in accordance with appropriate regulations and environmental permits to prevent pollution of soils.
- 17.8.20 Measures to protect controlled waters are detailed in **Chapter 20** of this ES [TR020001/APP/5.01].

#### ***Protective measures during construction***

- 17.8.21 The CoCP provided as **Appendix 4.2** of this ES [TR020001/APP/5.02] describes the key principles that would be followed to avoid, reduce or manage the construction effects. The CoCP takes the key elements of the control and mitigation measures identified within the Outline Remediation Strategy which are required to reduce potential impacts in the environment and human health from proposed remedial works. The implementation of the CoCP, and the requirements within it, is a Requirement of the DCO, including the development of further detailed plans to be prepared by the appointed contractor and approved by the planning authority. An outline of key measures includes:
- a. Good construction site practices, method statements and safe systems of working, including high standards of hygiene and use of appropriate Personal Protective Equipment (PPE).
  - b. Monitoring of confined spaces for possible ground gas accumulations, restricting access to confined spaces i.e. to suitably trained personnel only, and use of specialist PPE, where necessary.
  - c. The lead contractor would prepare method statements and ensure compliance to address health, safety site security and environmental issues.
  - d. Best practice guidance will be followed on UXOs (Ref. 17.44), this would include: detailed UXO risk assessment, site induction and toolbox talks, and a watching brief in areas identified as having the potential for UXO identified from surveys undertaken to date. The lead contractor would also prepare and implement an emergency response procedure in the event that UXO is discovered.
  - e. An environmental monitoring and audit system with lines of formal communication will be established to report to the Applicant and communicate actions/impacts/monitoring results, to be recorded weekly

and provided in a monthly summary report. The report would be provided to the relevant local authority and the Applicant.

- f. A watching brief may be required in Area B to identify geological features of interest exposed by excavation of the chalk with an action plan to produce a record should such features be identified.
- g. Procedures for identifying and dealing with any unexpected contamination encountered during construction to ensure that contamination is appropriately managed and associated risks are dealt with.
- h. A Dust Management Plan would be prepared by the lead contractor which would include limits and controls on dust, air pollution, odour and exhaust emissions.

17.8.22 An Outline Soils Management Plan (SMP) has been prepared and is provided as **Appendix 6.6** of this ES [TR020001/APP/5.02]. That document describes measures to manage and reduce impacts to topsoil and subsoils to be excavated and reused within the Proposed Development from agricultural land owned by the Applicant.



## 17.9 Assessment

17.9.1 This section presents the results of the Soils and geology assessment of likely significant effects with the embedded and good practice mitigation measures, described in the previous section, in place.

17.9.2 A summary of the assessment of effects is provided in **Table 17.24**. The assessment relates to all areas of the Proposed Development with the exception of Areas B and C which were scoped out of further assessment earlier in this assessment. Refer to **Section 17.7** for further detail.

### Assessment Phase 1

#### *Construction effects*

17.9.3 Assessment Phase 1 is primarily centred around the expansion of the existing Terminal 1 to increase passenger capacity. However, there would be some activities which could lead to exposure of human health receptors to Made Ground/landfill material and gases during this period including:

- a. a small quantity of landfill material (approximately 30,000m<sup>3</sup>) in Area A would be excavated during this period for remodelling and creation of car parking, construction of an attenuation tank, and a new stand and apron on the landfill;
- b. construction of a platform to allow an extension of the airport apron using Made Ground/ material excavated from the LLAOL Contractor's Compound (approximately 64,000m<sup>3</sup>);
- c. surcharging of a portion of the landfill using material stockpiled for use in assessment Phase 2a;
- d. surcharging of a portion of the landfill using material stockpiled for use in assessment Phase 2a;
- e. excavation of soil for foundations within the Existing Airport Land for expansion of Terminal 1;
- f. placement of approximately 20,000m<sup>3</sup> of landscaping materials to form a landscape bund to the north east of the landfill in Wigmore Valley Park; and
- g. Installation of perimeter gas protection measures.

17.9.4 These activities could expose construction workers (medium sensitivity), adjacent residential areas to the north and users of the airport (high sensitivity) to contaminants in dust, vapours and gases through a number of potential routes of exposure, as summarised in **Table 17.20**. Implementation of design and environmental management mitigation measures set out in the Outline Remediation Strategy and CoCP would reduce the potential magnitude of impact for these receptors to very low. These measures would include: careful phasing to minimise landfill material exposed, appropriate PPE, dampening down of dusts and monitoring against control and action levels. Therefore, this is expected to result in an overall short-term, temporary, reversible, **minor adverse** effect on human health receptors, which is **not significant**.

- 17.9.5 Potential for presence of aggressive ground conditions, in particularly in development on the former landfill (Area A) could impact buried infrastructure (low sensitivity) within the car park areas and airport stand developed on the landfill during this stage. This would produce a potential impact of very low (adverse) on this low sensitivity receptor and therefore, expected to result in a long-term permanent, **negligible** adverse effect, which is **not significant**.

### ***Operational effects***

- 17.9.6 The former landfill does not currently have an engineered capping layer and has the potential to expose future maintenance workers (medium sensitivity) and users of the airport (high sensitivity) to contaminants in the landfill material/Made Ground/landfill leachate through a number of potential routes of exposure, as summarised in **Table 17.20**. The Proposed Development would largely comprise hardstanding which would prevent contact with these materials however additional measures are required. Mitigation is proposed in the form of an engineered cover system, and placement of services/drains/ducts in the cover system with active gas protection measures. This would be installed beneath the airport apron constructed over the landfill in assessment Phase 1. Extension to the areas of car parking would introduce additional hardstanding over the landfill. This would reduce the potential magnitude of impact to these receptors to very low (adverse) through the reduction of risk to human health by reducing potential for exposure to contaminants in the landfill. This is therefore, expected to result in an overall medium term, **minor** adverse effect on human health receptors, which is **not significant**.
- 17.9.7 The disturbance to the landfill in Area A and surcharging during construction works, creates the potential for migration of landfill gases off-site which has been identified as having the potential to expose adjacent residential areas and users of the airport (high sensitivity) to landfill gas/ground gases. Perimeter gas protection measures are proposed to be installed prior to commencement of construction works to prevent migration of landfill gases outside of the landfill. The form of the gas protection measures is to be determined at detailed design stage. The identification and treatment of possible preferential pathways such as the TVD would also be undertaken to prevent off-site gas migration. This would provide a beneficial impact as an improvement on the current situation as landfill gas is uncontrolled. These mitigation measures would produce a potential magnitude of impact for these receptors of very low (beneficial). Therefore, based on the assessment methodology this would have resulted in a permanent, long-term minor beneficial effect on human health receptors. However, as these receptors are offsite this is assessed to be a **negligible** beneficial effect which is **not significant**.

## **Assessment Phase 2a**

### ***Construction effects***

- 17.9.8 A substantial volume of excavation work occurs during assessment Phase 2a, the majority of the landfill excavation occurs during this assessment phase. The activities include:

- a. Creation of the earthworks platform for expansion of the apron and aircraft stands. This platform would be created using approximately 240,000m<sup>3</sup> of Chalk, 110,000m<sup>3</sup> of clay excavated from Area B and Area C (from creation of the infiltration tank and platforms for car parks and the water treatment plant) and 600,000m<sup>3</sup> of Made Ground.
- b. Excavation of landfill material (approximately 340,000m<sup>3</sup>) in Area A to achieve formation levels and allow for construction of a capping layer and construction of apron on the landfill.
- c. Piling works through the landfill in Area A to create foundations for new structures including: Terminal 2 building, west pier and energy centre.
- d. Excavation of Made Ground and landfill material to create the Luton DART extension.
- e. Excavation of Made Ground associated with the construction of the Airport Access Road on Existing Airport Land, Off-site Highway Interventions and Off-site Car Parks (Areas D and E).

- 17.9.9 These activities could expose construction workers (medium sensitivity) and adjacent residential areas to the north and users of the airport (high sensitivity) to contaminants in dust, vapours and gases through a number of potential routes of exposure, as summarised in **Table 17.20**. Implementation of design measures as outlined in **Section 17.8**, including; method statements, safe systems of working, PPE, monitoring, dust and odour suppression, would reduce the impact to very low and is expected to result in a short-term, temporary **minor adverse** effect which is **not significant**.
- 17.9.10 The extensive construction works during this assessment phase has the greatest potential to encounter and disturb Unexploded Ordnance (UXO) through construction of foundations i.e. piling (Areas A, E, LLAOL Contractor's Compound). The risk from UXO is present to construction workers (high sensitivity) adjacent residential areas and users of the airport (high sensitivity). These risks can be mitigated by following good practice measures as set out in the CoCP and recommendations in UXO assessments. Application of these mitigation measures would ensure **no impact** on high sensitivity receptors.
- 17.9.11 Potential for presence of aggressive ground conditions, in particularly in development on the former landfill (Area A) could impact buried infrastructure (low sensitivity) within the car park areas and airport stand developed on the landfill during this stage. However, appropriate design including use of resistant materials, e.g. use of appropriate concrete class, secured at detailed design. This would produce a potential impact of very low (adverse) on this low sensitivity receptor and therefore, expected to result in a long-term permanent, **negligible** adverse effect, which is **not significant**.
- 17.9.12 The risks to groundwater arising from the potential for creation of pathways into the underlying chalk during piling are assessed in **Chapter 20** of this ES [TR020001/APP/5.01].
- 17.9.13 The approach to the management of waste from construction of the Proposed Development is described in **Chapter 19** of this ES [TR020001/APP/5.01].

### ***Operational effects***

- 17.9.14 Migration of landfill gases into future buildings (i.e. Terminal 2) and build-up of gas is identified to pose a potential risk to future users of the Proposed Development (high sensitivity). The loading of the landfill due to the construction of the apron would also stimulate migration of landfill gases into buildings and along preferential pathways. Implementation of the gas management measures detailed in **Section 17.8** would prevent gas migration into the buildings on site and the ducts on the airfield, producing a potential magnitude of impact for these receptors of very low (adverse). This is expected to result in a permanent, **minor** adverse effect on human health receptors, which is **not significant**.
- 17.9.15 As discussed previously under construction of assessment Phase 1, the perimeter gas control measures would continue to protect offsite receptors during the operational phase and assuming on-going monitoring and maintenance of perimeter gas mitigation, as described in **Section 17.8**, the effect is assessed as permanent, long-term **negligible** beneficial to these receptors and **not significant**.
- 17.9.16 The former landfill does not have an engineered capping layer and has the potential to expose future maintenance workers (medium sensitivity) and users of the airport (high sensitivity) to contaminants in the landfill material/Made Ground/landfill leachate through a number of potential routes of exposure, as summarised in **Table 17.20**. The Proposed Development would largely comprise hardstanding which would prevent contact with these materials however measures are required particularly in landscape areas. Mitigation is proposed in the form of an engineered cover system, and placement of services in the cover system as described in the Outline Remediation Strategy **Appendix 17.5** of this ES [TR020001/APP/5.02], which would be further developed during detailed design. This would reduce the potential magnitude of impact to these receptors to very low (adverse). Therefore, this is expected to result in an overall long-term **minor** adverse effect on human health receptors, which is **not significant**.

## **Assessment Phase 2b**

### ***Construction effects***

- 17.9.17 Assessment Phase 2b is the final assessment stage and involves the following activities which could lead to exposure of human health receptors to Made Ground/landfill material and gases during this period including:
- a. piling works through the landfill in Area A to create foundations for the extension to Terminal 2 building and multi-storey car parks;
  - b. expansion of the airfield platform for new apron/stands/east pier using approximately 910,000m<sup>3</sup> of Chalk and 310,000m<sup>3</sup> of Clay excavated from Areas B and C;
  - c. excavation of landfill materials in Area A (approximately 20,000m<sup>3</sup>) to create foundations for ancillary airport buildings (e.g. catering/cargo warehouses);

- d. excavation of approximately 170,000m<sup>3</sup> of Made Ground and 110,000m<sup>3</sup> of suitable materials stockpiled at assessment Phase 2a;
- e. placement of 275,000m<sup>3</sup> of suitable materials in the landscape cap as landscaping; and
- f. completion of the Airport Access Road, relocation of fire training ground and development of new hangars on existing airport land would involve excavation of some Made Ground.

- 17.9.18 Expansion of the new terminal and associated works in Area A could expose construction workers (medium sensitivity) and adjacent residential areas to the north and users of the airport (high sensitivity) to contaminants in dust, vapours and gases through a number of potential routes of exposure, as summarised in **Table 17.20**. The excavation of landfill materials would be in smaller quantities as the bulk of excavations have occurred in assessment Phase 2a, the risk would therefore be reduced. However, implementation of design measures as noted for assessment Phase 2a i.e. including; method statements, safe systems of working, PPE, monitoring, dust and odour suppression as detailed in the CoCP, would be required to reduce any potential impact to very low on these medium to high sensitivity receptors. Therefore, likely to result in a temporary, short-term **minor adverse** effect, which is **not significant**.
- 17.9.19 Construction works are comparable to those in assessment Phase 2a with extension to the Terminal 2 and construction of the multi-storey car park and hangars. The potential risks from UXO to human health receptors to be addressed as described for assessment Phase 2a. Application of these mitigation measures would ensure **no impact** on high sensitivity receptors.
- 17.9.20 Potential for presence of aggressive ground conditions in all areas could impact foundations and buried infrastructure, however appropriate design including use of resistant materials e.g. use of appropriate concrete class, secured through the Outline Remediation Strategy and specified during detailed design. This would produce a potential impact of very low (adverse) magnitude on this low sensitivity receptor; therefore, result in a long-term, permanent, **negligible** adverse effect, which is **not significant**.
- 17.9.21 The risks to groundwater arising from the potential for creation of pathways into the underlying chalk during piling are assessed in **Chapter 20** of this ES [TR020001/APP/5.01].
- 17.9.22 The approach to the management of waste materials arising from the construction of the Proposed Development is described in **Chapter 19** of this ES [TR020001/APP/5.01].

### ***Operational effects***

- 17.9.23 Migration of landfill gases into future buildings (i.e. Terminal 2 extension, ancillary airport buildings) and build-up of gas is identified to present a risk to future users of the Proposed Development (high sensitivity). Implementation and maintenance of the gas management measures detailed in **Section 17.8** would prevent gas migration into the buildings on site producing a potential magnitude of impact for these receptors to very low (adverse), this would result



in a long-term, permanent, **minor** adverse effect on human health receptors, which is **not significant**.

- 17.9.24 As discussed previously under construction for assessment Phase 1, the perimeter gas control measures would continue to protect offsite receptors during the operational phase and assuming on-going monitoring and maintenance of perimeter gas mitigation, as described in **Section 17.8**, the effect is assessed as permanent, long-term **negligible** beneficial to these receptors, which is **not significant**.
- 17.9.25 The engineered capping layer would be extended to cover the final areas of the development, to remove contaminant pathways as described for the previous assessment phases. This would produce a potential magnitude of impact of very low (adverse) on these medium to high sensitivity receptors (future maintenance workers and users of the airport). Therefore, providing the capping is maintained overall this is expected to result in a long-term, permanent, **minor** adverse effect, which is **not significant**.

### Sensitivity analysis

- 17.9.26 There are certain known scenarios or risks that may occur that could influence the conclusions of the Core Planning Case assessment. These scenarios and the general approach to considering them in this assessment are described in **Section 5.4 of Chapter 5** Approach to the Assessment of this ES [TR020001/APP/5.01].
- 17.9.27 **Table 17.21** provides a qualitative assessment of any likely changes to the conclusions of the assessment reported in this chapter, in the event that that scenario or risk is realised.

Table 17.21: Qualitative Sensitivity Analysis

scenario	Title	Potential impact and change	Likely effect
1	19 mppa Application	Not likely to change the assessment as no change to potential impacts on resources and receptors for soils and geology.	No changes to effects or significance
2	Faster growth	Not likely to change the assessment as no change to potential impacts on resources and receptors for soils and geology	No changes to effects or significance
3	Slower growth	Not likely to change the assessment as no change to potential impacts on resources and receptors for soils and geology	No changes to effects or significance
4	Next generation aircraft	Not likely to change the assessment as no change to potential impacts on resources and receptors for soils and geology	No changes to effects or significance

scenario	Title	Potential impact and change	Likely effect
5	J10 without National Highways Smart Motorway upgrade (hard shoulder running scheme)	Not likely to change the assessment as no change to potential impacts on resources and receptors for soils and geology	No changes to effects or significance
6	Changes to airspace	Not likely to change the assessment as no change to potential impacts on resources and receptors for soils and geology	No changes to effects or significance



## **17.10 Additional mitigation**

- 17.10.1 No significant effects have been identified during construction and operation and therefore no additional mitigation measures have been identified as required during construction and operation.

## 17.11 Residual effects

- 17.11.1 Based on the provision of the embedded and good practice mitigation measures as described in **Section 17.8**, the residual effects remain as those assessed and reported in **Section 17.9**.
- 17.11.2 **Table 17.24** provides a summary of the identified impacts, mitigation and likely significant effects of the Proposed Development on soils and geology. It has been assessed that no additional mitigation is required.
- 17.11.3 It is assessed that the Proposed Development would provide an overall minor beneficial effect in terms of land contamination, by removing, processing and treating contaminated soils, installing gas control measures along the landfill perimeter and to the buildings, and placement of an engineered cover system reducing risks to human health, and the environment.

## 17.12 In-combination climate change effects

- 17.12.1 This section provides an assessment of potential changes to the findings of the Soil and geology assessment, taking into account the predicted future conditions as a result of climate change, known as In-combination Climate Change Impacts (ICCI).
- 17.12.2 This assessment has been undertaken using the methodology and climate change predictions described in **Chapter 9** Climate Change Resilience of this ES [TR020001/APP/5.01]. The results are described in **Table 17.22**.

Table 17.22: Soil and geology in-combination climate change impacts

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
Decreased summer precipitation; increased summer temperatures	Frequent	Dry exposed Made Ground and landfill waste could lead to increase production of dusts and airborne contaminated soils.	The consequence of this ICCI is minimised as far as reasonably practicable using good construction practice measures set out in the CoCP for example, dampening down of dusts particularly where material is stockpiled.	Remote	Low	Minor, not significant
	Frequent	Differential settlement of ground caused by decreases in moisture content can be sufficient to damage property, roads, and infrastructure.	The design of the Proposed Development takes into account ground conditions, and how this may be affected by future climate change. Mitigation such as surcharging/ground improvement techniques, flexible pavements and modified service connections will be used.	Remote	Low	Minor, not significant

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
	Very Likely	Creation of gas pathways due to drying/cracking of soils and capping layer caused by decreases in moisture content	Gas management measures detailed in <b>Section 17.8</b> would prevent gas migration into the buildings on site. The perimeter gas protection measures would prevent gas migration off-site.	Possible	Very Low	Negligible, not significant
Increase in maximum/mean summer air temperature	Very Likely	Increase in soil temperature due to hotter conditions. Increased soil temperatures may increase rate emission of volatile contaminants and gases in soils.	Gas management measures detailed in <b>Section 17.8</b> would prevent gas/vapour migration into the buildings on site. The perimeter gas protection measures would prevent gas / vapour migration off-site.	Possible	Very Low	Negligible, not significant
	Very Likely	Decrease in heavy metal mobility due to hotter conditions. Heavy metals are less likely to be	Hardstanding/engineered landscaping and the proposed capping means there is unlikely to be any	Possible	Very Low	Negligible, not significant

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
		leached in drier conditions, leading to increased persistence in soils.	direct contact with underlying soils.			
Increase in winter precipitation rate	Very Likely	Changing precipitation patterns, increased flood risk could lead to increased soil erosion.	Mitigation measures used during construction to prevent erosion such as compaction of soils, phased excavation, use of temporary capping and geotextile layers, design of slopes to comply with stability risk assessments. During operation the design includes hardstanding and an engineered cover system for hardstanding and soft landscapes which makes soil erosion unlikely.	Possible	Very Low	Negligible, not significant

## 17.13 Monitoring

17.13.1 Monitoring and measurement of groundwater, ground gas and air quality is required to ensure that remediation, earthworks and subsequent construction on site would not create new contamination pathways or cause migration of current contamination. It is also required to demonstrate the success of the remediation undertaken at site and for compliance with the DfR permit.

### Pre-construction – baseline

- 17.13.2 Substantial baseline monitoring of: groundwater, vapour, leachate and ground gas has been completed over 12 months of monitoring. An Outline Monitoring Strategy Report for Groundwater, Ground Gas and Leachate Monitoring has been prepared by the Applicant to obtain data whilst the application for development consent is being progressed, which is provided as **Appendix 17.7** of this ES [TR020001/APP/5.02]. This monitoring strategy has been discussed and agreed with the regulators (Environment Agency and LBC EHO). The appointed lead contractor would develop their own groundwater/leachate/ground gas monitoring plan, which is likely to be a continuation of pre-construction monitoring, as required by the Outline Remediation Strategy (**Appendix 17.5** of this ES [TR020001/APP/5.02]) and CoCP (**Appendix 4.2** this ES [TR020001/APP/5.02]).
- 17.13.3 The proposed frequency of monitoring for groundwater and leachate is based on the recommendation for an ‘initial characterisation’ period as identified in guidance (Ref. 17.45). This is usually done prior to development of a landfill but is considered relevant in this instance. The scope of the testing requirements has been developed based on the monitoring and analysis results from the previous GIs and at least 12 months of monitoring. The testing includes the priority contaminants as specified in LFGTN02 (Ref. 17.45) and contaminants of concern identified Controlled Waters DQRA provided as **Appendix 17.4** of this ES [TR020001/APP/5.02]. A summary is provided in **Table 17.23**, the rationale and further detail is provided in the Outline Strategy Report for Groundwater, Ground Gas and Leachate Monitoring, in **Appendix 17.7** of this ES [TR020001/APP/5.02].



Table 17.23: Proposed Monitoring Programme

Media	Monitoring Programme over 6 month period		
	Levels	In-situ Testing	Sampling
Groundwater	Quarterly water level	Low flow parameters	Quarterly 27No. wells
Ground Gas	Quarterly groundwater level in 45 wells	Quarterly spot monitoring in 45 wells for Gas Suite.	Quarterly vapour and bulk gas sampling from 11 wells (no spot monitoring from these wells)
		Continuous monitoring in 3No. wells	
Leachate	6-monthly - 9No. wells	-	6-monthly 9No. wells

17.13.4 The baseline monitoring would be used to establish ‘Investigation’ and ‘Action’ Levels for the site during construction and remediation. These levels if exceeded, would be used to inform the appropriate measures to be taken during the remediation.

### Construction monitoring

17.13.5 The data obtained during the pre-construction period would assist the lead contractor in obtaining necessary environmental permits for the earthworks establish the rationale for environmental controls and identify impacts against the pre-established baseline. It is a requirement in the Outline Remediation Strategy (**Appendix 17.5** of this ES [TR020001/APP/5.02]) and CoCP (**Appendix 4.2** this ES [TR020001/APP/5.02]) for the lead contractor to prepare individual monitoring plans which would likely be a continuation of that outlined above in **Table 17.23**. The Environment Agency has indicated that the frequency of monitoring would need to be increased during construction and this would be secured through the Remediation Strategy, as a Requirement of the DCO, and environmental permit. Plans would include monitoring locations and contaminants to be monitored, but would include groundwater, ground gas/vapour, leachate and air. The monitoring plan is to be agreed with the relevant regulators (Environment Agency and LBC EHO) and would cover baseline, during remediation/materials management, post works and long-term (operational).

- 17.13.6 Monitoring would be required throughout the construction works so retaining the monitoring locations, where possible, would ensure a continuous data set. The requirements for site wide long-term monitoring and any necessary management measures would be identified following the remediation/main earthworks at the verification stage.

### **Operational monitoring**

- 17.13.7 Groundwater and ground gas monitoring would be required post construction and during operation, this would be agreed between the Applicant, lead contractor, and appropriate regulators (Environment Agency and LBC EHO) prior to commencement of construction. The monitoring strategies may be adjusted during the course of the works based on the monitoring results and regulator agreement. Appropriate compliance criteria would need to be agreed for cessation of monitoring which would then allow the DfR permit to be surrendered. At which point formal approval would be sought from the regulators (Environment Agency and LBC EHO) to cease monitoring and decommission the monitoring wells. Discharge of relevant requirements will subsequently be sought from the relevant planning authority.

## 17.14 Assessment summary

17.14.1 **Table 17.24** provides a summary of the identified impacts, mitigation and likely significant effects of the Proposed Development on Soils and geology. The table has been subdivided into effects for each assessment phase as shown on **Figures 4.1 to 4.3** of this ES [TR020001/APP/5.03] and the Proposed Development areas which are presented on **Figure 17.1** of this ES [TR020001/APP/5.03].

Table 17.24: Soils and geology assessment summary

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
<b>Assessment Phase 1 Construction</b>						
Area A, Existing Airport Land, LLAOL Contractors Compound: Exposure of construction workers (medium sensitivity) and adjacent residential areas and users of the airport (high sensitivity) to contaminants in dusts, vapours and gases, from landfill material/Made Ground through a	Implementation of design measures i.e. careful phasing to minimise landfill material exposed, and construction environmental management measures that are set out in the Outline Remediation Strategy and CoCP, including PPE, dampening down of dusts, odour suppression and monitoring against investigation and action levels would reduce the potential magnitude of impact from	Very Low (adverse)	Medium/High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
number of exposure routes.	contaminants, which could affect human health receptors.					
<b>Buildings and Infrastructure</b>						
Area A, Existing Airport Land: Impact of aggressive ground conditions on piled foundations and buried infrastructure (medium sensitivity)	Assessment of soil conditions in accordance with BRE (Ref.17.46), use of resistant construction materials.	Very Low (adverse)	Low	Negligible Adverse (Not Significant)	None Required	Negligible Adverse (Not Significant)
<b>Assessment Phase 1 Operational</b>						
Area A: Exposure of maintenance workers (medium sensitivity) and users of the airport (high sensitivity) to contaminants in soils, dusts, vapours and gases from landfill material/Made	Engineered cover system, to areas of hard and soft landscaping and placement of services in cover system as described in the Outline Remediation Strategy, design to be finalised at detailed design stage.	Very Low (adverse)	Medium/High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Ground/landfill leachate.						
Area A: Migration of ground gases from former landfill, off-site (e.g. methane) and inhalation by adjacent site users e.g. residential housing and other buildings on the airport, WVP Community Centre/pavilion (high sensitivity)	The Outline Remediation Strategy includes measures to ensure preferential pathways for gases from the landfill are not created and includes a requirement for installation of perimeter gas protection measures, the exact design to be determined at detailed design stage. The Outline Remediation Strategy also includes measures to detect and, if necessary, treat any existing features such as the TVD to be implemented. This would provide a beneficial impact as an improvement on the current situation as landfill gas is uncontrolled.	Very Low (beneficial)	High	Negligible Beneficial (Not Significant)	None Required	Negligible Beneficial (Not Significant)

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	Consultation with relevant parties (Environment Agency, LBC EHO) to obtain regulatory approval would be undertaken.					
<b>Assessment Phase 2a Construction</b>						
Areas A, D, E, Existing Airport Land, Airport Access Road and Off-site Highway Interventions: Exposure of construction workers (medium sensitivity) and adjacent residential areas and users of the airport (high sensitivity) and commercial areas (medium) to contaminants in dusts, vapours and gases, from landfill material/Made	Implementation of design measures i.e. careful phasing to minimise landfill material exposed, and construction environmental management measures that are set out in the Outline Remediation Strategy and CoCP, including PPE, dampening down of dusts, odour suppression and monitoring against investigation and action levels, would reduce the potential magnitude of impact from contaminants, which	Very Low (adverse)	Medium/High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)

<b>Impact</b>	<b>Embedded/Good Practice Mitigation</b>	<b>Magnitude</b>	<b>Receptor Sensitivity</b>	<b>Description of effect and significance</b>	<b>Additional Mitigation</b>	<b>Residual Effect</b>
Ground through a number of exposure routes.	could affect human health receptors.					
Areas A, E, LLAOL Contractor's Compound: Driving of piles impacting UXO – potential explosive hazard affecting construction workers (high sensitivity) and adjacent site users; residential housing, existing airport (high sensitivity)	Risks mitigated by following best practice and recommendations in detailed UXO assessments and control measures included in the CoCP. Application of the mitigation measures would ensure no impact.	No Impact	High	No Effect	None Required	No Effect
<b>Buildings and Infrastructure</b>						
Area A, Existing Airport Land: Impact of aggressive ground conditions on piled foundations and buried infrastructure (medium sensitivity)	Assessment of soil conditions in accordance with BRE (Ref.17.46), use of resistant construction materials.	Very Low (adverse)	Low	Negligible Adverse (Not Significant)	None Required	Negligible Adverse (Not Significant)



Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
<b>Assessment Phase 2a Operational</b>						
<p>Area A: Migration of landfill gas into future buildings (Terminal 2, Green Horizons Park buildings) and subsequent exposure of future users (high sensitivity)</p>	<p>Implementation of gas protection measures in all buildings constructed over the former landfill with detailed design in accordance with BS8485 (Ref. 17.42). Measures described in the Outline Remediation Strategy to be developed and approved as a requirement of the DCO.</p>	<p>Very Low (adverse)</p>	<p>High</p>	<p>Minor Adverse (Not Significant)</p>	<p>None Required</p>	<p>Minor Adverse (Not Significant)</p>
<p>Area A: Significant re-engineering of landfill has the potential to trigger migration of ground gases from former landfill off-site (e.g. methane) and inhalation by adjacent site users residential areas/ users of the</p>	<p>Installation of boundary gas protection (type determined at detailed design) and treatment of preferential pathways during assessment Phase 1, as described in the Outline Remediation Strategy, with on-going monitoring and maintenance of the systems installed. This</p>	<p>Very Low (beneficial)</p>	<p>High</p>	<p>Negligible Beneficial (Not Significant)</p>	<p>None Required</p>	<p>Negligible Beneficial (Not Significant)</p>

<b>Impact</b>	<b>Embedded/Good Practice Mitigation</b>	<b>Magnitude</b>	<b>Receptor Sensitivity</b>	<b>Description of effect and significance</b>	<b>Additional Mitigation</b>	<b>Residual Effect</b>
airport, WVP Community Centre/pavilion (high sensitivity)	would be beneficial compared to the current situation with no gas controls.					
Area A: Exposure of maintenance workers (medium sensitivity) and users of the airport (high sensitivity) to contaminants in soils, dusts, vapours and gases from landfill material/Made Ground/landfill leachate.	Engineered cover system, to areas of hard and soft landscaping and placement of services in cover system as described in the Outline Remediation Strategy, to be confirmed at detailed design.	Very Low (adverse)	Medium/High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)
<b>Assessment Phase 2b Construction</b>						
Area A: Exposure of construction workers (medium sensitivity) and adjacent residential areas and users of the	Implementation of design measures i.e. careful phasing to minimise landfill material exposed, and construction environmental management measures that are set out in the	Very Low (adverse)	Medium/High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
airport (high sensitivity) to contaminants in dusts, vapours and gases, from landfill material/Made Ground through a number of exposure routes.	Outline Remediation Strategy and CoCP, including PPE, dampening down of dusts, odour suppression and monitoring against investigation and action levels with increased control measures as required, would reduce the potential magnitude of impact from contaminants, which could affect human health receptors.					
Area A, Existing Airport Land: Driving of piles impacting UXO – potential explosive hazard affecting construction workers (high sensitivity) and adjacent site users; residential housing, existing	Risks mitigated by following best practice and recommendations in detailed UXO assessments and control measures included in the CoCP. Application of the mitigation measures would ensure no impact.	No Impact	High	No Effect	None Required	No Effect

<b>Impact</b>	<b>Embedded/Good Practice Mitigation</b>	<b>Magnitude</b>	<b>Receptor Sensitivity</b>	<b>Description of effect and significance</b>	<b>Additional Mitigation</b>	<b>Residual Effect</b>
airport (high sensitivity)						
<b>Building and Infrastructure</b>						
Area A: Impact of aggressive ground conditions on piled foundations and buried infrastructure (medium sensitivity)	Assessment of soil conditions in accordance with BRE (Ref.17.47)), use of resistant construction materials.	Very Low (adverse)	Low	Negligible Adverse (Not Significant)	None Required	Negligible Adverse (Not Significant)
<b>Assessment Phase 2b Operational</b>						
Area A: Migration of landfill gas into future buildings (Terminal 2 extension and airport ancillary buildings) and subsequent exposure of future users (high sensitivity)	Implementation of gas protection measures in all buildings constructed over the former landfill with detailed design in accordance with BS8485 (Ref. 17.42). Measures described in the Outline Remediation Strategy and confirmed at detailed design stage.	Very Low (adverse)	High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)
Area A:	On-going maintenance of the boundary	Very Low (beneficial)	High	Negligible Beneficial	None Required	Negligible Beneficial

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Final re-engineering phase of landfill has the potential to trigger migration of ground gases from former landfill off-site (e.g. methane) and inhalation by adjacent site users residential areas/ users of the airport, WVP Community Centre/pavilion (high sensitivity)	protection systems installed in assessment Phase 2a and described in the Outline Remediation Strategy, continued monitoring to confirm efficacy of the control measures. This would be beneficial compared to the current situation with no gas controls.			(Not Significant)		(Not Significant)
Area A: Exposure of maintenance workers (medium sensitivity) and users of the airport (high sensitivity) to contaminants in soils, dusts, vapours and gases from landfill material/Made	Completion of engineered cover system, to areas of hard and soft landscaping and placement of services in cover system as described in the Outline Remediation Strategy, final design confirmed at detailed design stage.	Very Low (adverse)	Medium/High	Minor Adverse (Not Significant)	None Required	Minor Adverse (Not Significant)

<b>Impact</b>	<b>Embedded/Good Practice Mitigation</b>	<b>Magnitude</b>	<b>Receptor Sensitivity</b>	<b>Description of effect and significance</b>	<b>Additional Mitigation</b>	<b>Residual Effect</b>
Ground/landfill leachate.						

## COMPETENT EXPERTS

Topic	Role	Company	Qualifications/competencies/experience of author
Soils and geology	Author	Arup	BSc, MSc, MEnvSc, CSci Twenty-five years' experience in all aspects of land contamination, investigation assessment and remediation.
	Technical reviewer	Arup	BSc, MSc, FGS, CGeol, MEnvSci, CEnv, PIEMA Over 30 years' experience as a land quality and Soils and geology specialist with extensive experience of EIA on large infrastructure and development projects, for both Hybrid Bill and DCO applications. This includes over ten years as land quality lead on High Speed 2, Phases 1, 2A and 2b.



## GLOSSARY AND ABBREVIATIONS

Term	Definition
<b>Abbreviations</b>	
AAR	Airport Access Road
ACM	asbestos containing material
ANPS	Airports National Policy Statement
AOD	Above Ordnance Datum
BGS	British Geological Survey
BS	British Standard
CBC	Central Bedfordshire Council
CL:AIRE	Contaminated Land: Applications in Real Environments
CoCP	Code of Construction Practice
COMAH	Control of Major Accident Hazards
CIRIA	Construction Industry Research and Information Association
Luton DART	Luton Direct Air-Rail Transport
DCO	Development Consent Order
DEFRA	Department of Environment Food and Rural Affairs
DfR	Deposit for Recovery permit
DMRB	Design manual for roads and bridges
DoWCoP	Definition of waste code of practice
DQRA	Detailed Quantitative Risk Assessment
EIA	Environmental Impact Assessment
ES	Environmental Statement
GQRA	Generic Quantitative Risk Assessment
GI	ground investigation
IPPC	Integrated Pollution Prevention and Control
LCRM	Land Contamination Risk Management
LR	Luton Rising (the Applicant)
LLAOL	London Luton Airport Operator Limited
LBC	Luton Borough Council
MMP	materials management plan
MSA	mineral safeguarding area
NPPF	National Planning Policy Framework
NHBC	National House Building Council

<b>Term</b>	<b>Definition</b>
NHDC	North Hertfordshire District Council
NVZ	nitrate vulnerable zone
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
PCL	potential contaminant linkage
PFAS	per- and poly-fluoroalkyl substances
PPE	personal protective equipment
PRA	Preliminary Risk Assessment
RCL	Relevant Contaminant Linkage
RS	Remediation Strategy
SMP	Soil Management Plan
SPZ	Source Protection Zone
SWMP	Site Waste Management Plan
TPH	total petroleum hydrocarbons
UXO	unexploded ordnance
VOC	volatile organic compound
ZOI	zone of influence
<b>Glossary</b>	
Above ordnance datum (AOD)	Above ordnance datum (AOD) is a vertical measurement used by ordnance survey as the basis for deriving altitudes on maps, usually by comparison with the mean sea level.
Adverse (environmental) effect	A detrimental or negative effect to an environmental resource or receptor.
Aquifer	An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt).
Artificial ground	Artificial ground is a term used by the BGS for those areas where the ground surface has been significantly modified by human activity and includes areas of made ground, worked ground, landscaped and infilled ground.
Baseline	A description of the current state of the environment without implementation of the project.
Beneficial (environmental) effect	An advantageous or positive effect to an environmental resource or receptor.
Construction Code of Practice (CoCP)	The CoCP outlines the environmental management and mitigation requirements to be implemented throughout

Term	Definition
	the construction period for the delivery of the Proposed Development
Controlled waters	<p>These are fully defined in section 104 of the Water Resources Act 1991 [4]. Controlled waters include, in summary:</p> <ul style="list-style-type: none"> <li>relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured</li> <li>coastal waters from the low-tide limit to the high-tide limit or fresh-water limit of a river or watercourse</li> <li>inland freshwaters: natural and artificial lakes, ponds, reservoirs, rivers or watercourses above the fresh-water limit</li> <li>natural and artificial underground rivers and watercourses</li> <li>surface water sewers, ditches and soakaways that discharge to surface or groundwater it also includes those that may be currently dry</li> <li>groundwaters – any waters contained in underground strata.</li> </ul>
Cumulative effects	<p>Impacts that result from incremental changes caused by other present or reasonably foreseeable actions together with the project.</p> <p>NOTE: For the purpose of this guidance, a cumulative impact can arise as the result of the:</p> <ul style="list-style-type: none"> <li>combined impact of a number of different environmental factors-specific impacts from a single project on a single receptor/resource</li> <li>combined impact of a number of different projects within the vicinity (in combination with the environmental impact assessment project) on a single receptor/resource</li> </ul>
Department for Environment and Rural Affairs (DEFRA)	UK government department responsible for safeguarding the natural environment, supporting the food and farming industry, and sustaining a thriving rural economy.
Design Manual for Roads and Bridges (DMRB)	The Design Manual for Roads and Bridges (DMRB) contains information about current standards relating to the design, assessment and operation of motorway and all-purpose trunk roads in the UK.
Detailed assessment	Method applied to gain an in-depth appreciation of the beneficial and adverse consequences of the project and to inform project decisions. Detailed Assessments are likely to require detailed field surveys and/or quantified modelling techniques.

Term	Definition
Development Consent Order (DCO)	A Development Consent Order (DCO) is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects. This includes energy, transport, water and waste projects.
Effect	Term used to express the result/consequence of an impact (expressed as the 'significance of effect').
Effluent discharge	Effluent discharge is liquid waste, other than waste from kitchens or toilets, surface water or domestic sewage.
EIA	See 'Environmental Impact Assessment (EIA)'.
EIA Quality Mark	The EIA Quality Mark is a stamp of quality awarded by IEMA to successful registrants. It is based around a set of commitments, which registrants agree to comply with. The Institute of Environmental Management and Assessment (IEMA) operates the EIA Quality Mark and undertakes an independent review of an organisation's compliance with its EIA commitments both during the application process and once registered through an annual review process.
EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) (EIA) Regulations 2017 (SI 2017/572), which requires an Environmental Statement (ES) to be submitted with the DCO application that presents an assessment of the likely significant environmental impacts arising from the Proposed Development.
EIA Scoping	The process of considering the information required for reaching a (reasoned) conclusion on the likely significant effects of a project on the environment.
EIA Scoping Opinion	A written opinion of the relevant consenting authority, following a request from the applicant, as to the information to be provided in the Environmental Statement.
Embedded mitigation	Design measures which are integrated into a project for the purpose of minimising and/or preventing adverse environmental effects.
Emission	A material that is expelled or released to the environment. Usually applied to gaseous or odorous discharges to the atmosphere.
Enhancement	A measure that is over and above what is required to mitigate the adverse effects of a project.
Environment Agency	The Environment Agency is responsible for environmental protection and regulation in England and plays a central role in implementing the government's

Term	Definition
	environmental strategy. The Environment Agency is the main body responsible for managing the regulation of major industry and waste, treatment of contaminated land, water quality and resources, fisheries, inland river, estuary and harbour navigations, and conservation and ecology. They are also responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.
Environment Agency Recorded Pollution Incidents	A record of pollution incidents to water, land and air held by the Environment Agency.
Environmental Impact Assessment (EIA)	DMRB LA101 – Introduction to environmental assessment [11] defines EIA as: “Statutory process consisting of: preparation of an Environmental Statement; consultation; examination by the competent authority of the information contained within the Environmental Statement; the reasoned (justified or evidenced) conclusion by the competent authority on the significant effects of the project on the environment; and the reasoned (justified or evidenced) decision by the competent authority to grant or refuse development consent”
Environmental Management Plan (EMP)	An Environmental Management Plan (EMP) provides the framework for recording environmental risks, commitments and other environmental constraints and clearly identifies the structures and processes that will be used to manage and control these aspects. The EMP also seeks to ensure compliance with relevant environmental legislation, government policy objectives and scheme specific environmental objectives. It also provides the mechanism for monitoring, reviewing and auditing environmental performance and compliance.
Environmental Masterplan	An EMP at outline stage which will later be refined and expanded into a full EMP as more information becomes available and there is more certainty in terms of the proposed layout, construction methods, programme and the likely environmental effects.
Environmental Statement (ES)	A statutory report (this document) produced by the developer including: a description of the project a description of the likely significant effects of the project on the environment

Term	Definition
	<p>a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment</p> <p>a description of the reasonable alternatives</p> <p>a non-technical summary</p> <p>any additional information relevant to the characteristics of a project</p>
Flood Zone	<p>Flood Zone definitions are set out in the national Planning Policy Guidance (PPG):</p> <p>Flood Zone 1 – land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (&lt;0.1%).</p> <p>Flood Zone 2 – land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.</p> <p>Flood Zone 3 – land assessed as having a 1 in 100 or greater annual probability of river flooding (&gt;1%), or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year.</p>
Future baseline scenario	An outline of the likely evolution of the current state of the environment without implementation of the project.
Groundwater	Groundwater is the water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations.
Groundwater divide	The boundary between groundwater basins; defined by a line connecting the high points on the water table or other potentiometric surface. Groundwater flows away from a groundwater divide.
Hard standing	Ground improvement by the use of compacted stone or other materials which facilitates increased surface loading from vehicles or other plant.
Hazardous waste	Waste which displays one or more of the hazardous properties listed in Annex III of the Waste Framework Directive.
Impact	The change or action. Either beneficial or adverse.
In-situ	In the natural, original or appropriate position.
Inert materials	Inert material is material which is neither chemically or biologically reactive and will not decompose. Examples of this are sand, drywall, and concrete. This has

Term	Definition
	particular relevance to landfills as inert materials typically require lower disposal fees than biodegradable waste or hazardous waste.
Local authorities	An administrative body in local government. The Proposed Development is situated within three authority boundaries: Luton Borough Council (LBC); North Hertfordshire District Council (NHDC); and Central Bedfordshire Council (CBC).
Local Authority Pollution Prevention Controls	Local authorities who regulate businesses are usually district or borough councils. If an area has only one council (a unitary council) then that's the regulator. The Port Health Authority may be the regulator in port areas. This guidance helps local authorities: follow statutory guidance under regulation 64 of the Environmental Permitting (England and Wales) Regulations 2016 (EPR) [Ref. 17.3] understand the EPR's main functions, procedures and terminology [Ref. 17.47]
Locally Important Geological and Geomorphological Sites (LGS)	Locally Important Geological and Geomorphological Sites (LGS) exhibit important geological and geomorphological features and range from sarsen stones, rock outcrops to geological faces in active quarries.
Made Ground	An area of land that has been man-made, generally through the reclamation of marshes, lakes, or shorelines. An artificial fill is used, consisting of materials, refuse, etc.
Main river	Main rivers are usually larger rivers and streams. The Environment Agency carries out maintenance, improvement or construction work on main rivers to manage flood risk.
Materials Management Plan (MMP)	A Materials Management Plan (MMP) is a mechanism by which those who are developing a site can comply with Environment Agency regulations for excavated ground materials.
Mitigation measure	Measure aiming at preventing/reducing an adverse environmental effect.
National Planning Policy Framework (NPPF)	The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England, replacing the previous system of topic-specific Planning Policy Guidance Notes (PPG) and Planning Policy Statements (PPS).



Term	Definition
Non-hazardous waste	Waste that is not covered under Article 2 (c) of the Landfill Directive (1999/31/EC) [Ref.17.48], i.e. neither classed as hazardous nor as inert.
Non-statutory consultee	Non-statutory consultees are organisations and bodies (e.g. National Trust), identified in national planning policy, who should be consulted on relevant applications.
Non-waste	Non waste is defined as materials that have not been discarded and/or classified as waste.
Ordinary watercourse	An ordinary watercourse is a watercourse that is not part of a main river. It includes rivers, streams, land and roadside ditches, drains, cuts, culverts, dykes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991 [Ref. 17.49] and passages, through which water flows.
Planning Inspectorate	On 1 April 2012, under the Localism Act 2011 [19], the Planning Inspectorate became the agency responsible for operating the planning process for nationally significant infrastructure projects (NSIP).
Planning Practice Guidance (PPG)	A web-based resource that came into force in 2014 and is periodically updated. It seeks to consolidate existing technical guidance into a consolidated online format and provides further detail on the policies contained within the NPPF.
Pollutant	A substance that pollutes something, especially water or the atmosphere.
Pollution Prevention Guidelines (PPG)	Practical advice and guidance for the prevention of pollution during construction and demolition projects. The guidance explains what is required by law and describes good practice measures to reduce the risks of a pollution incident. The guidance was withdrawn in 2015.
Potable water	Water that is safe to drink/consume.
Potential contaminant linkage	The potential contaminant linkage determines how contaminant travels from the contaminant source to a receptor.
Preliminary Environmental Information Report (PEIR)	The PEIR was prepared in compliance with the EIA Regulations to enable the local community, any other interested person and stakeholders to understand the environmental effects of the Proposed Development and enable an informed response to the consultation. The document set out how each environmental topic area is being assessed, the potential environmental effects of the Proposed Development based on the information available at the time, and measures proposed to avoid or

Term	Definition
	reduce such effects. This is to support consultees in developing an informed view of the likely significant environmental effects of the Proposed Development. The additional information from consultation on the PEIR has been included in the EIA and this ES, as appropriate.
Proposed Development	The proposed expansion of Luton Airport with new terminal and stands and associated developments (as described in <b>Chapter 4</b> of this ES [TR020001/APP/5.01]).
Receptor (sensitive)	A component of the natural, created, or built environment such as human
Regionally Important Geological and Geomorphological Sites (RIGS)	Regionally important geological and geomorphological sites (RIGS) (also known as regionally important geological sites or, especially in Wales, regionally important geodiversity sites) are locally designated sites of local, national and regional importance for geodiversity (geology and geomorphology) in the UK.
Residual effects	Those effects of the Proposed Development that cannot be mitigated following implementation of mitigation proposals.
Resource	A defined but generally collective environmental feature usually associated with soil, water, air, climatic factors, landscape, material assets, including the architectural and archaeological heritage that has potential to be affected by a project.
River basin	A river basin is an area of land drained by a river and its tributaries.
Scoped In/Out	A term used in EIA, referring to whether a technical topic is included ('scoped in') or not ('scoped out') in the EIA – often presented as a discrete chapter in the ES if scoped in.
Site of Importance for Nature Conservation (SINC)	Sites of Importance for Nature Conservation (SINC) are designations used by local authorities in the United Kingdom for sites of substantive local nature conservation and geological value. The Department for Environment, Food and Rural Affairs has recommended the generic term 'local site', which is divided into 'local wildlife site' and 'local geological site'.
Site of Special Scientific Interest (SSSI)	A Site of Special Scientific Interest (SSSI) is a conservation designation denoting a protected area in the UK, designated due to special interest in its flora, fauna, geological or physiographical features. They are protected by law to conserve their wildlife or geology.

Term	Definition
Site Waste Management Plan (SWMP)	Site Waste Management Plans (SWMP) encourage the effective management of materials and ensure waste is considered at all stages of a project – from design through to completion. Although no longer a regulatory requirement in England, SWMPs are still considered to be good practice. The SWMP is requirement of the CoCP, and secured as a requirement of the DCO.
Source protection zone (SPZ)	Source Protection Zones (SPZ) are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.
Special Area of Conservation (SAC)	A Special Area of Conservation (SAC) is a site designated under the Habitats Directive. These sites, together with Special Protection Areas (or SPA), are called Natura sites (or European sites) and they are internationally important for threatened habitats and species.
Special Protection Area (SPA)	A special protection area is a designation under the European Union (EU) Directive on the Conservation of Wild Birds [21]. Under the Directive, Member States of the EU have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds. These sites, together with Special Area of Conservation (SAC), are called Natura sites (or European sites) and they are internationally important for threatened habitats and species.
Stakeholder	A person or organisation with an interest or concern in something (in this case, the Proposed Development).
Statement of Common Ground (SoCG)	A written statement prepared jointly by the applicant and another party or parties, setting out any matters on which they agree. In some cases, statements of common ground will also identify areas where agreement has not been reached.
Statutory consultees	Groups or bodies that, by law, must be consulted as part of the DCO application process for EIA development.
Study area	Defined area surrounding the site in which is collected and analysed in order to set the site into its context. This varies as stated within each technical assessment.
Surface water	Water that collects on the surface of the ground.
Topography	The natural and man-made features of an area collectively.

Term	Definition
Tributary	A river or stream flowing into a larger river or lake.
Unexploded ordnance (UXO)	Unexploded ordnance (UXO), unexploded bombs, or explosive remnants of war are explosive weapons that did not explode when they were employed and still pose a risk of detonation, sometimes many decades after they were used or discarded.
Waste	Waste is defined in Article 3(1) of the European Waste Framework Directive 2008/98/EC (OJL 312/3) [Ref. 17.50] as any substance or object which the holder discards or intends or is required to discard. The term 'holder' is defined under article 3(6) as 'the waste producer or the natural or legal person who is in possession of the waste'. The waste 'producer' is defined under article 3(5) as 'anyone whose activities produce waste (original waste producer) or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of the waste'. Waste can be further classified as hazardous, non-hazardous or inert.
Waste facility	A facility where the main purpose of the facility is the treatment or disposal of waste.
Waste hierarchy	The 'waste hierarchy' ranks waste management options according to what is best for the environment. It gives top priority to preventing waste in the first place. When waste is created, it gives priority to preparing it for re-use, then recycling, then recovery, and last of all disposal (e.g. landfill).
Waste infrastructure	The structures, systems and facilities for waste management within an area.
Water Framework Directive (WFD)	The Water Framework Directive 2000/60/EC [Ref. 17.51] is an EU directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies by 2015. It is a framework in the sense that it prescribes steps to reach the common goal rather than adopting the more traditional limit value approach.
Water quality	Water quality refers to the chemical, physical, and biological characteristics of water based on the standards of its usage.
WFD status	The WFD classification scheme for water quality includes five status classes: high, good, moderate, poor and bad. 'High status' is defined as the biological, chemical and morphological conditions associated with no, or very low, human pressure.

<b>Term</b>	<b>Definition</b>
World Health Organisation (WHO)	The World Health Organization (WHO) is a specialised agency of the United Nations that is concerned with international public health.
Worst-case (scenario)	The definition of a 'worst-case' varies by the field to which it is being applied, however ultimately it is the most unfavourable foreseen scenario. Often assessments use a worst-case scenario.
Zone of influence (ZOI)	The zone of influence is the area over which (e.g.) ecological features may be subject to significant effects. This area may differ for different receptors.

## REFERENCES

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- Ref 17.1 Environmental Protection Act 1990: Part 2A The Contaminated Land Regulations, UK Public General Acts, c.43, s78.
- Ref 17.2 The Waste (England and Wales) Regulations 2011. (SI 2011/988) Environmental Protection, England and Wales.)
- Ref 17.3 The Environmental Permitting (England and Wales) Regulations 2016. (SI 2016/1154).
- Ref 17.4 Department for Transport (2018) The Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England. London:HMSO.
- Ref 17.5 Ministry of Housing, Communities and Local Government (2021) National Planning Policy Framework.
- Ref 17.6 Department for Transport (2014) National Policy Statement for National Networks. HMSO, UK
- Ref 17.7 Luton Local Plan 2011-2031 (adopted November 2017).
- Ref 17.8 Central Bedfordshire (2021) Central Bedfordshire Local plan 2015-2035.
- Ref 17.9 North Hertfordshire District Council (2022). North Hertfordshire Local Plan 2011-2031. Available at: <https://www.north-herts.gov.uk/north-herts-local-plan-2011-2031>.
- Ref 17.10 Dacorum Borough Council (2013) Core Strategy 2006-2030. Adopted 25 September 2013.
- Ref 17.11 North Hertfordshire District Council, Central Bedfordshire and Luton Borough Councils (2014). Minerals and Waste Local Plan: Strategic Sites and Policies. Adopted January 2014.
- Ref 17.12 Bedfordshire and Luton Minerals and Waste Local Plan 2000-2015 – saved policies. (Adopted 2005)
- Ref 17.13 Hertfordshire County Council Minerals Local Plan Review, 2002-2016. (Adopted March 2007).
- Ref 17.14 Hertfordshire County Council. Hertfordshire Minerals Local Plan 2016-2031. Consultation Draft 2017.
- Ref 17.15 Hertfordshire County Council (2019) Hertfordshire Minerals Local Plan Proposed Submission 2019.
- Ref 17.16 British Standards (BS). BS10175:2011+A2:2017. Investigation of Potentially Contaminated Sites - Code of Practice. London:BSI, 2017.
- Ref 17.17 Environment Agency . Land Contamination Risk Management (LCRM). How to assess and manage the risks from land contamination. 2020. Updated April 2021. (Online) Available from: <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm> (Accessed 12 September 2021).
- Ref 17.18 Environment Agency. Contaminated Land Report 11 (CLR11). Model Procedures for the Management of Land Contamination. EA, 2004. (Withdrawn October 2020)
- Ref 17.19 Environment Agency GPLC2 - FAQs, technical information, detailed advice and references, 2010.
- Ref 17.20 Rudland, D J; Lancefield, R M; Mayell, P N. Contaminated Land Risk Assessment. A guide to good practice. Report C552. London: Construction Industry Research and Information Association (CIRIA), 2001.
- Ref 17.21 Wilson, S; Oliver, S; Mallett, H; Hutchings, H; Card G. Assessing risks posed by hazardous ground gases to buildings. C665. London: CIRIA, 2007.
- Ref 17.22 Nathanail, CP, Jones, A, Ogden, R, Robertson, A. Asbestos in soil and made ground: a guide to understanding and managing risks. C733. London: CIRIA, 2014.
- Ref 17.23 Ministry of Housing Communities and Local Government (MHCLG). Planning Practice Guidance. Land affected by contamination. 2014, updated 2019.
- Ref 17.24 National House Building Council (NHBC), Environment Agency and the Chartered institute of Environmental Health. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D Publication 66:2008 Volume 1. Milton Keynes: NHBC, 2008 (online)
- Ref 17.25 Highways England, Transport Scotland, Welsh Government, Department for Infrastructure, Design Manual for Roads and Bridges (DMRB), Volume 11, Section 2, Part 4 Environmental Assessment and Monitoring, Revision 1, July 2019.
- Ref 17.26 Highways England, Transport Scotland, Welsh Government, Department for Infrastructure, Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 11 Geology and Soils, Version 0, October 2019
- Ref 17.27 Department for Transport (2018) Beyond the horizon, The future of UK aviation, Making best use of existing runways, June 2018. Available at: <https://www.gov.uk/government/publications/aviation-strategy-making-best-use-of-existing-runways> [Accessed: 30/11/22].



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- Ref 17.28 British Geological Survey (BGS). Geological Map-Leighton Buzzard 220 (Solid and Drift) 1:50,000 series. Geological survey of Great Britain (England and Wales), 1992.
- Ref 17.29 British Geological Survey (BGS). Geological Map-Hitchin 221 (Solid and Drift) 1:50,000 series. Geological survey of Great Britain (England and Wales), 1995.
- Ref 17.30 Hopson, P.M.; Aldiss, D.T.; Smith, A.; Wood, C.J.; Wilkinson, I.P.; Woods, M.A.; Allsop, J.M.; Cheney, C.S.; Wymer, J.J.; British Geological Survey. Geology of the country around Hitchin. Memoir for 1:50,000 geological Sheet 221 (England and Wales). London, HMSO, 1996.
- Ref 17.31 Department for Food and Rural Affairs (DEFRA) MAGIC website. (online) Available from: <https://magic.defra.gov.uk/MagicMap.aspx>. (Accessed September 2021).
- Ref 17.32 Groundsure. Groundsure.io environmental data viewer.
- Ref 17.33 Groundsure. EnviroInsight GeolInsight, MapInsight Reports. Ref: GS- GS-2762878, 2018.
- Ref 17.34 Groundsure. EnviroInsight, GeolInsight, MapInsight Reports. Ref: GS- GS- 5534632, 2018.
- Ref 17.35 Groundsure. Enviro+Geo Insight and MapInsight Reports. Ref: GSIP-2020-10588-3215, 2020.
- Ref 17.36 Groundsure. Enviro+Geo Insight and MapInsight Reports. Ref: GSIP-2020-10588-3212, 2020.
- Ref 17.37 Department of the Environment. Industry profiles, 1995/1996.
- Ref 17.38 Highways England, Transport Scotland, Welsh Government, Department for Infrastructure. Design manual for roads and bridges (DMRB) Volume 11, Section 2, Part 5 (HA205/08) Environmental Assessment and Monitoring. 2008 (withdrawn).
- Ref 17.39 Highways England, Transport Scotland, Welsh Government, Department for Infrastructure. DMRB , Volume 11, Section 3, Part 11 Environmental assessment. Environmental assessment techniques. Geology and soils. 2014. (withdrawn)
- Ref 17.40 Highways England, Transport Scotland, Welsh Government, Department for Infrastructure. DMRB Volume 11 Section 3 Part 6. Environmental assessment. Environmental assessment techniques. Land use. 2001 (withdrawn)
- Ref 17.41 London Luton Airport Limited (LLAL). Century Park Development, Airport Way – Landfill Area. Contamination Quantitative Risk Assessment, 2017.
- Ref 17.42 British Standards (BS). BS8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. London, BSI, 2015.
- Ref 17.43 EN 1997-1 (2004) (English): Eurocode 7: Geotechnical design - Part 1: General rules.
- Ref 17.44 K Stone, A Murray, S Cooke, J Foran, L Gooderham. Unexploded ordnance (UXO) A guide for the construction industry (C681). London:CIRIA, 2009.
- Ref 17.45 Environment Agency. LFTGN02. Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, 2003. (online)
- Ref 17.46 British Research Establishment (BRE). Concrete in aggressive ground. Third Edition. BRE Construction Division, 2005.
- Ref 17.47 DEFRA. Statutory Guidance: Local Authority Pollution Control: general guidance manual, 2017.
- Ref 17.48 European Union. Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste. EU,1999.
- Ref 17.49 Secretary of State. Water Industry Act 1991. London: HMSO. 1991.
- Ref 17.50 European Union. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance). EU, 1998.
- Ref 17.51 European Union. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. EU, 2000.