



## UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks  
and adjoining land, Bedford

### Environmental Statement Volume 1

## Chapter 11 - Ground Conditions, Soils and Agricultural Land

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## 11. GROUND CONDITIONS, SOILS AND AGRICULTURAL LAND

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### 11.1. INTRODUCTION

- 11.1.1. This chapter has been prepared in support of the planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement (ES). This reports the outcome of the assessment of likely significant effects arising from the Proposed Development in relation to Ground Conditions, Soils and Agricultural Land during construction and operation.

#### SUPPORTING DOCUMENTATION

- 11.1.2. This chapter is based on the baseline conditions provided in **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)** and historical ground investigation data provided in **Appendix 11.2: Ground Investigation Technical Note (Volume 3)**. It should be read in conjunction with this supporting documentation.
- 11.1.3. This chapter is intended to be read in conjunction with the following supporting figures and appendices:
- **Figure 11.1: Ground Conditions, Soils and Agricultural Land Study Area (Volume 2);**
  - **Figure 11.2: Previous Ground Investigations (Volume 2);**
  - **Appendix 3.1: Legislation, Policy and Guidance for all ES Technical Topics (Volume 3);**
  - **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3);**
  - **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3);**
  - **Appendix 11.2: Ground Investigation Technical Note (Volume 3);**
  - **Appendix 11.3: Mineral Resource Assessment (Volume 3); and**
  - **Appendix 11.4: Outline Land Remediation Strategy (Volume 3).**
- 11.1.4. Potential effects on Ground Conditions, Soils and Agricultural Land are interrelated with potential effects on Air Quality, Ecology and Water Resources. Therefore, this chapter should be read in conjunction with other environmental assessments including **Chapter 6: Ecology and Nature Conservation (Volume 1)**, **Chapter 8: Air Quality (Volume 1)** and **Chapter 12: Water Resources (Volume 1)**.

#### LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

- 11.1.5. The relevant legislation, policy and guidance to the assessment of Ground Conditions, Soils and Agricultural Land effects associated with the Proposed Development are detailed in **Appendix 3.1: Legislation, Policy and Guidance for all ES Technical Topics (Volume 3)**.

## 11.2. ASSUMPTIONS USED TO INFORM TOPIC ASSESSMENT

- 11.2.1. The assessment presented in this chapter has been based on the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)**. This chapter has also used the following assumptions to build on the information in **Chapter 2: Description of the Proposed Development (Volume 1)** to support undertaking an assessment of a cautious worst case (where the phrase “cautious worst case” is used it means “a cautious worst case that provides a robust assessment of likely significant effects”).
- 11.2.2. Portions of the Site, specifically in the Lake Zone, are assumed to be contaminated and further contaminated land assessment and remediation may be required. Any such actions will be undertaken in accordance with the *Land Contamination Risk Management (LCRM)* (2023) guidance (Ref. 11.1).

## 11.3. ENGAGEMENT, SCOPE AND STUDY AREA

### ENGAGEMENT

- 11.3.1. Engagement to date has been undertaken with the Environment Agency for Ground Conditions, Soils and Agricultural Land, as summarised in **Table 11-1**.

**Table 11-1 - Summary of Engagement Undertaken**

Body/ Organisation	Individual/Stat Body/Organisation	Meeting Dates and Other Forms of Engagement	Summary of Outcome of Discussions
Environment Agency	Groundwater and Contaminated Land	30 May 2024 (Microsoft Teams Meeting)	Summary of contaminated land information presented to the Environment Agency.
Environment Agency	Groundwater and Contaminated Land	29 April 2025 (Microsoft Team Meeting)	Summary of potential contaminated land at Site, ground investigations undertaken to date, and presentation of proposed approach to land remediation.  A document setting out Summaries of Agreed Position between the two parties in relation to Ground Conditions is submitted as <b>Appendix 4</b> of the <b>Planning Statement (Document Reference 6.1.0)</b> .

- 11.3.2. Much of the assessment has been based on information presented in a third-party report prepared by Arcadis (Ref. 11.2). Therefore, the assessment of risk is unlikely to change based on further engagement with regulators.

### SCOPE OF THE ASSESSMENT

- 11.3.3. A formal Environmental Impact Assessment (EIA) scoping process has not been undertaken in support of the preparation of this assessment. However, this assessment has been undertaken in line with best practice guidance, engagement with statutory bodies and using professional judgement.

- 11.3.4. The assessment of Ground Conditions, Soils and Agricultural Land has considered the potential for the Construction Phase of the Proposed Development to result in likely significant effects.
- 11.3.5. There are not considered to be any potentially significant effects regarding Ground Conditions and Soils during the Operational Phase as any contamination identified during the Construction Phase will be remediated in line with national and local planning policy and guidance, including following LCRM *Stage 3 remediation and verification* (**Ref. 11.3**).
- 11.3.6. The elements shown in **Table 11-2** are considered to be likely to give rise to potentially significant effects during construction of the Proposed Development and have therefore been considered within this assessment.

**Table 11-2 - Elements Scoped into the Assessment**

Element Scoped in	Construction Phase
Third-party neighbours in relation to potential exposure to contamination within underlying soils/groundwater.	✓
Controlled waters in relation to potential contamination within the underlying soils/groundwater and mobilisation of contamination and potential degradation of surface water quality in the lakes and brook.	✓
Below ground services in relation to potential contamination within the underlying soils/groundwater.	✓
Agricultural land and soils in relation to loss of good quality agricultural soil and potential contamination within the underlying soils/groundwater.	✓

#### Elements Scoped out of the Assessment

- 11.3.7. The elements shown in **Table 11-3** are considered to be unlikely to give rise to potentially significant effects as a result of the Proposed Development and have therefore not been considered within this assessment.

**Table 11-3 - Elements Scoped Out of the Assessment**

Element Scoped Out	Justification
Construction staff in relation to potential exposure to contamination within the underlying soils/groundwater.	Potential risks to human health from any encountered (unexpected) ground contamination will be mitigated using appropriate Personal Protective Equipment/Respiratory Protective Equipment and by adopting appropriate working practices (as per legal requirements under <i>The Construction, Design and Management Regulations 2015</i> ( <b>Ref. 11.4</b> ) to ensure suitable health and safety controls are in place during construction works). Further controls to minimise negative environmental impacts and associated health risks from unknown land contamination are set out in the Outline Land Remediation Strategy provided as <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b> .

Element Scoped Out	Justification
Damage to designated geological Sites of Scientific Interest (SSSIs) and/or Regionally Important Geodiversity Sites (RIGSs).	No geological SSSI or RIGS identified at or within 250m* of the Site.
Effects on ecological receptors.	Potential effects due to the Proposed Development are covered in <b>Chapter 6: Ecology and Nature Conservation (Volume 1)</b> .
New groundwater borehole abstraction.	Refer to <b>Chapter 12: Water Resources (Volume 1)</b> .
Human health, controlled waters, building fabric, phytotoxic risk to new planting and services and agricultural soils during the Operational Phase.	The risk of effects during the Operational Phase is proposed to be scoped out on the basis that any contamination identified during the Construction Phase will be remediated in accordance with the applicable laws.
*As per '250m study area' detailed under the Extent of the Study Area section below.	

## MINERAL RESOURCE ASSESSMENT

- 11.3.8. It has been identified that the majority of the Site lies within a Minerals Safeguarding Area for Oxford Clay within the Minerals and Waste Policies Map Location Plan, found within the Mineral and Waste Local Plan: Strategic Sites and Policies (MWLP: SSP) (**Ref. 11.5**). The Site area includes Peterborough Member of the Oxford Clay Formation (brick clay resource) across the entire Site.
- 11.3.9. WSP completed a Mineral Resource Assessment (MRA) based on three Ground Investigations in 2023 and 2024. The findings of are provided in **Appendix 11.3: Mineral Resource Assessment (Volume 3)**.
- 11.3.10. Policy MSP12 of the MWLP: SSP (**Ref. 11.5**) allows the surface development of sites in Mineral Safeguarding Areas provided that the “*mineral concerned is proven to be of no economic value as a result of the undertaking of the Mineral Resource Assessment*”. The policy also includes other exceptions which are that the development will not inhibit extraction if required in the future, or there is an overriding need for the development and prior extraction cannot be reasonably undertaken, or that the mineral can be extracted prior to the development taking place. Only one of these policy tests needs to be satisfied to comply with the policy.
- 11.3.11. The MRA addresses the requirement to demonstrate that the mineral is of no economic value, primarily due to:
- Permitted extraction of allocated minerals on-Site will not go ahead as the mineral is deemed of no economic value due to the carbon and sulphur content within the Peterborough Member which means production cannot comply with UK Air Quality Standards;
  - Other existing sites and allocated brick clay extraction sites (specific to Oxford Clay extraction) are estimated to contain 38.7 million cubic meters off-Site across six sites within 5km of the Site. It is identified that demand for brick clay has been very limited, therefore, these sites enable the area to meet any unforeseen demand to be met; and

- Following investigation deposits have been shown to be unsuitable for extraction as the material doesn't comply with a typical brick earth specification comprising a sand content of 35-50%, a silt content of 20-35% and a clay content 20-30%.

11.3.12. Based on this assessment, minerals has been scoped out and has not been taken any further as part of this assessment.

## EXTENT OF THE STUDY AREA

11.3.13. The study area considered for the purpose of this assessment consists of the area within the Site, as well as identified receptors within a 250m buffer zone from the Site boundary. This study area extends up to 1km from the Site boundary in relation to sensitive Controlled Water receptors only, which is considered appropriate for indirect effects.

11.3.14. Impacts to agricultural land and soil function are considered within the Site boundary only. These will be referred to as '250m study area', '1km study area' and 'Soils study area' (which is the area within the Site boundary).

11.3.15. The 250m distance is referenced in best practice documentation, including *Guidance for the Safe Development of Housing on Land Affected by Contamination* (Ref. 11.6), and is typical at the hazard identification stage of an assessment based on professional judgement.

11.3.16. Consideration has been given to the study area selected and, based on the Site specifics (such as the underlying geology, an appreciation of the water environment and previous land use) the buffer zone extends up to 1km for controlled water receptors which is considered suitable and sufficient to account for any likely significant effects.

11.3.17. Where features or receptors are identified as on/off-Site this indicates that they either fall inside or outside of the Site. On-Site materials are considered to comprise natural soils and/or Made Ground recovered from within the Site during earthworks most likely to occur during the Construction Phase.

## 11.4. METHODOLOGY

### METHOD OF BASELINE DATA COLLATION

#### Desk Study

11.4.1. A desk-based data collection exercise has been undertaken in the form of a Phase 1 Preliminary Risk Assessment (PRA). The PRA includes a review of available information to determine the baseline conditions of the study area and assess potential land contamination constraints relevant to the Construction Phase of the Proposed Development.

11.4.2. The PRA is included as **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**. Within **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**, key sources of information, such as the Groundsure report (see **Annex 4: Groundsure Report of Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**), have been used to determine the baseline ground, soils and agricultural land conditions. **Appendix 11.2: Ground Investigation Technical Note (Volume 3)** has been produced to accompany and inform this chapter.

## Site Walkover

- 11.4.3. A Site walkover was undertaken on 8 May 2024. The Site comprises predominantly agricultural land with the exception of the Lake Zone. The Lake Zone comprises an agricultural field in the northwestern section of the area. The central eastern section of the Lake Zone comprises several artificial lakes, which were former clay excavation pits. The southwestern section of the Lake Zone comprises hardstanding areas (either concrete hardstanding or asphalt) with soft standing to the east. A number of stockpiles are located in the hardstanding areas. The stockpiles appear to predominantly comprise construction and demolition rubble. The Proposed Development zones are mapped on the **Zonal Plan (Document Reference 1.8.0)**.

## ASSESSMENT METHODOLOGY

- 11.4.4. The assessment will be prepared in accordance with the legislation and guidance referenced in **Appendix 3.1: Legislation, Policy and Guidance for all ES Technical Topics (Volume 3)**.
- 11.4.5. The assessment presented within this chapter considers potential effects from the construction of the Proposed Development.
- 11.4.6. Further details on the methodology used in the assessment of Ground Conditions, Soils and Agricultural Land are presented in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**.
- 11.4.7. Each environmental topic has undertaken specific environmental technical assessments in line with best practice guidance, engagement with statutory bodies and using professional judgement. Based on the elements set out in **Table 11-2**, the scope of the assessment is set out in **Table 11-4**.

**Table 11-4 - Assessment Methodology**

Elements Scoped in	Methodology
Third-party neighbours in relation to potential exposure to contamination within underlying soils/groundwater.	<p><i>The Environment Agency's LCRM guidance (Ref. 11.1).</i></p> <p>The assessment of these elements is based on the risk presented by the presence of a hazard (for example, contamination) for a given circumstance, i.e. the probability and consequence of an event occurring.</p> <p>The level of risk has been evaluated in accordance with the methodology set out in the <i>Contaminated land risk assessment. A guide to good practice (C552) (Ref. 11.7)</i>.</p>
Controlled waters in relation to potential contamination within the underlying soils/groundwater/surface water.	
Below ground services in relation to potential contamination within the underlying soils/groundwater/surface waters.	
Agricultural land and soils in relation to loss of good agricultural soil and potential contamination within the underlying soils/groundwater.	<p>The methodology followed to categorise agricultural land receptor sensitivity is in line with <i>the Design Manual for Roads and Bridges LA 109 (Ref. 11.8)</i>, the <i>Ministry of Agriculture, Fisheries and Food revised guidelines (Ref. 11.9)</i>, the <i>National Planning Policy Framework (NPPF) (Ref. 11.10)</i> and the Institute of Environmental Management and</p>

Elements Scoped in	Methodology
	Assessment (IEMA) guide titled <i>A New Perspective on Land and Soil in Environmental Impact Assessment (2022)</i> (Ref. 11.11).

## SIGNIFICANCE CRITERIA

### Approach to Assessing Significance

- 11.4.8. The approach to assessing significance of effects for land contamination on human health, controlled waters, below ground services, building structures, soils and agricultural land is provided in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**.
- 11.4.9. The attribute importance (sensitivity) assigned to environmental attributes and contaminated land receptors along with the justification is shown in **Table 11-5**.

**Table 11-5 - Attribute Importance (Sensitivity)**

Sensitive Receptor	Justification	Sensitivity
Third-party neighbours in relation to potential exposure to contamination within underlying soils/groundwater.	Third-party neighbours are those present at adjacent Public Rights of Way and Accessible Open Land, surrounding commercial properties, surrounding roads and Kempston Hardwick Station. They are unlikely to be within areas of construction which include significant disturbance of ground during construction. Additionally, the Construction Phase will be undertaken in accordance with the measures set out in <b>Appendix 2.3: Outline Construction Environmental Management Plan (OCEMP) (Volume 3)</b> and <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b> . As presented in <b>Appendix 2.3: OCEMP (Volume 3)</b> , all relevant legislation, guidance and best practice will be followed, which will mitigate risks to third-party neighbours during construction of the Proposed Development. The Outline Land Remediation Strategy ( <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b> ) outlines how remediation will be undertaken, and unexpected contamination will be managed.	Low to Medium
Below ground services in relation to potential contamination within the underlying soils/groundwater.	Utility services and structures located off-Site but within the 250m Site boundary including those associated with adjacent commercial and residential properties and surrounding roads and rail. Some buried pipe materials are susceptible to chemical attack, causing degradation and / or leaching through e.g. plastic pipe walls and contamination of a water supply. Damage of buried pipes can also lead to leaks of liquids and gases, impacting soil and water quality. Service trenches can act as pathways for contaminants via more permeable backfill such as crushed concrete and shingle.	Low
Groundwater within the Secondary Undifferentiated Aquifer and Secondary A Aquifer.	The superficial Head Deposits is a Secondary Undifferentiated Aquifer. The superficial Alluvium is a Secondary A aquifer. The Groundsure Report indicates that groundwater residing in the superficial aquifers is of	Medium

Sensitive Receptor	Justification	Sensitivity
	medium to high vulnerability. A groundwater body is highly vulnerable to pollution when it is in an area with high leaching soils, which allows pollutants to move quickly through the soil profile and into groundwater. A groundwater body is described as having medium vulnerability when there is some protection from overlying soils, but is still susceptible to pollution.	
Groundwater within the bedrock: Peterborough Member.	The Peterborough Member Mudstone is an unproductive aquifer. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. No area of the Proposed Development is located within a published groundwater Source Protection Zone (SPZ).	Low
Groundwater within the bedrock: Kellaways Sand Member (Kellaways Formation).	The Kellaways Sand Member is a confined Secondary A Aquifer situated beneath the Peterborough Member Mudstone. No area of the Proposed Development is located within a published groundwater SPZ. However, ground investigation has proven that a groundwater body is present in the Kellaways Sand Member beneath the Site, that would be vulnerable to pollution from above.	Low to Medium
Groundwater within the bedrock: Cornbrash Formation.	The Cornbrash Formation is a Principal Aquifer located beneath the Kellaways Formation. Information has not been found to indicate that it supports local groundwater abstractions and none of the Site is located within a groundwater SPZ. However, the Cornbrash Formation would be vulnerable to pollution from above.	Low to Medium
Surface water features.	<p>The surface water features are considered to be Medium being located within two surface water body catchments including the Elstow Brook (US Shortstown) (Water body ID: GB105033038050 (ecological quality 'Moderate'; physico-chemical quality 'Good'; chemical quality 'Fail')) and the Harrowden Brook (Water body ID: GB105033038010 (ecological quality 'Bad'; Physico-chemical quality 'Good'; chemical quality 'Fail')).</p> <p>The Elstow Brook runs parallel to the western boundary of the Lake Zone.</p> <p>Unnamed lakes/ponds are located throughout the Lake Zone.</p> <p>An unnamed stream runs through the Core Zone, from the "Coronation Lake" (existing surface water features shown on <b>Figure 12.3: Existing Surface Water Regime (Volume 2)</b>).</p> <p>Minor field drains are Site-wide.</p>	Medium
Agricultural soils (biomass production).	Previous Agricultural Land Classification (ALC) study by others has reported ALC Grade 3a (best and most versatile (BMV)) and 3b (non-BMV) located within the Site boundary. See <b>Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)</b> for full classification of sensitive receptors.	Medium to High

Sensitive Receptor	Justification	Sensitivity
Soil Function (ecological habitat, soil carbon, soil hydrology and mineral resource).	Soils are considered to be Medium due to their likely soil hydrology value and potential ecological and archaeological importance. See <b>Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)</b> for full classification of sensitive receptors.	Medium

## 11.5. BASELINE CONDITIONS

- 11.5.1. The PRA is included as **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**. This details the baseline conditions at the Site and within the study areas with respect to ground conditions, soils and agricultural land, including:
- The '250m study area' (human health);
  - '1km study area' (controlled waters); and
  - 'Soils study area' (soils and agricultural land).
- 11.5.2. **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)** includes a Conceptual Site Model of the Proposed Development in order to identify potential sources of contamination with regards to the sensitive receptors and potential contaminant pathways.
- 11.5.3. Sources reviewed to produce **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)** are listed in **Table 1-1 in Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**.
- 11.5.4. A summary of the existing baseline conditions considering the study area's historical land use; previous ground investigations; geology; ground stability hazards; mining; hydrology; hydrogeology; water abstractions; ecological designations; radon risk; unexploded ordnance (UXO) risk; and potential sources of contamination is provided below.

### HISTORICAL LAND USE

- 11.5.5. A historical review of activities at the Site and within the surrounding land from the late 19<sup>th</sup> Century to present day, plus historical maps, are presented in **Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**.

### GROUND INVESTIGATIONS

- 11.5.6. The following third-party ground investigation reports have been reviewed:
- Former Kempston Brickworks Factual Geotechnical Investigation Report (SLR Consulting) (**Ref. 11.12**); and
  - Phase 2 Preliminary Geo-Environmental Ground Investigation Interpretive Report (Arcadis) (**Ref. 11.2**).
- 11.5.7. **Appendix 11.2: Ground Investigation Technical Note (Volume 3)** provides a detailed review of the above ground investigation reports.
- 11.5.8. It is noted that there are uncertainties related to the third-party land contamination information reviewed, in particular:
- Areas of landfill have not been fully delineated which may impact future design/material re-use opportunities;

- No waste characterisation assessments of soils have been undertaken to date; and
- Historic ground investigation has not been undertaken for either the East or West Gateway Zones.

### Regionally Important Geodiversity Sites

11.5.9. There are no RIGS located at the Site or within 250m of the Site boundary.

### GEOLOGY

- 11.5.10. Previous ground investigation completed within the Lake and Core Zones has confirmed the presence of Made Ground at varying thicknesses with a maximum layer of 10.80m encountered below the former Kempston Hardwick Brickworks at the southern extent of the Lake Zone. Ground investigation completed across the wider area of the Lake Zone, beyond Kempston Hardwick Brickworks, encountered Made Ground up to 3.0m in thickness. Very limited recovery of Made Ground was recorded across the Core Zone, with a maximum thickness of 0.6m recorded.
- 11.5.11. The Peterborough Member of the Oxford Clay Formation was typically encountered immediately below the Made Ground with exception to where Alluvium or Head Deposits were present within the Core Zone.
- 11.5.12. The Kellaways Formation was encountered beneath the Peterborough Member at a thickness of approximately 5.0 to 5.5m, which in turn was sitting above the Cornbrash Formation, encountered at depths between 17.25m and 19.55m below ground level (bgl).

### GROUND STABILITY HAZARDS

- 11.5.13. **Annex 4: Groundsure Report of Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)** provides information on ground stability hazards at the Site. A review of this information indicates that as a whole, ground stability risks range from negligible to moderate and are listed in **Table 11-6**.

**Table 11-6 - Summary of Ground Stability Hazards**

Feature	Hazard Rating
Shrink swell clays	Negligible to moderate
Running sands	Negligible to low
Compressible deposits	Negligible to moderate
Collapsible deposits	Negligible to very low
Landslides	Very Low to low
Ground dissolution of soluble rocks	Negligible

11.5.14. The soils at the Site comprise cohesive Head Deposits and Peterborough Member, which have volume change potential resulting in shrink/swell properties. Ground investigations will be required to support the detailed design of the Proposed Development (as per the mitigation measures set out in **Appendix 11.4: Outline Land Remediation Strategy (Volume 3)**), and these will include tests to characterise the extent of volume change potential. Detailed design stages will incorporate an assessment of the effect of volume change on foundation design and if required measures to prevent the impact of shrink/swell will be incorporated into the foundation design. This will include consideration of the proximity to trees that may result in desiccation to the soils.

11.5.15. In order to fulfil development requirements, existing Site levels may need to be altered as outlined in **Chapter 2: Description of the Proposed Development (Volume 1)**.

## MINING

11.5.16. The Site is not located within a coal mining reporting area and no natural cavities or mining cavities, have been reported on-Site or within 250m of the Site.

11.5.17. Four Brit Pits were identified at the Site, with three located in the Lake Zone and one in the Core Zone. All were used for the extraction of clay and shale.

11.5.18. Numerous records of surface workings were listed at the Site relating to brick works, clay pits, cuttings, ponds, water bodies and various unspecified works.

11.5.19. The Site is within a historical mineral planning area for clay surface mineral working.

## LANDFILLS AND WASTE SITES

### Historical Records

11.5.20. One on-Site historical record pertains to a clay pit (identified as 'Clay Pit'; Site Ref. 18/1977, PIT 63; Environment Agency Ref. EAHL01152), adjacent to the Kempston Hardwick Brickworks. The licence holder was London Brick Landfill Limited. The landfill is recorded as operating between 31 December 1977 to 31 December 1993 and accepted inert, industrial, commercial, and household waste when active. The licence is recorded as having been surrendered. This is also the location of a former waste transfer station.

11.5.21. Another three records relate to 'L Field Clay Pit', 20m west of the Site, with three surrendered licences from 1978, 1984 and 1986 each taking inert, industrial, commercial, household, special, and liquid sludge.

11.5.22. Another record relates to a Waste Site (Elstow Brickworks Site Ref. 5/1976, PIT 55) for Bedfordshire County Council, which is located approximately 159m northeast of the Site. The Site was active between 1964 to 1996 and was licensed to accept household, commercial, and industrial waste.

### Active or Recent Landfills

11.5.23. According to the Groundsure Report (**Annex 4: Groundsure Report of Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**), the Stewartby landfill Site (Environment Agency Ref. EAHL00975), which is located approximately 21m west, is currently active for waste landfilling excluding inert waste.

11.5.24. A Metal Recycling Site, (car breakers), is located immediately east of the Site, on the opposite side of Amphill Road.

## HYDROLOGY

- 11.5.25. The primary sensitive surface water feature within the Site is the Elstow Brook. There are numerous other surface water features within the Site which are detailed in **Chapter 12: Water Resources (Volume 1)**.

## HYDROGEOLOGY

- 11.5.26. Groundwater was observed to be in hydraulic connection with Made Ground and underlying natural deposits (water strikes were encountered between 1.3m and 3.2m bgl during trial pitting within the Kempston Hardwick Brickworks). Where superficial Alluvium and Head Deposits were encountered, a shallow groundwater table between 1.0 to 2.0m bgl that was in continuity with the Made Ground was observed.
- 11.5.27. A deeper aquifer within the Peterborough Member (Oxford Clay Formation) was encountered between 3.9m and 12.9m bgl. A confined groundwater body was recorded within the Kellaways Sand Member, which was evidenced by a significant rise in the groundwater level within a cable percussion borehole of 5.5m after 20 minutes.
- 11.5.28. If the groundwater at the Site is in hydraulic connectivity with the local surface water network, it will likely flow northwards towards the Elstow Brook and then into the River Great Ouse.
- 11.5.29. Further information regarding aquifer designation, groundwater abstractions (public and private) and groundwater quantity and quality is presented in **Chapter 12: Water Resources (Volume 1)**.

## ECOLOGICAL DESIGNATIONS

- 11.5.30. Ecologically sensitive land uses that have been identified within 500m of the Site (as detailed in **Chapter 6: Ecology and Nature Conservation (Volume 1)**); are noted below.
- 11.5.31. The Site is partially located within four SSSI Impact Risk Zones (IRZs); 1) Kings Wood and Glebe Meadows, Houghton Conquest SSSI, 2) Hanger Wood SSSI, 3) Marston Thift SSSI, and 4) Maulden Wood and Pennyfather's Hill SSSI, Maulden Heath SSSI and Maulden Church Meadow SSSI. Whilst all these SSSIs are located more than 2km from the Site, IRZs require consideration of potential indirect effects upon SSSIs e.g. noise, water and air quality from all planning applications, particularly those relating to large infrastructure projects or similar large projects related to aviation and air pollution for livestock and slurry.
- 11.5.32. Two non-statutory County Wildlife Sites (CWSs); Kempston Hardwick Pits CWS and Coronation Pit CWS partially extend into the Site, both are designated a county level for standing water and scrub and woodland habitats they support.
- 11.5.33. The Site is within three nitrate vulnerable zones: one for the Great Ouse surface water, one for the Stewartby Lake eutrophic water, and one for the Huntingdon River Gravels groundwater.

## CLIMATE CHANGE - FUTURE CLIMATE CHANGE

### Sea Level Rise/Flood Risk

- 11.5.34. The Site is currently located approximately 95km from the English Channel and is at an elevation approximately 30m Above Ordnance Datum. Under Representative Concentration Pathway<sup>1</sup> 8.5 (Representative Concentration Pathway (RCP) 8.5) (**Ref. 11.13**), sea level along the coast in proximity to the Site is projected to rise by 1.13m by the year 2100 but will have no impact on the Site.
- 11.5.35. On-Site flood risk is detailed in **Chapter 12: Water Resources (Volume 1)**. The majority of the Site falls within Flood Zone 1, indicating a low risk (less than 0.1% annual probability) of flooding. Localised parts of the Site are located within Flood Zones 2 and 3 indicating they are at a high risk of flooding from rivers. Note that climate change may result in changes to the frequency of extreme weather events and associated flooding.

### Projected Changes to Groundwater Level

- 11.5.36. Far-future median projections<sup>2</sup> (**Ref. 11.13**) for the nearest monitored borehole indicate no significant groundwater level changes for this bedrock aquifer.

## SOIL FUNCTION

- 11.5.37. The National Soil Resources Institute's Soilscape mapping on MAGIC Map viewer (**Ref. 11.14**) indicates soils present are lime-rich loamy and clayey soils with impeded drainage. The 1:250,000 Kempston Hardwick soil map were identified as the Evesham 3 (411d) association which are summarised by Land Information System (LandIS) (**Ref. 11.15**) (Cranfield University, 2024) as slowly permeable seasonally waterlogged clayey soils mostly with brown subsoils. Some fine loamy over clayey and fine silty over clayey soils and, locally on slopes, clayey soils with seasonal waterlogging.
- 11.5.38. The more detailed 1:63,360 scale soil map (**Ref. 11.16**) identified the Site as the Rowsham Association, which is briefly described as clay, clay loam, sandy clay loam over clay loam, or clay with distinct ochreous mottling.

## AGRICULTURAL SOILS

- 11.5.39. Based upon pre-1988 ALC mapping available on the Department for Environment Food and Rural Affairs (Defra) MAGIC Maps (**Ref. 11.14**), the Site comprises agricultural land provisionally classified as between Grades 3 'good to moderate' and land classified as 'non-agricultural'. Pre-1988 mapping does not differentiate between Grade 3a BMV and Grade 3b (non-BMV) and no Post-1988 ALC mapping is available for the Site. However, an area of agricultural land immediately to the west of the Lake Zone indicates the presence of soils mapped as Grade 2 (BMV), Grade 3a (BMV) and Grade 3b (non-BMV). Although the Lake Zone is indicated to be non-agricultural on pre-1988 ALC mapping, a Site walkover has shown that the fields in the north of the Lake Zone (not covered by

<sup>1</sup> To model and predict future climate it is necessary to make assumptions about the economic, social and physical changes to the Environment that will influence climate change. RCPs are a method for capturing those assumptions within a set of scenarios. The conditions of each scenario are used in the process of modelling possible future climate evolution.

<sup>2</sup> For all catchments and boreholes, daily river flow (groundwater level) projections have been produced from 1982 – 2080.

lake and remains of the former brickworks) is in current agricultural usage. There may be potential for BMV soils to be present within this area of the Site. The East Gateway Zone is also mapped as non-agricultural, and it does not appear to be in agricultural usage. The Proposed Development Zones are mapped on the **Zonal Plan (Document Reference 1.8.0)**.

- 11.5.40. An ALC survey was undertaken in October 2018 within the West Gateway Zone and Core Zone covering an area of approximately 130ha. The West Gateway Zone was classified as Grade 3b (non-BMV). The main limitation identified was seasonal wetness within the subsoils depicted by slowly permeable layers and gleying being present. The majority of the Core Zone was classified as Grade 3b with areas of non-agricultural land associated with roads and woodland. The survey indicated that approximately 12ha of Grade 3a (BMV) was present within the Core Zone. The total area of Grade 3b (non-BMV) across the 120ha surveyed was 104ha.

## RADON

- 11.5.41. Review of both the Groundsure Report (see **Annex 4: Groundsure Report of Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**) and UK Health Security Agency website (**Ref. 11.17**) indicates that the Site is located within an area where less than 1% of properties would exceed the Radon Action Level.
- 11.5.42. Although the radon data used above is related to measurements in homes, the maps indicate the likely extent of the local radon hazard in all buildings. The information is therefore relevant to employers in assessing workplace risks. Under the Health and Safety at Work Act 1974 (**Ref. 11.18**), employers must, so far as is reasonably practicable, ensure the health and safety of employees and others who have access to their work environment. *The Management of Health and Safety at Work Regulations 1999* (**Ref. 11.19**) require the assessment of health and safety risks, and this should include radon in the following circumstances:
- All below ground workplaces in the UK; and
  - All workplaces located in radon affected areas.
- 11.5.43. Radon mitigation measures are not expected to be required for the Proposed Development.

## UNEXPLODED ORDNANCE

- 11.5.44. WSP commissioned Zetica Limited to complete a Pre-Desk Study Assessment and a detailed UXO Desk Study and Risk Assessment to further assess UXO risks at the Site; Zetica provided the report UXO Desk Study and Risk Assessment (see **Annex 5: Unexploded Ordnance of Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**).
- 11.5.45. The detailed assessment concluded that the risk of encountering UXO was assessed as Low, defined as 'no positive evidence that UXO is present, but its occurrence cannot be totally discounted'. Zetica did recommend that a UXO awareness briefing was prudent for all construction staff involved with below ground excavations. This recommendation is detailed in **Appendix 2.3: OCEMP (Volume 3)**.
- 11.5.46. A copy of the WSP Technical Note with the full Zetica detailed UXO Desk Study and Risk Assessment is provided in **Annex 5: Unexploded Ordnance of Appendix 11.1: Contaminated Land Preliminary Risk Assessment (Volume 3)**.

## POTENTIAL SOURCES OF CONTAMINATION

11.5.47. **Table 11-7** provides a summary of the potential sources of contamination that may be present at the Site, as well as the potential contaminants of concern resulting from such and their distribution across the Site.

**Table 11-7 - Potential Sources of Contamination**

Potential Source	Potential Contaminants of Concern	Likely/Anticipated Distribution
<b>ON-SITE</b>		
Made Ground associated with infilled river channel, former brickworks (including Above-Ground Storage Tanks and Underground Storage Tanks), clay pits, infilled land, historical landfill sites and surrounding on-Site roads and railway	Inorganics, Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPHs), metals, asbestos, Volatile Organic Compounds (VOCs), Benzene Toluene Ethylbenzene Xylene (BTEX), Semi Volatile Organic Compounds (SVOCs) and ground gases/vapours.	Lake Zone, East Gateway Zone and West Gateway Zone
Electrical Substations	Polychlorinated biphenyls (PCBs), mineral oils and Asbestos Containing Materials (ACMs).	Southern boundary of the Lake Zone and southern boundary of East Gateway Zone.
Structurally bound asbestos within the fabric of remaining buildings.	ACMs.	Site-wide.
Agricultural practices and use of pesticides and herbicides	Petroleum hydrocarbons, PAHs, BTEX, oils, fertilisers, herbicides and pesticides.	Northern area of Lake Zone, Core Zone and West Gateway Zone.
<b>OFF-SITE</b>		
Made Ground	Asbestos fibres, metals, PAHs, TPH, BTEX, VOCs, SVOCs fuel oils, ground gases (methane and carbon dioxide).	Associated with surrounding developed land.
Railway sidings	Asbestos, metals, inorganics, PAHs, TPHs, BTEX compounds, VOCs, PCBs and hazardous ground gases (methane and carbon dioxide) and vapours.	All directions.
Disused pits converted to landfill	Mercury, cadmium, arsenic, chromium, copper, iron, lead and nickel	Immediately south of the Site.

Potential Source	Potential Contaminants of Concern	Likely/Anticipated Distribution
Concrete Plants	Inorganics, metals, TPH, PAHs, SVOCs and VOCs.	Between the Core Zone and Lake Zone and on the eastern boundary of the Lake Zone.

## FUTURE BASELINE

- 11.5.48. Other than the above potential Site conditions, in the absence of the Proposed Development, it is likely that the Site conditions would remain as they are reported within the baseline. Potential areas of contamination located within the Site boundary are unlikely to be disturbed and thus the degree of risk to the identified receptors is unlikely to increase if the surrounding land use remains unchanged.
- 11.5.49. Based upon current climate change scenario projections under RCP8.5 (**Ref. 11.13**) there are not anticipated to be significant changes to groundwater levels or sea level rise from the present baseline.
- 11.5.50. There are no identified committed developments within the Site that are likely to affect the future baseline.

## SENSITIVE RECEPTORS

11.5.51. The following sensitive receptors have been assessed:

- Human Health:
  - Third-party neighbours.
- Controlled waters:
  - Groundwater within the Secondary Undifferentiated Aquifer, Secondary A Aquifers and Principal Aquifer; and
  - Surface Water - Elstow Brook and other surface water features (detailed in **Chapter 12: Water Resources (Volume 1)**).
- Services:
  - Below ground services
- Other:
  - Agricultural land and soils.

## 11.6. ASSESSMENT OF POTENTIAL EFFECTS, MITIGATION AND RESIDUAL EFFECTS

### CONSTRUCTION PHASE

- 11.6.1. The assessment of potential effects, mitigation, residual effects and monitoring during construction is provided in **Table 11-8**.
- 11.6.2. The assessment of effects during the Construction Phase assumes that embedded mitigation in the form of adherence to the following relevant legislation, guidance and best practice:
- Building Research Establishment (BRE), 'BRE Special Digest 1:2005 Concrete in Aggressive Ground' (**Ref. 11.20**);

- UK Water Industry Research (UKWIR), 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' (**Ref. 11.21**); and
- British Standards Institution, 'BS 6031:2009 – Code of Practice for Earthworks' (**Ref. 11.22**).

11.6.3. Where this is particularly relevant to the sensitive receptor, the assessment tables set this out in **Table 11-8**.

**Table 11-8 - Assessment of Potential Effects, Mitigation, Residual Effects and Monitoring During Construction**

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
Third-party neighbours	<b>Potential Effects</b>	<p>Excavation of potentially contaminated soils could pose a health risk to third-party neighbours present at properties in the immediate vicinity of the Proposed Development, through inhalation of contaminated dusts and particulate matter generated by excavation/activities that involve the disturbance of Made Ground. Exposure to dust during construction works is further detailed in <b>Chapter 8: Air Quality (Volume 1)</b>.</p> <p>Third-party neighbours may be exposed to contaminants that are present in the Made Ground, or that are present in the ground (i.e. after migrating from off-Site sources) during any earthworks or activities that involves the disturbance of Made Ground. These works may facilitate exposure to asbestos or other contaminants by the inhalation of dusts, gases or vapours, dermal contact with soil and groundwater and ingestion of soil and dust.</p> <p>Previous ground investigation has targeted the Lake Zone and Core Zone within the boundary of the Site; however, data gaps exist for those areas where no ground investigation has been undertaken to date and unknown contamination could be present. No remediation work has been completed to date and elevated concentrations of contaminants of concern such as metals, metalloids, organics and asbestos could be present within the underlying soils.</p> <p>The impact to third-party neighbours would be dependent on the type and nature of contamination (if present) and the characteristics of receptor and duration of exposure (i.e., vulnerable child or elderly person). Exposure/impact to third-party neighbours would most likely be indirect (i.e., inhalation of windblown dusts in ambient air). If these receptors are exposed to contaminants above threshold concentrations, there is potential for both short (temporary) and long-term (permanent) health problems to arise dependent on the nature of the contaminants encountered.</p> <p>On this basis, the potential for mobilisation of contamination to impact off-Site human health receptors for the:</p> <ul style="list-style-type: none"> <li>■ Baseline is Moderate/Moderate to Low risk; and</li> <li>■ Construction without mitigation High/Moderate risk.</li> </ul> <p>Change in risk (significance) without mitigation are likely to be <b>Moderate Negative (Significant)</b>.</p>
	<b>Additional Mitigation</b>	The following measures have been incorporated in <b>Appendix 2.3: OCEMP (Volume 3)</b> :

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring
	<ul style="list-style-type: none"> <li>Water will be sprayed onto material being worked to damp down any potentially contaminated dust and prevent it from becoming airborne where it may affect third-party neighbours. Wheel washing of site vehicles will be implemented to prevent tracking of contaminated material off-Site; and</li> <li>Dust suppression measures (e.g., damping down) will be implemented to minimise the potential for dust generation (see <b>Appendix 2.3: OCEMP (Volume 3)</b>).</li> </ul> <p>Ground investigation and risk assessment will be carried out within areas of temporary and permanent land take and where not previously investigated to identify potential contaminant linkages prior to commencement of the Construction Phase in line with <i>British Standards 10175 (2011+A2:2017), Investigation of Potentially Contaminated Sites - Code of Practice</i> (<b>Ref. 11.23</b>) and LCRM guidance (<b>Ref. 11.1</b>) as set out in <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b>.</p> <p><b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b> outlines the mitigation measures required in order to manage any residual risks to human health receptors arising from different types of potential contaminants. A detailed Land Remediation Plan will be prepared based on the findings of the ground investigations and the measures within <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b>.</p> <p>As explained in <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b>, any remediation undertaken would be validated and reported on within a Verification Report to provide confidence that it has been undertaken in accordance with the agreed strategy.</p> <p>There is a possibility that previously unidentified contamination may be encountered within soils and groundwater during construction works. A watching brief for ground contamination will be maintained. If visually contaminated or odorous material is encountered during the works, the assistance of a suitably qualified and experienced person (a geo-environmental engineer) will be sought.</p> <p><b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b> also details the materials management measures that must be complied with during the Primary Phase Construction Phase. The document requires that a Materials Management Plan (MMP) be prepared following detailed earthworks modelling and prior to the commencement of cut and fill works (post-consent) by the Contractor(s) to monitor the maximum reuse of both natural soil and made ground. The MMP will be approved and submitted by a Qualified Person. This is a self-certification procedure and the MMP will be submitted Contaminated Land: Applications in Real Environments (CL:AIRE).</p> <p>The MMP would be undertaken in accordance with the <i>CL:AIRE 'Definition of Waste: Development Industry Code of Practice'</i> (<b>Ref. 11.24</b>) to ensure that soil reuse and imported materials are suitable for their intended use and will not significantly affect human health or the environment.</p>

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
	<b>Residual Effects and Monitoring</b>	<p>The baseline risk has been assessed as Moderate/Moderate Low and the risk associated with construction, following the mitigation measures provided above, has been assessed as Moderate/Low. The mitigation measures will negate against the release of dust, particulates and fibres and subsequent exposure to occupants of neighbouring land. Therefore, the overall change in risk (significance) has been assessed as <b>Minor Positive</b>, which is <b>Not Significant</b> in EIA terms<sup>3</sup>.</p>
<p>Controlled waters</p> <ul style="list-style-type: none"> <li>■ Groundwater within the Secondary Undifferentiated Aquifer, Secondary A Aquifers and Principal Aquifer; and</li> <li>■ Surface Water - Elstow Brook and other surface water features.</li> </ul>	<b>Potential Effects</b>	<p>Contaminative land uses have been identified for parts of the Site, in particular historical activities associated with the brickworks and landfilling.</p> <p>Ground investigation works undertaken to date have not reported significant contaminant impact within groundwater underlying the Site which are not considered to require remedial intervention. However, data gaps exist in the current contaminated land assessments and further ground investigation would be required to target additional areas of the Site.</p> <p>Ground investigations have not yet been undertaken within areas of temporary land use (such as for construction compounds). However, should contaminants be present within these areas, migration to groundwater or surface water during any earthworks or activities (including reprofiling of existing lake and partial infill) may occur.</p> <p>During construction, the exposure and/or displacement of soils/Made Ground via the removal of surface cover (e.g., hardstanding and/or vegetation) has the potential to mobilise soil-bound contaminants/sediment via soil erosion/overland flow migration pathways, resulting in impacts on surface water features and lead to an increase in the vertical leaching of contaminants from soils to underlying groundwater.</p> <p>Piling techniques may be required through future foundation design for the Proposed Development. Piling may create preferential/direct exposure contaminant migration pathways (i.e., connect contaminants (if present) within shallow soils to underlying aquifers, including the Kellaway Sand Member Secondary Aquifer and the Cornbrash Formation Principal Aquifer).</p> <p>Impacts to underlying groundwater may have an indirect adverse effect on the quality of local licensed and unlicensed abstractions which could be undergoing potable use.</p> <p>The use of machinery and plant associated with construction activities (including the establishment of a Site construction</p>

<sup>3</sup> There is no established guidance on how to use the LCRM risk assessment approach as the basis for the evaluation of the significance of effects within the EIA process. For the purposes of the EIA, the magnitude of a change in status from baseline is identified as an impact caused by the Proposed Development and the consequences of those changes are identified as effects. Consequently, for the assessment, the impact and its effect have been defined as a change in risk and the magnitude of the change in risk from baseline, through construction pre- and post-mitigation measures. The assessment of Agricultural Land Classification (ALC) and soil function is distinct and separate from the methodology followed for the contaminated land assessment (further detail is provided in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**).

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
		<p>compound and storage of chemicals or fuels) could give rise to localised, indirect contaminant impact to surface and groundwater receptors through accidental fuel/oil and chemical spills and leaks.</p> <p>Based on the principles of natural attenuation (i.e., eventual weakening of contaminants caused by various processes e.g., dilution) all effects on controlled waters receptors would be temporary but would vary in duration dependent on the nature of the contaminants released.</p> <p>On this basis, the potential for mobilisation of contamination to impact controlled water receptors is as follows:</p> <ul style="list-style-type: none"> <li>■ Baseline is Moderate/Moderate to Low risk; and</li> <li>■ Construction without mitigation is Moderate risk.</li> </ul> <p>Change in risk (significance) without mitigation <b>Minor Negative (Not Significant)</b>.</p>
	Additional Mitigation	<p>During the Construction Phase, risks posed to controlled waters from potential sources of contamination will be accounted for within a Construction Environmental Management Plan (CEMP) prepared by the appointed Principal Contractor. Within this document a number of mitigation measures protective of controlled waters will be detailed such as the specification of on-Site fuel storage (i.e., integrally bundled containers).</p> <p>Ground investigation and risk assessment will be carried out within areas of permanent and temporary land take to identify potential contaminant linkages prior to commencement of the Construction Phase in line with <i>British Standards 10175 (2011+A2:2017), Investigation of Potentially Contaminated Sites - Code of Practice (Ref. 11.23)</i> and <i>LCRM guidance (Ref. 11.1)</i>.</p> <p>An Outline Land Remediation Strategy has been produced, outlining the mitigation measures required in order to manage any residual risks to controlled waters as set out in <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b>.</p> <p>Any remediation undertaken would be validated and reported on within a Verification Report to provide confidence that it has been undertaken with the agreed strategy.</p> <p>There is a possibility that previously unidentified contamination may be encountered within soils and groundwater during construction works. A watching brief for ground contamination will be maintained. If visually contaminated or odorous material is encountered during the works, the assistance of a suitably qualified and experienced person (a geo-environmental engineer) will be sought.</p> <p>If Site-won material is to be reused across the Proposed Development, this should be undertaken in accordance with a MMP, in accordance with <i>CL:AIRE Definition of Waste: Code of Practice (Ref. 11.24)</i> as set out in <b>Appendix 11.4: Outline Land Remediation Strategy (Volume 3)</b>. This will also form part of a wider Earthworks Specification for the Proposed Development, covered by <b>Appendix 2.3: OCEMP (Volume 3)</b>. This will ensure the chemical suitability of the placement of soils at depth (i.e., potentially in contact with underlying groundwater) or within close</p>

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
		<p>proximity to sensitive receptors i.e., embankments associated with surface water features that fall within the Site.</p> <p>A Piling Risk Assessment would be produced to outline measures to protect the underlying aquifers during construction and mitigate risk of creating preferential pathways for potential contamination as set out in Section 3.9 of <b>Appendix 2.3: OCEMP (Volume 3)</b>.</p>
	<b>Residual Effects and Monitoring</b>	<p>The baseline risk has been assessed as Moderate/Moderate Low and the risk associated with construction following mitigation measures has been assessed as Low.</p> <p>The mitigation measures will negate against pathways being formed during construction that could adversely impact on controlled waters. Therefore, the overall change in risk (significance) has been assessed as <b>Minor Positive</b>, which is <b>Not Significant</b> in EIA terms.</p>
Below ground services in relation to potential contamination within the underlying soils/groundwater.	<b>Potential Effects</b>	<p>Risks to below ground services, building structures and foundations may be present in the Construction Phase during open trench excavation for new installations.</p> <p>However, they are not considered likely to be adversely affected by contamination during construction as the Construction Phase for the Proposed Development will be undertaken in accordance with all relevant legislation, guidance and best practice, which will mitigate the migration of potential contamination to the receptors.</p> <p>Potable water supply pipes have the potential to be impacted by contamination. Chemical data will be obtained at the detailed design stage and used to ensure appropriate construction materials (such as concrete classification) are selected for new installations.</p> <p>On this basis, the risk to below ground services is as follows:</p> <ul style="list-style-type: none"> <li>■ Baseline is Moderate/Moderate to Low risk; and</li> <li>■ Construction without mitigation is Moderate risk.</li> </ul> <p>Change in risk (significance) without mitigation <b>Minor Negative Adverse (Not Significant)</b>.</p>
	<b>Embedded Mitigation</b>	<p>The Proposed Development will be undertaken in accordance with all relevant legislation, guidance and best practice so that specification of below ground materials will be suitable to identified ground conditions, including:</p> <ul style="list-style-type: none"> <li>■ Building Research Establishment (BRE), 'BRE Special Digest 1:2005 Concrete in Aggressive Ground' (<b>Ref. 11.20</b>);</li> <li>■ UK Water Industry Research (UKWIR), 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' (<b>Ref. 11.21</b>); and</li> <li>■ British Standards Institution, 'BS 6031:2009 – Code of Practice for Earthworks' (<b>Ref. 11.22</b>).</li> </ul> <p>Measures to include, for example, are:</p> <ul style="list-style-type: none"> <li>■ Use of sulphate resistant concrete if required depending upon aggressive ground risk assessment;</li> </ul>

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
		<ul style="list-style-type: none"> <li>■ Buried pipe material risk assessment to select appropriate subsurface construction materials; and</li> <li>■ Use of clean backfill in utility corridors.</li> </ul>
	Residual Effects and Monitoring	<p>The construction risk with mitigation is Low Risk.</p> <p>The mitigation measures will negate against new subsurface construction materials being at risk of chemical attack or creating new contaminant pathways. Therefore, the change from the current baseline risk and the effect following mitigation would be <b>Minor Positive</b>, which is <b>Not Significant</b> in EIA terms.</p>
Agricultural Soils	Potential Effects	<p>An ALC has been undertaken for the majority of land within the West Gateway Zone and Core Zone covering an area of approximately 130ha. Pre-1988 mapping has been reviewed for all other areas within the Site boundary.</p> <p>The detailed ALC survey determined that 12ha of ALC Grade 3a (BMV) soils are present within the Core Zone. 104ha of Grade 3b (non-BMV) are present across the remainder of the Core Zone and West Gateway Zone.</p> <p>For areas within the Soils study area not subject to a detailed ALC survey, based upon pre-1988 mapping, non-agricultural land is mapped as being present within the Lake Zone and East Gateway Zone. However, a Site walkover has shown that the field in the north of the Lake Zone is used for agricultural purposes and covers an area of approximately 31ha. Additionally Post-1988 ALC mapping indicates that Grade 2 (BMV) and Grade 3a (BMV) soils are present in the area and therefore may be present within the Lake Zone although is highly unlikely to cover the entire field. Historical mapping also indicates the southern portion of this field was previously a river which was since infilled. However considering a cautious worst case assessment it is assumed that the entirety of this field is BMV.</p> <p>Therefore, the total area of BMV land required for the Proposed Development is approximately 43ha all of which will be permanent land take. The remainder of the soils within the soil study area are Grade 3b (non BMV) or non-agricultural.</p> <p>Construction activities associated with the Proposed Development will result in adversely impacting underlying agricultural soils by the compaction, sealing and loss of potentially productive/valuable agricultural land.</p> <p>The impact to soils beneath the footprint of the Proposed Development will be permanent (i.e., will be covered in hardstanding). Impacts to soils within areas of temporary construction works (i.e., within satellite compounds or access tracks) may only be temporary and could be subject to a period of restoration.</p> <p>The sensitivity of agricultural soils range between low to high and the magnitude of impact, prior to mitigation, is major as &gt;20ha of BMV will be impacted. Therefore, there is likely to be a direct, temporary/permanent, long-term <b>Large/Very Large Adverse</b> effect</p>

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
		(Significant) on agricultural soils prior to the implementation of additional mitigation measures.
	Additional Mitigation	<p>A Soil Resource Survey will be undertaken to inform how soils across the Proposed Development may best be managed, protected or re-used.</p> <p>A Soil Management Plan would be produced prior to any enabling or construction works commencing as part of the CEMP, the principles are set out in <b>Appendix 2.3: OCEMP (Volume 3)</b>. This will describe best practice methods to reduce impacts to soil during handling and would be informed by Site-specific soil and climatological data. This would include details on stripping methods, stockpiling requirements, appropriate management (including weather conditions during handling, seeding of stockpiles, stockpile heights etc) and reinstatement. Works will also be undertaken in compliance with Defra's Construction Code of Practice (<b>Ref. 11.25</b>).</p> <p>Site-won material is to be reused across the Proposed Development, which will be undertaken in accordance with a MMP, in accordance with <i>CL:AIRE Definition of Waste: Code of Practice</i> (<b>Ref. 11.24</b>).</p>
	Residual Effects and Monitoring	<p>The sensitivity of underlying agricultural soil resources is low-high, and the magnitude of effect, following mitigation, remains major due to the permanent loss of 43ha of BMV. Therefore, there is likely to be a direct, temporary/permanent, long-term <b>Large/Very Large Adverse</b> residual effect on soil resources (<b>Significant</b>).</p>
Soil Function	Potential Effects	<p>Soils within the Site are lime-rich loamy and clayey soils and are therefore considered to be mineral soils (medium sensitivity) which play an important role as a carbon store. Continued agricultural use can lead to the gradual loss of carbon overtime through aeration and oxidation. However, disturbance, removal or sealing of the soils will also have a negative impact on the soils' ability to store carbon.</p> <p>The impact to soil function (in particular the soils' function in supporting water flows and flood risk management within the catchment) (medium sensitivity) beneath the footprint of the Proposed Development will be permanent (i.e., will be covered in hardstanding). Impacts to soils within some areas of temporary construction works (i.e. within the Lake Zone) may only be temporary and could be subject to a period of restoration.</p> <p>Compaction caused by soil handling activities and construction traffic can cause significantly reduced soil infiltration rates. This may result in an adverse impact of the underlying soil function in supporting water flows and flood management associated with the River Great Ouse by the removal, compaction, and sealing of these soils.</p> <p>Two non-statutory CWSs - Kempston Hardwick Pits CWS and Coronation Pit CWS - partially extend into the Site. Both are designated a county level for standing water, scrub and woodland</p>

Sensitive Receptor	Potential Effects/Mitigation/Residual Effects and Monitoring	
		<p>habitats they support and are supported by the soils on-site (medium sensitivity).</p> <p>Overall, the sensitivity of soil function is medium and the magnitude of impact, prior to mitigation, is moderate. Therefore, there is likely to be a direct, temporary/permanent, long-term <b>Moderate Adverse effect (Significant)</b> on soil function prior to the implementation of additional mitigation measures.</p>
	<b>Additional Mitigation</b>	<p>A Soil Resource Survey will be undertaken to inform how soils across the Proposed Development may best be managed, protected or re-used.</p> <p>A Soil Management Plan would be produced prior to any enabling or construction works commencing a part of the CEMP, the principles are set out in <b>Appendix 2.3: OCEMP (Volume 3)</b>. This will describe best practice methods to reduce impacts to soil during handling and would be informed by site-specific soil and climatological data. This would include details on stripping methods, stockpiling requirements, appropriate management (including weather conditions during handling, seeding of stockpiles, stockpile heights etc) and reinstatement. Works should also be undertaken in compliance with Defra's Construction Code of Practice (<b>Ref. 11.25</b>).</p> <p>Measures outlined within Annex E and Appendix K of the <i>IEMA A New Perspective on Land and Soil in Environmental Impact Assessment</i> guidance (<b>Ref. 11.11</b>) will also be followed by the Contractor.</p> <p>In addition, best practice construction methods would be included in the CEMP to provide methods of minimising the loss or reduction of soil functions. The principles are set out in <b>Appendix 2.3: OCEMP (Volume 3)</b>.</p> <p>If Site-won material is to be reused across the Proposed Development, this will be undertaken in accordance with a MMP, in accordance with <i>CL:AIRE Definition of Waste: Code of Practice</i> (<b>Ref. 11.24</b>).</p>
	<b>Residual Effects and Monitoring</b>	<p>The sensitivity of underlying soil function is medium, and the magnitude of effect, following mitigation, is minor. Therefore, there is likely to be a direct, temporary/permanent, long-term <b>Minor Adverse</b> residual effect on soil function (<b>Not Significant</b>) following the implementation of mitigation measures.</p>

## CUMULATIVE EFFECTS

- 11.6.4. As referred to in **Chapter: 3 Approach to EIA (Volume 1)**, the cumulative assessment for Ground Conditions, Soils and Agricultural Lands is set out in **Chapter 18: Cumulative Effects (Volume 1)**.

## 11.7. OPPORTUNITIES FOR ENVIRONMENTAL ENHANCEMENT

- 11.7.1. The NPPF (**Ref. 11.10**) requires the Proposed Development to be ‘suitable for use’ in relation to ground contamination (NPPF Paragraph 196(a)) and “*after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990*” (NPPF Paragraph 196(b)). Therefore, should contamination be present, the development of the Proposed Development would provide a beneficial effect through remediation works, if required. Beyond this it is not considered that there are further opportunities for environmental enhancements in relation to ground conditions, soils, and agricultural land for the Proposed Development.

## 11.8. DIFFICULTIES AND UNCERTAINTIES

- 11.8.1. The work undertaken to provide the basis of this assessment comprised a study of available documented information from a variety of sources. WSP cannot warrant the work of these third-party reports.
- 11.8.2. It should be noted that any risks identified in this chapter are perceived risks based on the information reviewed; actual risks can only be assessed following further surveys and intrusive investigation of the Site. Future ground investigation shall target the proposed end use of the Site based on detailed design where possible.

## 11.9. SUMMARY OF LIKELY SIGNIFICANT EFFECTS AND PROPOSED MITIGATION

- 11.9.1. **Table 11-9<sup>4</sup>** and **Table 11-10** present a summary of the likely significant effects relating to Ground Conditions, and Soils and Agricultural Land as a result of the Proposed Development, and the mitigation measures proposed to avoid, prevent, reduce or, offset (if possible and required) any identified significant adverse effects. The tables summarise those effects that were identified within the assessment as likely to be significant prior to the consideration of mitigation. Significant effects are identified as Major or Moderate. Effects that are identified as Negligible or Minor are not considered to be significant, and therefore, are not listed in the summary tables.

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<sup>4</sup> There is no established guidance on how to use the LCRM risk assessment approach as the basis for the evaluation of the significance of effects within the EIA process. For the purposes of the EIA, the magnitude of a change in status from baseline is identified as an impact caused by the Proposed Development and the consequences of those changes are identified as effects. Consequently, for the assessment, the impact and its effect have been defined as a change in risk and the magnitude of the change in risk from baseline, through construction pre- and post-mitigation measures. The assessment of Agricultural Land Classification (ALC) and soil function is distinct and separate from the methodology followed for the contaminated land assessment (further detail is provided in **Appendix 3.2: Significance Criteria for all ES Technical Topics (Volume 3)**).

**Table 11-9 - Summary of Likely Significant Effects and Proposed Mitigation for Ground Conditions (Land Contamination) Assessment**

	Baseline Level of Risk			Construction Risk before Mitigation Measures			Change in Risk (Significance) without Mitigation	Construction Risk following Mitigation Measures			Change in Risk (Significance) with Mitigation
	Like-lihood	Consequence	Risk	Like-lihood	Consequence	Risk		Like-lihood	Consequence	Risk	
Construction											
Impact on occupants of neighbouring land (migration of dust, fibres, particulates)	Low to Likely	Medium to Severe	Moderate to Moderate/ Low	Likely	Medium to Severe	High/Mod erate	Moderate Negative (Potentially Significant)	Unlikely	Medium to Severe	Moderate/ Low Risk	Minor Positive (Not Significant)

**Table 11-10 - Summary of Residual Effects for Soils and Agricultural Land**

Key to table:

**P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable**

Receptor	Description of Effect	Classification of Effect	Additional Mitigation	Classification of Residual Effect	Significant/not Significant
Agricultural Soils	Potential effects associated with construction activities impacting agricultural soils.	<b>Large/Very Large Adverse ('Major Adverse')</b> P/T/D/LT	Completion of a Soil Resource Survey. Any Site-won material to be reused across the Proposed Development should be undertaken in accordance with an MMP. A Soil Management Plan should be produced prior to any enabling or construction works commencing.	<b>Large/Very Large Adverse ('Major Adverse')</b> P/T/D/LT	<b>Significant</b>
Soil Function	Potential effects associated with construction activities impacting soil resource and function.	<b>Moderate Adverse</b> P/T/D/LT	Completion of a Soil Resource Survey. If Site-won material is to be reused across the Proposed Development, this should be undertaken in accordance with an MMP. A Soil Management Plan should be produced prior to any enabling or construction works commencing. Measures outlined within Annex E and Appendix K of the IEMA <i>A New Perspective on Land and Soil in Environmental Impact Assessment</i> guidance ( <b>Ref. 11.11</b> ) should also be incorporated into the CEMP. The principles are set out in <b>Appendix 2.3: OCEMP (Volume 3)</b> .	<b>Minor Adverse</b> P/T/D/LT	<b>Not Significant</b>

## 11.10. REFERENCES

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