

13. Contaminated Land and Ground Conditions

13.1. Introduction

13.1.1. This Chapter provides an assessment of the baseline ground conditions and contamination status of the Site. This Chapter considers the likely significant effects of the Proposed Development with respect to ground conditions and contamination and describes the methodology for carrying out the assessment. The Chapter also describes the likely mitigation and remedial measures required to avoid, prevent or reduce any significant negative effects as a result of the Proposed Development on sensitive receptors (i.e., human health and controlled waters) and the proposed structures.

13.1.2. This Chapter is supported by the following Appendix:

- **Appendix 13.1:** GeoDyne Limited report entitled '*Toton West, Toton – Phase I Desk Study*' for Bloor Homes Ltd, report ref:D44116, dated 19th December 2024.

13.1.3. The assessment provided in this Chapter is informed by the desk-based assessment and supporting Appendix outlined above. Phase II Exploratory Investigation works have not been undertaken at this stage. The baseline desk study information will be used to inform the scope of any Phase II Exploratory Investigation. It is anticipated that conditions will be applied to any planning permission to ensure that environmental and human receptors are suitably protected, and that appropriate mitigation would be included in the scope of works following the principles set out in this Chapter.

13.2. Assessment Approach

Methodology

Guidance

13.2.1. The assessment has been carried out with reference to the following guidance:

- *The Town and Country Planning (Environmental Impact Assessment) Regulations 2017*¹.

Extent of Study Area

13.2.2. The study area for the Phase I Desk Study (**Appendix 13.1**) comprised the Red Line Boundary for the Site which extends to an approximate area of 19 hectares (ha).

13.2.3. To assist with establishing the historical, environmental and geological setting of the Site and the surrounding area, a 250m search radius was adopted for the Site-specific environmental database search included within the Landmark Envirocheck Report commissioned as part of the Phase I Desk Study works. A copy of the Landmark Envirocheck Report, which includes plans showing the search radius is included in the Phase I Desk Study (see **Appendix 13.1**).

¹ Town and Country Planning (Environmental Impact Assessment) Regulations 2017 [on-line] available at <https://www.legislation.gov.uk/ukxi/2017/571/contents> last accessed 17th January 2025

Contaminated Land and Ground Conditions

- 13.2.4. In relation to the physical effects of the Proposed Development, the study area will be the Site as defined by the **Figure 1.1 'Site Location Plan**.

Site Walkover

- 13.2.5. A site walkover was carried out (December 2024) to obtain photographic records of the Site and to inform the site description included within the Phase I Desk Study Report. Photographic records are included within the Phase I Desk Study Report (**Appendix 13.1**).

Desk Study Information

- 13.2.6. Information utilised within the Desk Study to establish baseline conditions at the Site was obtained from a number of sources, including:
- County Series and Ordnance Survey historical and contemporary mapping;
 - British Geological Survey (BGS) 1:50000 Series Sheets 'Derby' Bedrock and Superficial Deposits (2014) and 'Loughborough' Bedrock and Superficial Deposits (2001);
 - BGS 1:10560 Series Sheet SK43NE (1969);
 - Environmental database search, included within a site-specific Landmark Envirocheck Report;
 - Zetica UXO; and
 - The Coal Authority.
- 13.2.7. The relevant information is summarised and included within the Phase I Desk Study (**Appendix 13.1**).

Assessment of Significance

Significance Criteria

- 13.2.8. The overarching legislation for dealing with contaminated land in England is provided with Part 2A of the Environmental Protection Act 1990² (Part 2A) and The Environment Act 1995³. These Acts recognise that land contamination is of concern if there is an associated potential or actual risk.
- 13.2.9. Section 78A(2) of Part 2A defines contaminated land as:
- "any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –*

² Environmental Protection Act 1990 [on-line] available at <https://www.legislation.gov.uk/ukpga/1990/43/contents> [last accessed 17th January 2025]

³ Environment Act 1995 [on-line] available at <https://www.legislation.gov.uk/ukpga/1995/25/contents> [last accessed 17th January 2025]

- (a) *significant harm is being caused or there is a significant possibility of such harm being caused; or*
- (b) *significant pollution of controlled waters is being caused, or there is the significant possibility of such pollution being caused”.*

13.2.10. Section 78A(4) of Part 2A defines harm as:

“harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property”.

13.2.11. The potential for harm is assessed by developing a Conceptual Site Model (CSM), this is based on the DEFRA (2012)⁴ guidance, which establishes the following:

“The process of risk assessment involves understanding the risks presented by land, and the associated uncertainties. In practice, this understanding is usually developed and communicated in the form of a “conceptual model”.

The development of a CSM is typically undertaken as an iterative process, reflecting the changes in understanding as more detailed site information becomes available.

In development of a CSM, specifically to contaminated land, three essential elements need to be considered to identify the presence of a significant pollutant linkage. These elements form the contaminant–pathway–receptor (CPR) model and are defined as follows:

A “contaminant” is a substance in, on or under the land which has the potential to cause significant harm to a relevant receptor, or to cause significant pollution of controlled waters.

A “receptor” is something that could be adversely affected by a contaminant, for example, a person, an organism, an ecosystem, property or controlled waters.

A “pathway” is a route by which a receptor is or might be affected by a contaminant”.

13.2.12. The presence of measurable contaminant concentrations within the ground does not necessarily imply that contamination is present; for land to be considered potentially contaminated under Part 2A, all three elements of a pollutant linkage must exist.

13.2.13. These principles have been applied within this assessment, together with the application of best practice techniques, including published guidance, and professional judgement based on past experience of contaminated land assessment, to establish the likelihood of a contamination impact and likely severity.

Likely Significant Effects

13.2.14. The assessment considers the likely significant effects to sensitive receptors and the proposed structures with respect to contamination and ground conditions that could result from the Proposed Development during both the construction and operation phases of the Proposed Development.

⁴ Department for Environment, Food & Rural Affairs (DEFRA) (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance

Contaminated Land and Ground Conditions

13.2.15. Where appropriate, the effects of the Proposed Development have been assessed using site-specific data within the Phase I Desk Study Report (**Appendix 13.1**). Where site-specific data is not available, the effects have been assessed using professional judgement.

13.2.16. Schedule 4 of the 2017 regulations¹ requires the following factors of the likely significant effects to be considered for a development:

- Direct and indirect effects;
- Secondary, cumulative and transboundary effects;
- Short term, medium term and long term effects;
- Permanent and temporary effects; and
- Positive (beneficial) and negative (adverse) effects.

Valuation of the Receptor

13.2.17. The criteria adopted to assess the sensitivity of the receptor are detailed in **Table 13.1**. The assessment will be made based on professional judgement, best practice and relevant guidance.

Table 13.1 Criteria for Receptor Sensitivity

Sensitivity of Receptors	Definition
High	A fundamental (either positive or negative) change to the ground conditions and associated sensitive receptors (human health and controlled waters) could be expected as a result of the Proposed Development
Medium	A moderate (either positive or negative) change to the ground conditions and associated sensitive receptors (human health and controlled waters) could be expected as a result of the Proposed Development
Low	The ground conditions and associated sensitive receptors (human health and controlled waters) are able to tolerate change (either positive or negative) which could be expected as a result of the Proposed Development.
Negligible	No discernible change is expected to the ground conditions and associated sensitive receptors (human health and controlled waters) as a result of the Proposed Development.

13.2.18. The criteria adopted to assess the magnitude of an effect are detailed in **Table 13.2**. The assessment will be made based on professional judgement, best practice and relevant guidance.

Table 13.2 Criteria for Magnitude of Change

Magnitude of Impact	Definition
High	Substantial change to the baseline conditions during / following development. For example, development proposals will encounter contamination at concentrations significantly in excess of guideline values. Contamination exceeding the guideline values will be encountered during the operation phase of the Proposed Development. Remediation will be required.
Medium	Moderate change to the baseline conditions during / following development. For example, development proposals may encounter contamination at concentrations close to the guideline values. Contamination close to the guideline values may be encountered during the operation phase of the Proposed Development. Remediation / mitigation may be required.
Low	Minor change to the baseline conditions during / following development. For example, development proposals may encounter contamination concentrations below the guideline values. Remediation will not be required, however, the potential impact may be reduced by mitigation measures.
Negligible	No discernable change to the baseline conditions during / following development. Development Proposals will encounter low contamination concentrations. Remediation / mitigation will not be required.

13.2.19. The significance of the effects can be established by considering the nature of the receptor and scale of the effect. This can be assessed by referring to the matrix in **Table 13.3**.

Contaminated Land and Ground Conditions

Table 13.3 Significance Matrix

	Sensitivity of Receptor				
		High	Medium	Low	Negligible
Magnitude of change	High	Major (Adverse/ Beneficial)	Major to Moderate (Adverse/ Beneficial)	Moderate (Adverse/ Beneficial)	Negligible
	Medium	Major to Moderate (Adverse/ Beneficial)	Moderate (Adverse/ Beneficial)	Minor to Moderate (Adverse/ Beneficial)	Negligible
	Low	Moderate (Adverse/ Beneficial)	Minor to Moderate (Adverse/ Beneficial)	Minor (Adverse/ Beneficial)	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Legislative and Policy Framework

Legislation

13.2.20. The relevant legislation and guidance are listed below.

Environmental Protection Act 1990 (Part 2A)

13.2.21. The overarching legislation for contaminated land in England is provided within Part 2A of the Environmental Protection Act. As stated in Paragraph 13.2.9, Section 78(A) of the legislation provides the legal definition of contaminated land and sets out a legal framework for dealing with unacceptable risks to human health and the environment from contaminated land in England.

Environment Act 1995

13.2.22. The Environment Act 1995 sets out provisions for contaminated land and creates a system for Local Authorities to identify contaminated land. This Act requires that contamination must not result in 'significant harm or significant possibility of harm' or 'the pollution of controlled waters'.

Department for Environment, Food and Rural Affairs (DEFRA), (2012) Environmental Protection Act – Contaminated Land Statutory Guidance

- 13.2.23. This guidance provides Local Authorities a way to establish a legal framework for dealing with contaminated land and sets out the responsibilities of the Local Authority.
- 13.2.24. S.3.8 of the guidance realises for a relevant risk of significant pollution to exist, one or more contaminant-pathway-receptor linkages must be present.
- 13.2.25. The assessment of these linkages is used to explore the potential for harm by developing a Conceptual Site Model (CSM).

Other Relevant Legislation and Guidance

- 13.2.26. Whilst not specifically referred to within this Chapter, the principles and guidance within the following legislation and guidance has been used:
- The Contaminated Land (England) Regulations 2000 – these place a legal duty on Local Authorities to identify any contaminated land in their areas and bring about its remediation.
 - The Contaminated Land (England) Regulations (2006) – identifies sites requiring regulation as ‘special sites’ and includes land contaminated by radioactive substances to this classification.
 - The Contaminated Land (England) (Amendment) Regulations 2012 – these amend and supersede the 2000 and 2006 Regulations, with the amendments predominantly revising the definition of Controlled Waters.
 - The Environment Agency’s approach to groundwater protection (2018) – provides position statements which provide information relating to the Environment Agency’s approach to managing and protecting groundwater.
 - Environment Agency Land Contamination Risk Management Guidance (2020, as amended) – provides guidance to all parties involved in, or responsible for managing land contamination. The guidance describes the process of risk assessment and how to develop strategies to manage the risks from contamination.
 - BS10175:2011 +A2:2017 Investigation of potentially contaminated sites. Code of practice – provides recommendations and guidance on how to investigate potentially contaminated land or land with naturally elevated concentrations of potentially harmful substances, to determine or manage any risks.
 - BS5930:2015+A1:2020 Code of practice for ground investigations – provides recommendations for the investigation of sites to assess their suitability for construction.
 - BS8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings – provides recommendations for the characterisation of a site with respect to methane and carbon dioxide and provides a code of practice for the design of protection measures for new buildings against the ingress of methane and carbon dioxide.

Contaminated Land and Ground Conditions

- BS8576:2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds – provides guidance on the monitoring and sampling of ground gases including Volatile Organic Compounds (VOCs) and permanent gases such as methane and carbon dioxide.
- Construction Industry Research and Information Association (CIRIA) C665 – Assessing risks posed by hazardous ground gases to buildings (2007) – provides advice for the measurement of ground gases and mitigation measures for risks from ground gases.
- The Water Framework Directive (2000/60/EC) – develops a framework for protecting the water environment. The directive is implemented as the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.
- Groundwater Directive (2006/118/EC) – develops a framework to prevent the release of hazardous substances and manage the release of non-hazardous pollutants into controlled waters. The directive is implemented as the Environmental Permitting (England and Wales) Regulations 2016.

Planning Policy

National Planning Policy

13.2.27. The National Planning Policy Framework (NPPF) sets out the government’s economic, social and environmental policies for England. Within the framework, local plans can be prepared to provide sufficient housing and other development in a sustainable manner. Current planning policies on contaminated land are set out in Chapter 15 of the National Planning Policy Framework (NPPF), updated in 2024.

13.2.28. Paragraph 196 of the NPPF requires that

“Planning policies and decisions made should ensure that:

- a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);*
- b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*
- c) adequate site investigation information, prepared by a competent person, is available to inform these assessments”.*

The Local Plan

13.2.29. Broxtowe Borough Council Part 2 Local Plan⁵, adopted in October 2019 is applicable to the Proposed Development.

⁵ Broxtowe Borough Council Part 2 Local Plan 2018–2028 [on-line] available at <https://www.broxtowe.gov.uk/for-you/planning/planning-policy/part-2-local-plan/> last accessed 17th January 2025

- 13.2.30. Policy 19 of the Plan relates to pollution, hazardous substances and ground conditions and requires that development cannot take place which would result in an unacceptable level of pollution or risk of exposure to any unacceptable level of pollution.

Scoping Criteria

Technical Scope

- 13.2.31. 13.2.31. As set out in Chapter 2 of this ES, EIA Scoping is not a statutory requirement, when committing a scheme to EIA. The Applicants have not requested a formal Scoping Opinion in relation to Toton East in isolation, however have instead followed the scope of that agreed in relation to the larger, separate 'Toton North' scheme, which lies adjacent to the Toton East Site. Given the primary reason for undertaking an EIA is in relation to the potential significant cumulative effects that could occur with Toton North (and other potential schemes), this is considered appropriate and robust. The scope of this assessment therefore includes:
- A site walkover to identify current land use at the Site and ascertain any potential existing sources of contamination;
 - A review of historical mapping to identify historical land uses at the Site and identify potential historical sources of contamination;
 - A review of geological mapping to identify anticipated strata beneath the Site, the presence of any areas of man-made deposits and the potential for any sources of contamination and pathways;
 - A review of hydrology and hydrogeology at the Site to identify and potentially sensitive receptors;
 - A review of environmental searches relating to the Site and its wider area, to establish the presence of any on or off-site environmental features including landfills, pollution incidents, discharge consents. This will enable the identification of potential sources of contamination and ground gases applicable to the Site;
 - A review of the Sites coal mining status to establish any coal mining related issues;
 - A review of the Sites radon status to give consideration to radon gas as a potential source of contamination at the Site; and
 - A review of the unexploded ordnance (UXO) status of the Site to ascertain the potential for UXO risks that may affect the development.

- 13.2.32. The relevant information to assist our desk-based assessment are included in the Phase I Desk Study Report prepared for the Site (**Appendix 13.1**).

Receptors

- 13.2.33. This Chapter considers the potential effects of the Proposed Development with respect to risks from contaminated land (including ground gases) and ground conditions to the identified receptors:
- Human health (construction personnel, future site residents, visitors and occupants of neighbouring properties);

Contaminated Land and Ground Conditions

- Controlled Waters; and
- Proposed structures (including associated services / utilities).

13.2.34. This Chapter considers the potential for the creation of new pathways between identified contamination sources and sensitive receptors during the construction and operation phases of the Proposed Development.

Temporal Scope

13.2.35. The assessment considers the following potential effects:

Construction Phase

- Risk of exposure of contamination to construction personnel;
- Risk of exposure of contamination to Controlled Waters;
- Risk of exposure of contamination to neighbouring properties (including occupants);
- Risk of exposure of ground gases to construction personnel; and
- Risk of encountering UXO to construction personnel.

Operational Phase

- Risk of exposure of contamination to residents, employees and visitors;
- Risk of exposure of contamination to Controlled Waters;
- Risk of ground stability issues affecting proposed structures;
- Risk of exposure to contamination affecting proposed structures;
- Risk of exposure of ground gases to residents and visitors;
- Risk of exposure of ground gases to proposed structures;
- Risk of exposure to UXO to residents and visitors; and
- Risk of exposure to UXO to proposed structures.

13.2.36. Timescales associated with operational effects are as follows:

- Temporary – these are likely to be related to a particular activity and will cease when the activity finishes. This may be further clarified as follows:
 - Short term – a period of months, up to one year;
 - Medium term – a period of more than one year, up to five years; and
 - Long term – a period greater than five years.
- Permanent – this typically means unrecoverable change.

Limitations to the Assessment

- 13.2.37. The assessments made in this Chapter are based on the site walkover and review of desk-based information detailed within the Phase I Desk Study Report (**Appendix 13.1**).
- 13.2.38. Phase II Exploratory Investigation works inclusive of a contamination assessment of the soils, have not been carried out prior to, or as part of, this assessment. It should be noted that risks identified within this Chapter are characterised to the best degree of accuracy based on the third-party information and definitive risk can only be determined following further ground investigation of the Site.
- 13.2.39. It is assumed that the baseline conditions established within this Chapter and the Phase I Desk Study Report are reflective of those at the Site at the time of commencement of the Proposed Development. Assuming the land use at the Site remains unaltered, the contamination status of the Site would not be expected to significantly changed prior to the commencement of the Proposed Development.
- 13.2.40. The risks to controlled waters are considered from a contamination perspective only. Issues such as flooding are outside the scope of this Chapter.

13.3. Baseline Conditions

Site Description and Context

- 13.3.1. The Site extends to an approximate area of 19 hectares. The majority of the Site comprises three agricultural (arable) field parcels used for the production of crops.
- 13.3.2. A drainage ditch is present along the central part of the northern boundary of the Site, and continues through the northwestern area of the Site. An area of concrete hard standing is present within the northern area of the Site anticipated to be associated with a former building in this area. A Public Right of Way (PRoW) (Beeston FP 17) passes through the Site; further informal footpaths are also present on-site.
- 13.3.3. The Site boundaries are typically formed by mature hedgerows or wooden fencing (associated with residential dwellings to the Sites south). The northwestern boundary of the Site is undefined and the field which the Site comprises part of continues to the northwest.
- 13.3.4. Two electricity pylons are present within the Site; these are located towards the southwestern corner and within the central area. The pylons are connected by overhead electricity cables. Further overhead cables are present crossing the Site, these link a series of on-site wooden electricity poles.
- 13.3.5. Stapleford Lane forms the Sites eastern boundary. The land surrounding the Site comprises residential dwellings and public open space (to the south), a public footpath and Toton Railway Sidings (to the west), agricultural fields to the north and east (beyond Stapleford Lane), an electricity substation (to the northeast, off Stapleford Lane). Toton Lane Park and Ride (tram station) is present to the Sites northeast, beyond the electricity substation and Stapleford Lane. A sewage works and solar farm are also present to the Sites north, beyond the fields. A derelict structure (presumed glasshouse associated with a former commercial plant nursery) is also present to the northeast of the Site.

Site History

Contaminated Land and Ground Conditions

- 13.3.6. Historical mapping relating to the Site was commissioned within a Landmark Envirocheck Report and is included within the Phase I Report (see **Appendix 13.1**).
- 13.3.7. The historical map review revealed that much of the Site has remained undeveloped, as agricultural land, since at least the 1880s. Footpaths are present on the Site from 1900s, although the route of the paths varies over time.
- 13.3.8. From the 1950s onwards, a drainage ditch was indicated from the historical mapping along the central part of the sites northern boundary continuing across the northwestern area of the site.
- 13.3.9. Electricity pylons and poles are shown within the site from the 1950s, these are linked by a series of overhead cables which also link to an off-site electricity substation (to the Sites northeast).
- 13.3.10. Mapping from the 1980s reveals a small building to be present in the northeastern area of the site; hard standing can later be seen to surround the building. This structure was no longer present at site by 2021, although the hard standing remains.

Baseline Survey Information

Geological Setting

- 13.3.11. The baseline geological conditions were detailed within the Phase I Desk Study based on geological mapping published by the British Geological Survey (BGS), supplemented with information from the Geology of Britain Viewer⁶ and the Landmark Envirocheck Report commissioned as part of the Phase I Desk Study.

Superficial Deposits

- 13.3.12. The BGS mapping does not reveal the presence of any superficial deposits beneath the site. Deposits of Alluvium are indicated to the west of the Site; these may encroach into the western area of the Site. Alluvium is described in the reviewed publications as '*clay, silt, sand and gravel. It is the unconsolidated detrital material deposited by a river, stream or other body of running water*'.

Bedrock

- 13.3.13. The site straddles two geological maps. The northern map sheet (dated 2014) covers the majority of the Site and indicates the bedrock beneath the majority of the Site to comprise the Tarporley Siltstone Formation of the Mercia Mudstone Group. The map (dated 2001) covers the southwestern tip of the site and reveals the bedrock beneath this area to comprise the Radcliffe Formation of the Mercia Mudstone Group.
- 13.3.14. The Tarporley Siltstone Formation typically comprises Mudstone and Siltstone with bands of fine-grained Sandstone.
- 13.3.15. The Radcliffe Formation typically comprises interlaminated Mudstone, Siltstone and Sandstone. In current mapping nomenclature the Radcliffe Formation is known as the Radcliffe Member of the Sidmouth Mudstone Formation.

⁶ BGS Geology of Britain Viewer [on-line] available at <https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/> last accessed 17th January 2025

- 13.3.16. No geological faults are indicated to be present within the Site.

Man-Made Deposits

- 13.3.17. No man-made deposits are indicated from geological mapping to be present at the Site. However, localised Made Ground or Disturbed Ground may be anticipated in the vicinity of the former structure in the Sites northeast.

- 13.3.18. A significant area of Made Ground is indicated to be present to the immediate west and northwest of the Site associated with the railway sidings and sewage treatment works. Due to mapping inaccuracies, this Made Ground may locally encroach within the western area of the Site.

Geological Hazards

- 13.3.19. No significant ground stability hazards have been identified at the Site.

Radon

- 13.3.20. The Landmark Envirocheck Report reveals the Site falls within a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level).

- 13.3.21. The Landmark Envirocheck Report reveals that no specific mitigation in relation to radon issues is required at the Site.

Coal Mining

- 13.3.22. The Landmark Envirocheck Report reveals that the Site does not lie within a Coal Mining Reporting Area. No coal mining precautions or associated investigation works are required at the Site.

Hydrogeology

- 13.3.23. The Landmark Envirocheck Report (included within the Phase I Desk Study, **Appendix 13.1**) indicates the bedrock underlying the approximate northern half of the Site and locally beneath the southern area of the Site to be classified as a Secondary A Aquifer, the bedrock beneath the remainder of the Site is classified as a Secondary B Aquifer.

- 13.3.24. The Landmark Envirocheck Report reveals the Site is not within a Source Protection Zone (SPZ) as designated by the Environment Agency.

- 13.3.25. No water abstractions for ground or surface water are recorded within 250m of the Site. A groundwater (borehole) abstraction permit is listed approximately 472m to the sites northwest.

Hydrology

- 13.3.26. A surface water feature is present on the Site. This comprises a drainage ditch which is present along the central section of the northern boundary of the Site and passing through the northwestern area of the Site, towards the northwest.

- 13.3.27. The River Erewash is present approximately 400m to the west of the site.

Natural Metal Enrichment

Contaminated Land and Ground Conditions

- 13.3.28. Natural Metal Enrichment (NME) specific to arsenic, cadmium, chromium, lead and nickel is not anticipated at the Site, based on the BGS estimated soil concentrations detailed within the Landmark Envirocheck Report.

Sensitive Land Use

- 13.3.29. The Site and its immediate surrounding area are identified as being within a Nitrate Vulnerable Zone (NVZ).

Waste Sites

- 13.3.30. The Landmark Envirocheck Report does not identify any current or historic landfills at, or within 250m of, the Site.

- 13.3.31. Two Licensed Waste Management Facilities are recorded within 250m of the Site, the closest being a vehicle depollution facility located approximately 177m to the west of the Site. The second being a metal recycling site / vehicle dismantlers located approximately 239m to the northwest of the Site.

- 13.3.32. A Registered Waste Treatment or Disposal Site is recorded approximately 221m to the northwest of the site, relating to a scrapyard.

- 13.3.33. Four areas of potentially infilled land associated with former watercourses are identified within the Landmark Envirocheck Report within 250m of the site. This includes a record which appears to relate to an infilled channel of the River Erewash approximately 129m to the sites west; historical mapping indicates that this channel was diverted circa 1920s when the railway sidings were expanded. The area of infilled land associated with the former river channel lies within the area of Made Ground identified within the geological mapping. Based on historical mapping, the remaining three records appear to relate to small drainage ditches in the vicinity of the site.

Regulatory Licenses

- 13.3.34. Twenty four records relating to Discharge Consents are listed within 25m of the site; the closest being 183m to the Sites northwest. Of these consents, twenty two relate to the sewage works to the northwest of the Site and all but four of these have been revoked. The remaining consents relate to the discharge of final/treated effluent to land / soakaway from the railway sidings to the Sites west.

Substantiated Pollution Register

- 13.3.35. A record is detailed approximately 131m to the west of the Site relating to pollution from mixed / waste oils from an incident in 2017.

Unexploded Ordnance

- 13.3.36. An Unexploded Ordnance (UXO) Pre-Desk Study Assessment (PDSA) prepared by Zetica is included in the Phase I Desk Study Report (**Appendix 13.1**).

- 13.3.37. The PDSA notes military activity occurred in close proximity to the Site, within Chetwynd Barracks. Prior to becoming Chetwynd Barracks, the facility was used as Chilwell National Filling Factory (during WWI) and an army ordnance store for munitions with continuous use during WWII. Chetwynd Barracks currently remains operational.

13.3.38. Whilst the PSDA notes that there are no readily available records of bombing at the Site, a detailed specialist UXO Desk Study is recommended by Zetica to assess and potentially zone the UXO hazard level at the Site.

13.3.39. As the potential for UXO cannot be ruled out at this stage, consideration has been given in our assessment.

Potential Sources of Contamination (Existing / Residual)

13.3.40. The Land Use Assessment within the Phase I Desk Study Report identified the following potential sources of contamination at the Site:

- Metals and metalloids associated with any potential localised Made Ground beneath the Site;
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and / or carbonaceous inclusions in the near surface soils;
- Pesticides and herbicides associated with the historical (and current) agricultural use of the Site;
- Asbestos containing materials (ACMs) associated with any localised Made Ground beneath the site and construction materials to the former on-site building;
- Hazardous ground gases (i.e. methane and carbon dioxide) associated with any localised on-site Made Ground, potentially associated with the adjacent railway land.

13.3.41. The following potential off-site sources of contamination which may affect the Site were identified within the Land Use Assessment:

- Asbestos containing materials (ACMs) associated with the railway sidings to the Sites immediate west.
- Polychlorinated Biphenyls (PCBs) associated with the substation to the northeast of the Site.
- Hazardous ground gases (methane and carbon dioxide) associated with the Made Ground to the west / northwest of the Site including any Infilled Land associated with the former route of the river channel to the west of the Site.

Potential Sources of Contamination (Future)

13.3.42. The following potential sources of contamination are considered to be applicable to the construction and operational phases of the Proposed Development:

- During the construction phase there is the potential for accidental spillage / leakage of TPHs (fuels, oils, lubricants etc.) from site plant and vehicles;
- Potential sources of contamination following occupation of the proposed dwellings is anticipated to be limited to domestic activities such as vehicle washing / maintenance and DIY, which may result in potential contamination to surface water runoff.

Potential Aggressive Ground (Existing / Residual)

Contaminated Land and Ground Conditions

- 13.3.43. The ground conditions at the Site may pose a risk to proposed structures and associated infrastructure (including water supply pipes) with respect to aggressive ground conditions (i.e. elevated sulphates).

Potential Receptors

- 13.3.44. The Phase I Desk Study Report identified potential receptors at the Site. These have been split into those applicable to the construction operational phases of the Proposed Development.

Construction Phase

- 13.3.45. The following potential receptors are considered to be applicable with respect to the construction phase of the Proposed Development:

- Construction personnel (i.e. site workers) involved with the development of the Site (typically short-term [acute] exposure);
- Neighbouring properties and their occupants (off-site receptors);
- Controlled Waters (i.e. underlying groundwater and surface waters);
- Structures (i.e. proposed dwellings), and
- Construction materials (i.e. buried concrete and buried utilities).

- 13.3.46. The following potential receptors are considered applicable with respect to the operational phase of the Proposed Development:

- The final end users – residents (typically long-term [chronic] exposure and site visitors (typically short-term [acute] exposure);
- Neighbouring properties and their occupants (off-site receptors);
- Controlled Waters (i.e. underlying groundwater and surface waters);
- Structures (i.e. proposed dwellings), and
- Construction materials (i.e. buried concrete and buried utilities).

Potential Pathways

- 13.3.47. The following potential pathways are considered to exist at the Site:

- Direct ingestion of soil (either directly or as particles attached to produce);
- Inhalation of fugitive dust and vapours;
- Direct skin contact with the ground;
- Direct ingestion of home-grown produce;
- Direct ground contact with construction materials (including supply pipes);
- Vertical and lateral migration of contamination; and

- Vertical and lateral migration of potentially hazardous ground gases / vapours.

13.3.48. In addition to the foregoing, should the recommended UXO Desk Study (to be carried out by a Specialist prior to commencement of construction works) reveal the potential for UXO at the Site, the following pathway may also exist:

- Disturbance of / contact with UXO.

13.4. Assessment of Likely Significant Effects

Expected Change as a Result of Proposed Development

13.4.1. The Proposed Development comprises construction of a residential development of up to 420 residential dwellings with associated open space and infrastructure.

13.4.2. If the Site were to remain undeveloped, it is anticipated that there would not be any changes with respect to ground conditions and contamination.

Construction Phase

Risks to Construction Personnel and Neighbouring Properties

Contamination

13.4.3. Potential sources of contamination have been identified at the Site. These sources may be associated with any localised Made Ground, ashy / carbonaceous inclusions in the near surface soils, the use of pesticides and herbicides associated with the agricultural use of the Site and the former building in the Sites northeast. Off-site land-uses which represent potential sources of contamination have been identified which may locally affect the Site; these comprise the railway sidings to the Sites west and the substation to the northeast of the Site. Widespread contamination is not anticipated across the Site given its use as agricultural land.

13.4.4. There is the potential for any contaminated soils to pose a risk to the health of construction personnel and the occupants of neighbouring properties during the construction phase. This may include during enabling works, earthworks and construction through direct skin contact with the ground / excavated soils, ingestion (predominantly applicable to construction personnel only, through direct ingestion of soil from hands through poor hygiene) and inhalation of dust (breathing in dust and particulate matter during excavation activities).

13.4.5. There is the potential for the presence of residual Asbestos Containing Materials (ACMs) to be present at the surface of the ground and within any disturbed soils in the area of the former structure in the sites northeast and in the vicinity of the railway sidings to the sites west. Construction personnel and occupants of neighbouring properties could be exposed to airborne asbestos fibres during excavation activities.

13.4.6. The potential for risks to human health would depend on the nature and level of any contamination present. Where human health receptors are exposed to contaminants above the applicable threshold concentration, there is potential for both short term and long-term health effects; these are dependent on factors including the contaminant present and the exposure duration. The duration of exposure may be highly variable with some site personnel only present at the Site for a short period of time whereas others may be present throughout the duration of the construction programme.

Contaminated Land and Ground Conditions

- 13.4.7. With respect to the risk of exposure of contamination to construction personnel and neighbouring properties (including occupants) the sensitivity of the receptors (i.e. human health) is high and the magnitude of change prior to mitigation is considered to be medium. Therefore, there is likely to be an effect of **major to moderate adverse** significance to human health, **prior to implementation of mitigation measures**.

Ground Gases

- 13.4.8. The baseline conditions at the Site have identified the potential for ground gases (i.e. methane and carbon dioxide) to be present associated with Made Ground to the west / northwest of the Site (which has the potential to locally encroach within the Site) and the Infilled Land associated with the former route of the river channel to the west of the Site. If present, these gases would have the potential to accumulate in confined spaces during the construction works. Inhalation of these gases by construction personnel may lead to adverse health effects and potentially asphyxiation.

- 13.4.9. With respect to the risk of exposure of ground gases to construction personnel the sensitivity of the receptors (i.e. human health) is high and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be an effect of **major to moderate adverse** significance to human health, **prior to implementation of mitigation measures**.

Unexploded Ordnance

- 13.4.10. The baseline conditions at the Site have identified that there may be a risk relating to UXO at the Site. This risk should be ascertained by commissioning a specialist Desk Study for the Site. Where UXO is identified to be present, the risk to construction personnel and neighbouring properties may comprise injury / damage from explosion.

- 13.4.11. With respect to the risk of exposure of UXO to construction personnel and neighbouring properties, the sensitivity of the receptors is high and the magnitude of change prior to mitigation is high. Therefore, there is likely to be an effect of **major adverse** significance to construction personnel and neighbouring properties, prior to the **implementation of mitigation measures**.

Risks to Controlled Waters

Contamination

- 13.4.12. Controlled Waters have been identified at the Site associated with the underlying bedrock strata, classified as Secondary Aquifer (A or B classification).
- 13.4.13. Widespread sources of soil and groundwater contamination which would be considered a significant risk to Controlled Waters are not anticipated across the Site, taking account of the Sites predominant use as agricultural land.
- 13.4.14. During the construction phase, the use of plant and machinery and the storage of any associated fuels / oils (i.e. hydrocarbons) could result in contamination of the soils and groundwater, through accidental leakage / spillage during use. Soils impacted by hydrocarbon contamination may pose a future risk to Controlled Waters receptors through leaching.
- 13.4.15. Any on-site contamination may migrate towards the Controlled Waters bodies through leaching of contamination from the unsaturated zone into the groundwater and vertical and lateral migration within the groundwater. Lateral movement of any surface contamination entrained in

particulates within surface runoff may also migrate towards, and into, the surface watercourses. Furthermore, existing service runs at the Site have the potential to act as a preferential pathway for mobile contaminants.

- 13.4.16. With respect to the risk of exposure of contamination to Controlled Waters the sensitivity of the receptors is medium and the magnitude of change, prior to mitigation is low. Therefore, there is likely to be an effect of **minor to moderate adverse** significance to Controlled Waters, **prior to implementation of mitigation measures**.

Operational Phase

Risks to End-Users (Residents and Visitors)

Contamination

- 13.4.17. Potential sources of contamination have been identified at the Site. These sources may be associated with any localised Made Ground, ashy / carbonaceous inclusions in the near surface soils, the use of pesticides and herbicides associated with the agricultural use of the Site and the former building in the Sites northeast. Off-site land-uses which represent potential sources of contamination have been identified which may locally affect the Site; these comprise the railway sidings to the Sites west and the substation to the northeast of the site. Widespread contamination is not anticipated across the Site given its use as agricultural land.
- 13.4.18. Future end-users would be at risk of potential exposure to any residual contamination within the soils at the Site through direct skin contact with soils, ingestion of soil (either by direct ingestion through soil attached to home grown produce or ingestion of soils from hands through poor hygiene) and inhalation (breathing in dust, particulate matter (including asbestos) and vapours).
- 13.4.19. Given the existing predominant agricultural use of the Site, it is considered unlikely that it will be necessary to import materials (i.e. Topsoil and Subsoil) to Site for use within private gardens and areas of soft landscape. However, should importation of materials be proposed, these should be demonstrably free from unacceptable levels of contamination and suitable for use at the Site. Therefore, the risk to end-user from imported soils is considered likely to be **negligible**.
- 13.4.20. With respect to the risk of exposure of contamination to the human health of end-users (i.e. residents and visitors) the sensitivity of the receptors is high and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be an effect of **major to moderate adverse** significance to the human health of end-users, **prior to implementation of mitigation measures**.

Ground Gases

- 13.4.21. The baseline conditions at the Site have identified the potential for ground gases (i.e. methane and carbon dioxide) to be present associated with Made Ground to the west / northwest of the Site (which has the potential to locally encroach within the Site) and the Infilled Land associated with the former route of the river channel to the west of the Site. If present, these gases would have the potential to enter and accumulate within on-site structures. Inhalation of these gases by Site end-users may lead to adverse health effects and potentially asphyxiation.
- 13.4.22. The sensitivity of the human health receptors (i.e. residents and visitors) to exposure of ground gases would be high and the magnitude of change, prior to mitigation is medium. Therefore,

Contaminated Land and Ground Conditions

there is likely to be an effect of **major to moderate adverse** significance to the human health of end-users, **prior to the implementation of mitigation measures**.

Unexploded Ordnance

- 13.4.23. The baseline conditions at the Site have identified that there may be a risk relating to UXO at the Site. This risk should be ascertained by commissioning a specialist Desk Study for the Site. Where UXO is identified to be present, the risk to human health may comprise injury from explosion.
- 13.4.24. With respect to the risk of exposure to UXO to human health receptors (i.e. residents and visitors), the sensitivity of the receptors is high and the magnitude of change prior to mitigation is high. Therefore, there is likely to be an effect of **major adverse** significance to human health, **prior to implementation of mitigation measures**.

Risks to Controlled Waters

- 13.4.25. On-site Controlled Waters considered as part of this assessment comprise the Secondary Aquifer (A and B Classification) underlying the Site.
- 13.4.26. Off-site Controlled Waters considered as part of this assessment comprise the surrounding Secondary Aquifer and surface watercourses (including regional watercourses).
- 13.4.27. Potential sources of contamination following occupation of the proposed dwellings is anticipated to be limited to domestic activities such as vehicle washing /maintenance and DIY (including paints, solvents etc.), which may result in potential contamination to surface water runoff. Storage of significant quantities of fuel or chemicals is considered unlikely. Surface water runoff from hard standing is likely to enter new drainage infrastructure although there is the potential for the runoff to directly enter the soft landscaped areas where it may laterally or vertically migrate towards underlying aquifers or surface water bodies. It is considered that the source of contamination during the operational phase would be limited in quantity and localised, rather than widespread.
- 13.4.28. It is anticipated that any materials brought onto the Site would be uncontaminated and would therefore not represent a significant risk to Controlled Waters at the Site.
- 13.4.29. With respect to the risk of exposure of contamination to Controlled Waters the sensitivity of the receptors is medium and the magnitude of change, prior to mitigation is negligible. Therefore, there is likely to be an effect of **negligible** significance to Controlled Waters and therefore not significant.

Risks to on-site Structures and Construction Materials

Contamination / Potential Aggressive Ground

- 13.4.30. The soils (including any Made Ground) beneath the Site have the potential to contain elevated concentrations of sulphates which may result in aggressive ground conditions which could affect buried concrete.
- 13.4.31. Whilst contamination is not anticipated to be widespread across the Site, any localised residual contamination has the potential to affect water supply pipes.

13.4.32. With respect to the risk of exposure of contamination / aggressive ground conditions to construction materials (i.e. buried concrete, water supply pipes etc.) the sensitivity of the receptors is medium and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be an effect of **moderate adverse** significance to construction materials, **prior to implementation of mitigation measures**.

13.4.33. Ground Gases

13.4.34. The baseline conditions at the Site have identified the potential for ground gases (i.e. methane and carbon dioxide) to be present associated with Made Ground to the west / northwest of the Site (which has the potential to locally encroach within the Site) and the Infilled Land associated with the former route of the river channel to the west of the Site. If present, these gases have the potential to enter and accumulate within on-site structures which may lead to explosion.

13.4.35. With respect to the risk of ground gas ingress to on-site structures, the sensitivity of the receptors is high and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be an effect of **major to moderate adverse** significance to proposed structures, **prior to implementation of mitigation measures**.

Unexploded Ordnance

13.4.36. The baseline conditions at the Site have identified that there may be a risk relating to UXO at the Site. This risk should be ascertained by commissioning a specialist Desk Study for the Site. Where UXO is identified to present, the risk to proposed structures and construction materials may comprise damage from explosion.

13.4.37. With respect to the risk of exposure to UXO to proposed structures and construction materials, the sensitivity of the receptors is high and the magnitude of change prior to mitigation is high. Therefore, there is likely to be an effect of **major adverse** significance to proposed structures, **prior to the implementation of mitigation measures**.

13.5. Mitigation, Enhancement and Residual Effects

Mitigation by Design

13.5.1. Prior to commencement of development, a detailed programme of Phase II Exploratory Investigation works should be undertaken to establish ground conditions and determine the nature and extent of any contamination within the ground, including groundwater, where applicable. The data obtained during the Phase II Exploratory Investigation works will be used to inform a generic qualitative risk assessment to quantify the risks to the identified receptors and to refine the Conceptual Site Model (CSM).

13.5.2. The results of the Phase II Exploratory Investigation and refined CSM will be used to inform the requirements for remediation / mitigation measures, if necessary, to protect the sensitive receptors during the operational phase. Any necessary remedial / mitigation works should be detailed within a Remediation Method Statement which should be implemented during the Construction Phase. Validation works should also be undertaken to demonstrate compliance with the Remediation Method Statement, where appropriate.

13.5.3. The Phase II Exploratory Investigation should include an appropriate scope of geotechnical testing, the ground conditions (i.e. composition and strength of the soils / bedrock) and the results of the geotechnical testing should be taken into account during the design of the foundations and floor slab to mitigate against ground stability issues at the Site.

Contaminated Land and Ground Conditions

- 13.5.4. The results of the Phase II Exploratory Investigation should be used to inform necessary mitigation of risks to proposed structures and utilities / services from contaminated land and stability issues which may include:
- Adoption of an appropriate classification of concrete, for all buried concrete to mitigate against aggressive ground conditions.
 - Provision of an appropriate specification of water supply pipes to mitigate against any unacceptable concentrations of contamination within the soil and groundwater; and
 - Appropriate design of foundations and infrastructure to mitigate against ground stability issues.

- 13.5.5. Any risks to construction personnel should be reduced, mitigated and managed within site-specific risk assessments.

Additional Mitigation.

Construction Phase

- 13.5.6. An Unexploded Ordnance (UXO) Desk Study should be prepared by a UXO specialist prior to commencement of construction works. The Desk Study should establish the need for any mitigation measures with respect to UXO risk at the Site. Where mitigation measures are recommended, these should be appropriately implemented to ensure the health and safety of human health throughout the construction and operation phases of the development. Where applicable, mitigation measures to control risks to proposed structures should also be implemented.
- 13.5.7. A Construction Environmental Management Plan (CEMP) will be developed and implemented to outline how negative environmental impacts of the Proposed Development will be minimised.
- 13.5.8. Health and safety during the construction phase should be managed in accordance with the CDM regulations⁷.
- 13.5.9. The use of Site Inductions and Tool Box Talks should be used to inform and update site personnel / visitors of relevant information with regards to the presence of contamination and environmental awareness.
- 13.5.10. Good site practice measures, including risk assessments should be adopted to mitigate against adverse effects to site personnel from the ground conditions. This may include:
- The use of standard PPE by all site personnel and visitors. This should include safety boots, hard hat, gloves, hi-vis jacket, safety glasses and if necessary, disposable overalls, with additional measures identified where necessary. These measures should be detailed in the site-specific risk assessments; and
 - The adoption of standard hygiene measures by site personnel including hand washing and eating / drinking in designated areas.

⁷ The Construction (Design and Management) Regulations 2015

- 13.5.11. A Soil Management Strategy / Material Management Plan (MMP) should be implemented to control the removal, storage and re-use of soils at the Site. This should also provide systems to protect the quality of the soils to be re-used (including from cross contamination).
- 13.5.12. A Site Waste Management Plan (SWMP) should be implemented to manage and control waste generated during the works.
- 13.5.13. Fully bunded fuel and chemical storage areas should be constructed and maintained on-site to minimise the effects of any spillage / leakage during fuelling and maintenance of plant equipment. All plant and equipment should be properly maintained and inspected before use to reduce the risk of accidental spillage / leakage of hydrocarbons.
- 13.5.14. A provision for a fuel / oil / chemical spill kit (appropriate for the on-site chemicals) should be available at the Site.
- 13.5.15. Wheel washing of site vehicles should be carried out to minimise the potential for dust generation and transfer of dust / contamination across the Site and off-site to public roads which may lead to ingestion / inhalation by the general public.
- 13.5.16. Fuel interceptors should be used within the surface water drainage system to reduce the potential for hydrocarbon spillage / leakage to impact Controlled Waters.
- 13.5.17. The road drainage system should incorporate measures for dealing with contaminated runoff from roadways and car parking. This system should be regularly maintained.
- 13.5.18. Dust suppression measures (such as damping down) should be adopted to keep dust generation to a minimum, this is particularly important for any areas where contamination / asbestos fibres may be present.

Operational Phase

- 13.5.19. Following completion of the Phase II Exploratory Investigation, a Remediation Strategy may be required at the Site to ensure that the risks to sensitive receptors from unacceptable contamination are mitigated. The Remediation Strategy would detail the necessary provisions to address contamination within soils, groundwater and ground gases, where applicable. These may include but not be limited to:
- Provision of a remedial capping layer, where residual contamination is present.
 - Design and provision of ground gas protection measures to mitigate the risk of ingress of hazardous ground gases, if present.
- 13.5.20. Measures to control the likely mitigation requirements at the Site are detailed in **Table 13.4**.

Table 13.4: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Condition
1	Carry out detailed Phase II Exploratory Investigation to establish the ground conditions inclusive of a contamination			X

Contaminated Land and Ground Conditions

	assessment of the soils and to refine the CSM.			
2	The Phase II Exploratory Investigation should include a ground gas assessment. Where appropriate, ground gas protection measures should be designed and installed within the proposed dwellings.			X
3	Remediation / Mitigation Strategy and subsequent Validation Works to demonstrate the Strategy has been appropriately implemented.			X
4	Management of all environmental impacts throughout construction phase by provision of a CEMP.			X
5	Soil Management Strategy / Material Management Plan (MMP)			X
6	Site Waste Management Plan (SWMP)			X

Enhancements.

- 13.5.21. No additional enhancements are proposed with respect to ground conditions.

Residual EffectsRisks to Construction Personnel and Occupants of Neighbouring Properties – During Occupation*Contamination*

- 13.5.22. The sensitivity of construction personnel and occupants of neighbouring properties is high, however, the magnitude of change following implementation of appropriate mitigation with respect to contamination within the ground is considered to be negligible, **resulting in an overall negligible effect.**

Ground Gases

- 13.5.23. The sensitivity of construction personnel and occupants of neighbouring properties is high, however, the magnitude of change following implementation of appropriate mitigation measures with respect to ground gases is considered to be negligible, **resulting in an overall negligible effect.**

Unexploded Ordnance

- 13.5.24. The sensitivity of construction personnel and occupants of neighbouring properties is high; following implementation of any necessary mitigation measures with respect to the risks from UXO, the magnitude of change is considered to be negligible, **resulting in an overall negligible effect.**

Risks to Controlled Waters – During Construction

Contamination

- 13.5.25. The sensitivity of Controlled Waters at the Site is considered to be medium. Following the appropriate implementation of any necessary mitigation measures the magnitude of change with respect to contamination of Controlled Waters is considered to be negligible, **resulting in an overall negligible effect.**

Risks to End-Users (Residents and Visitors) – During Operation

Contamination

- 13.5.26. The sensitivity of the end-users to contamination within the ground is considered to be medium. Following the appropriate implementation of any necessary mitigation measures, the magnitude of change is considered to be negligible, **resulting in an overall negligible effect.**

Ground Gases

- 13.5.27. The sensitivity of end-users to ground gases is considered to be high. Following the implementation of appropriate ground gas protection measures, the magnitude of change is considered to be negligible, **resulting in an overall negligible effect.**

Unexploded Ordnance

- 13.5.28. The sensitivity of human health receptors during the operation phase (i.e. residents and visitors) is high; following implementation of any necessary mitigation measures with respect to the risks from UXO, the magnitude of change is considered to be negligible, **resulting in an overall negligible effects.**

Risks to Controlled Waters – During Operation

- 13.5.29. The sensitivity of Controlled Waters to contamination during the operational phase of the development is considered to be medium. Following the implementation of appropriate mitigation measures the magnitude of change is considered to be negligible, **resulting in an overall negligible effect.**

Risks to On-site Structures and Construction Materials

Contamination / Potential Aggressive Ground

- 13.5.30. The sensitivity of the construction materials within the Proposed Development to contamination and aggressive conditions within the ground is considered to be medium. Following implementation of appropriate mitigation measures, the magnitude of change is considered to be negligible, **resulting in an overall negligible effect.**

Ground Gases

- 13.5.31. The sensitivity of proposed structures to hazardous ground gases is considered to be high. Following implementation of any necessary mitigation measures within the structures, the magnitude of change is considered to be negligible, **resulting in an overall negligible effect.**

Unexploded Ordnance

Contaminated Land and Ground Conditions

- 13.5.32. The sensitivity to the Proposed Development with respect to UXO is considered to be high. Following implementation of appropriate mitigation measures, the magnitude of change is considered to be negligible, **resulting in an overall negligible effect**.

13.6. Cumulative and In-Combination Effects

- 13.6.1. Consideration has been given to the inter-project cumulative effects and the intra-project cumulative effects, defined as:

- Inter-project Cumulative Effects: The combined effects of development schemes which may, on an individual basis be insignificant but cumulatively, have significant effect; and
- Intra-project Cumulative Effects: The combined effect of individual effects (for example noise, airborne dust or traffic) on a single receptor where deemed potentially significant.

Inter – Project Cumulative Effects

- 13.6.2. As set out in Chapter 2, the following additional schemes have been considered with respect to cumulative effects of the Proposed Development of the Toton West Site.

- Southfields Farm, Common Lane, Bramcote – construction and operation of two adjacent Battery Energy Storage Systems (BESS) Facilities.
- Land at Toton North – construction of up to 880 dwellings, link road (means of access only), local centre, country park, education provision (forest school) and associated infrastructure.
- Land at Toton East – construction of 155 residential dwellings with associated open space and infrastructure.

- 13.6.3. The risks to human health, Controlled Waters and proposed structures are considered on a site-by-site basis, taking account of the baseline conditions at each site.

- 13.6.4. Implementation of necessary mitigation measures should also be carried out at each site to reflect conditions on that site; this is anticipated to be a requirement of the Planning Conditions for each development. Therefore, the inter-project effects with regards to ground conditions and contamination are considered to not be cumulative.

Intra – Project Cumulative Effects

- 13.6.5. The relationship and interactions between ground conditions and contamination with other environmental elements (i.e. Controlled Waters, for example) are incorporated into this assessment. The application of embedded and additional mitigation measures (i.e. CEMP, MMP, SWMP) within the project design and the requirement to carry out a Phase II Exploratory Investigation and the implementation of necessary remedial works. Significant effects on shared receptors are considered to be **negligible**.

- 13.6.6. There is the potential for ground conditions to have an adverse effect on sensitive receptors in other environmental topics resulting in cumulative effects. This may include air quality, ecology, flood risk and drainage and have been addressed in their relevant chapters of this ES.

13.7. Summary

Introduction

- 13.7.1. The scope of the works for this assessment considers the following:
- Establishing the baseline conditions at the Site;
 - Identification of potential sources of contamination within the ground and groundwater at the site and potential migration pathways beneath the Site to develop a CSM with respect to the Proposed Development;
 - Identification of potential ground stability issues which may affect the Proposed Development; and
 - Assessment of the likely significant effects on sensitive receptors during the construction and operation phases of the development.
- 13.7.2. This assessment has been carried out taking account of contaminated land legislation and guidance following a risk based approach; taking account of the Conceptual Site Model (CSM) developed within the Phase I Desk Study Report which considers plausible source (contaminant)–pathway–receptor linkages. The development of a CSM is an iterative process and the CSM should be revised (as appropriate) following completion of a comprehensive programme of Phase II Exploratory Investigation works.

Baseline Conditions

- 13.7.3. The following summary of the baseline conditions at the Site is based on a site walkover and review of published geological mapping, historical mapping and site-specific Landmark Envirocheck Report.
- 13.7.4. The site currently comprises a large portion of an agricultural field. A former structure was present in the northeastern area of the site; this has been removed however, the hard standing associated with the structure remains on-site. A drainage ditch passes through the northwestern area of the site. Two electricity pylons and a series of wooden electricity poles are present on site; these are connected by overhead cables which cross the Site. A public footpath passes through the Site.
- 13.7.5. The reviewed geological information does not indicate the presence of superficial deposits beneath the Site, however, deposits of Alluvium are indicated to the west of the Site, these may encroach the Sites western area. The geological information indicates the majority of the site to be underlain by bedrock comprising the Tarporley Siltstone Formation (Mercia Mudstone Group) and the Radcliffe Formation (also Mercia Mudstone Group) beneath the southwestern tip of the Site. The bedrock beneath the Site is classified as Secondary A or B Aquifer.
- 13.7.6. No man-made deposits are indicated to be present at the Site, however, a large area of Made Ground is indicated to the immediate west and northwest of the Site; this incorporates an area of Infilled Land associated with a former section of river channel.
- 13.7.7. Potential sources of contamination may be present at the Site associated with any localised Made Ground; the former on-site building and the agricultural use of the Site. In addition, off-site potential sources of contamination which may affect the Site have been identified; these include the electricity sub-station to the sites northwest and the railway sidings to the Sites west.

Contaminated Land and Ground Conditions

- 13.7.8. Potential sources of potentially hazardous ground gases (i.e. methane and carbon dioxide) have been identified within influencing distance of the site, associated with the Made Ground and Infilled Land to the sites west.
- 13.7.9. Potential sensitive receptors have been identified at the Site, these comprise human health (including construction personnel, future residents, visitors and occupants of neighbouring properties), Controlled Waters (i.e. surface watercourses and the underlying aquifer) and proposed structures.
- 13.7.10. Contamination is only considered to be a potential risk to receptors if there is a plausible Source-Pathway-Receptor linkage. In developing the conceptual site model, consideration has been given to potential pathways including direct contact with, or ingestion of, contaminated soils; inhalation of dust, vapours and hazardous ground gases, lateral / vertical migration or leaching of soil contamination into Controlled Waters. Potential risks also exist from aggressive ground or stability issues.

Likely Significant Effects

- 13.7.11. During the construction phase, significant effects to human health (i.e. construction personnel and occupants of neighbouring properties) may include direct contact and ingestion of contamination within soils together with inhalation of dust / vapours / particulates and hazardous ground gases.
- 13.7.12. Construction phase effects to Controlled Waters include the migration of any hydrocarbons from accidental spillage or leakage from plant and machinery, into groundwater or surface waters.
- 13.7.13. During the operation phase, significant effects to human health (i.e. residents and visitors) may include direct contact, ingestion of residual contamination within the soils together with inhalation of dust / vapours / particulates and hazardous ground gases.
- 13.7.14. Significant effects to the proposed structures may include risks to buried concrete from aggressive ground conditions. There is also the potential for permeation of residual contamination within the ground into water supply pipes and the ingress of hazardous ground gases into the structures.

Mitigation and Enhancement

- 13.7.15. A comprehensive programme of intrusive works should be carried out at the Site to establish the ground conditions and the presence and extent of any contamination. The findings of the intrusive works should be incorporated into a Phase II Exploratory Investigation Report which should include a generic qualitative risk assessment to quantify the risks of any on-site contamination to human health and Controlled Waters, taking into account the development proposals. The scope of the intrusive works should also include a programme of ground gas monitoring to establish the ground gas regime at the Site. Recommendations for any necessary mitigation / remediation measures should also be provided, together with any requirements for supplementary exploratory works and validation of mitigation / remediation measures.
- 13.7.16. The Phase II Exploratory Investigation should also include a detailed geotechnical assessment of the ground to inform foundation and infrastructure designs regarding any necessary measures to mitigate against ground stability issues, aggressive ground conditions and ground gases (where applicable).

- 13.7.17. Prior to commencement of construction works, a UXO Desk Study should be obtained from a specialist to ascertain any risks at the Site. Any recommended mitigation should be appropriately implemented.

Cumulative Effects

- 13.7.18. The inter-project and intra-project cumulative effects of the Proposed Development are considered to be **negligible**, following the implementation of any required mitigation measures.

Conclusion

- 13.7.19. The residual effects with respect to ground conditions and contamination are considered negligible as a result of the Proposed Development, following implementation of any required mitigation measures.
- 13.7.20. **Table 13.5** provides a summary of effects, mitigation and residual effects.

Contaminated Land and Ground Conditions

Table 13.5: Summary of Effects, Mitigation and Residual Effects

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
Construction Phase								
Construction Personnel and occupants of neighbouring properties	Contaminated soils – adverse health effects resulting from ingestion, direct contact and inhalation (dust / vapours / particulates potentially asbestos fibres)	Permanent / Direct Short to long term, likely to be affected by duration of exposure	High	Medium	Local	Major to moderate adverse	Carry out Phase II Exploratory Investigation to establish presence and extent of contamination. Provide and implement a Remediation Method Statement. Construction personnel should comply with health and safety requirements and general site rules.	Negligible (not significant)
Construction Personnel	Ground gases – adverse health effects and potentially	Permanent / Direct	High	Medium	Local	Major to moderate adverse	A programme of ground gas monitoring should be	Negligible

Environmental Statement

Contaminated Land and Ground Conditions

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
	asphyxiation resulting from inhalation	Short to long term likely to be affected by duration of exposure					undertaken as part of Phase II Exploratory Investigation to establish ground gas regime and classify site. Construction personnel should comply with health and safety requirements and the general site rules.	(not significant)
Construction Personnel and Neighbouring Properties (including occupants of neighbouring properties)	Disturbance of / contact with Unexploded Ordnance – potentially leading to explosion	Permanent / Direct	High	High	Local / Regional	Major adverse	Commission specialist UXO Desk Study to ascertain risk from UXO and potentially zone the Site. Implement any recommended mitigation measures. Construction personnel should comply with health and	Negligible (not significant)

Contaminated Land and Ground Conditions

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
							safety requirements and general site rules.	
Controlled Waters	Contaminated soils / groundwater – surface water runoff or leaching through strata within groundwater Leakage / spillage of fuels / oils / chemicals during construction	Temporary	Medium	Low	Local / Regional	Minor to moderate adverse	Carry out Phase II Exploratory Investigation to establish presence and extent of contamination. Provide and implement Remediation Method Statement. Compliance with general site rules and environmental management set out in CEMP.	Negligible (not significant)
Operational Phase								

Environmental Statement

Contaminated Land and Ground Conditions

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
End-users (human health of residents and visitors)	Contaminated soils – adverse health effects resulting from ingestion, direct contact and inhalation (dust / vapours / particulates)	Permanent / Direct Typically short to medium term for visitors, potentially long term for residents	High	Medium	Local	Major to moderate adverse	Carry out Phase II Exploratory Investigation to establish presence and extent of contamination	Negligible (not significant)
End-users (human health of residents and visitors)	Ground gases – adverse health effects and potentially asphyxiation resulting from inhalation	Direct Short to medium term for visitors, potentially long term for residents	High	Medium	Local	Major to moderate adverse	A programme of ground gas monitoring should be undertaken as part of Phase II Exploratory Investigation to establish ground gas regime and classify site. Where necessary appropriate ground gas protection measures should be installed within structures.	Negligible (not significant)

Contaminated Land and Ground Conditions

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
End-users (human health of residents and visitors)	Disturbance of / contact with Unexploded Ordnance – potentially leading to injury / explosion	Permanent / Direct	High	High	Local / Regional	Major adverse	Commission specialist UXO Desk Study to ascertain risk from UXO and potentially zone the Site. Implement any necessary mitigation measures	Negligible (not significant)
Controlled Waters	Contamination from anthropogenic activities – surface water runoff or leaching through strata within groundwater	Indirect / direct Temporary Likely to be short term	Medium	Negligible	Local / Regional	Negligible	Provision of a road drainage system which incorporates measures for dealing with contaminated runoff from roadways and car parking. This system should be regularly maintained.	Negligible (not significant)
On-site structures and	Residual Contamination – permeation	Direct / indirect	Medium	Medium	Local	Moderate	Carry out Phase II Exploratory Investigation to establish	Negligible

Environmental Statement

Contaminated Land and Ground Conditions

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
construction materials	of water supply pipes Aggressive Ground – sulphate attack on buried concrete	through leaching Permanent Long term					presence and extend of contamination. Provide and implement a Remediation Method Statement.	(not significant)
On-site structures and construction materials	Ground Gases – accumulation within structures potentially leading to explosion	Direct Permenant Long Term	High	High	Local	Major	A programme of ground gas monitoring should be undertaken as part of Phase II Exploratory Investigation to establish ground gas regime and classify site. Where necessary appropriate ground gas protection measures should be installed within structures.	Negligible (not significant)

Contaminated Land and Ground Conditions

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
On-site structures and construction materials	Contact with Unexploded Ordnance – potentially leading to explosion	Permanent / Direct	High	High	Local / Regional	Major adverse	Commission of specialist UXO Desk Study to ascertain risk from UXO and potentially zone the Site. Implement any recommended mitigation measures.	Negligible (not significant)