

10. Land Quality

10.1 Introduction

- 10.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development with reference to Land Quality. The chapter should be read in conjunction with **Chapter 2: Description of the Proposed Development** and with reference to relevant parts of other chapters including **Chapter 12: Surface Water and Flood Risk** and **Chapter 13: Groundwater**, where common receptors have been considered and where there is an overlap or relationship between the assessment of effects.

10.2 Limitations of this assessment

- 10.2.1 The baseline information informing this ES is predominantly derived from desk study information, carried out in accordance with the Environment Agency (EA) *Model Procedures for the Management of Land Contamination (Contaminated Land Report (CLR) 11)*¹. Access has not been possible to all areas of land associated with the Proposed Development. No intrusive investigations have been undertaken to date within the area of the Proposed Development and the assessment in this Chapter is therefore based on desk study information to develop a realistic worst-case scenario. It is considered unlikely that additional data that would be derived from intrusive investigations would significantly change the findings of this Chapter and the significance of the effects assessed.

10.3 Relevant legislation, planning policy and technical guidance

Legislative context

- 10.3.1 The following legislation is relevant to the assessment of the effects on Land Quality receptors:
- *Environmental Liability Directive (2004/35/EC)*²: Requires an operator to take preventative, as well as remedial, measures. It applies both to damage that has occurred and where there is an imminent risk of it occurring. The *Environmental Liability Directive* is implemented in England by the *Environmental Damage (Prevention and Remediation) Regulations 2009 (SI 2009/153)*³;
 - *Water Framework Directive (WFD) (2000/60/E)*⁴: The overall purpose is to establish a framework for the protection of surface fresh water, estuaries, coastal water and groundwater. The primary objectives are to improve surface water and groundwater quality and to ensure that pollutants are prevented from entering groundwater and surface water. This is implemented into English law through *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003*⁵;

¹ Environment Agency (2004). CLR 11 Model Procedures for the Management of Land Contamination, [online]. Available at: https://www.claire.co.uk/index.php?option=com_content&view=article&id=187&catid=45&Itemid=256 [Checked 23/08/2018].

² Environmental Liability Directive (2004/35/CE), [online]. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0056:0075:en:PDF> [Checked 23/08/2018].

³ The Environmental Damage (Prevention and Remediation) Regulations 2009, [online]. Available at: http://www.legislation.gov.uk/uksi/2009/153/pdfs/uksi_20090153_en.pdf [Checked 26/09/2018].

⁴ Water Framework Directive (WFD) (2000/60/E), [online]. Available at: http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm [Checked 23/08/2018].

⁵ The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, [online] Available at: <http://www.legislation.gov.uk/uksi/2003/3242/contents/made> [Checked 23/08/2018].

- *Groundwater Directive (80/68/EEC)*: Aims to protect groundwater against pollution caused by dangerous substances. The directive is primarily implemented in England and Wales by the *Environmental Permitting (England and Wales) Regulations 2016*⁶;
- *Directive on the Protection of Groundwater Against Pollution and Deterioration (2006/118/EC)*⁷ as amended by *Commission Directive 2014/80/EU* of 20 June 2014: Sets out specific measures for preventing and controlling groundwater against pollution and deterioration;
- *The Town and Country Planning Act (Environmental Impact Assessment) Regulations, 2017*⁸: Requires that the Environmental Impact Assessment (EIA) identify, describe and assess the significant direct and indirect effects of the Proposed Development on human health, biodiversity, land, soil and water. As per Schedule 1 Regulation "4(2): *The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on the following factors—(a)population and human health; (b)biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC(1) and Directive 2009/147/EC(2); (c)land, soil, water, air and climate; (d)material assets, cultural heritage and the landscape; (e)the interaction between the factors referred to in sub-paragraphs (a) to (d).*";
- *Town and Country Planning Act 1990*⁹: Historical land contamination is a material consideration under this act. It is necessary to ensure that any land which is to be redeveloped is suitable for its proposed end use. Therefore, prior to development, the planning authority may require investigation of the site and, if necessary, remediation to take place;
- *Environmental Protection Act 1990*¹⁰: The contaminated land regime is set out within Part 2A, which provides a statutory definition of 'contaminated land' and sets out the nature of liabilities that can be incurred as a result of contaminated land and groundwater. Contaminated land is defined 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:

- ▶ *Significant harm is being caused, or there is significant possibility of such harm being caused; or*
- ▶ *Significant pollution of controlled water is being caused or there is significant possibility of such pollution being caused".*

The accompanying statutory guidance¹¹ states that Part 2A takes a risk-based approach to defining contaminated land. The guidance follows established principles of risk assessment, including the concept of a 'contaminant linkage' (i.e. a linkage between a 'contaminant' and a 'receptor' by means of a 'pathway') where:

⁶ Environmental Permitting (England and Wales) Regulations 2016, [online]. Available at: <http://www.legislation.gov.uk/ukxi/2016/1154/contents/made> [Checked 23/02/2018].

⁷ Directive on the Protection of Groundwater Against Pollution and Deterioration (2006/118/EC) as amended by Commission Directive 2014/80/EU of 20 June 2014.

⁸ The Town and Country Planning (Environmental Impact Assessment) Regulations 2017, [online]. Available at: <http://www.legislation.gov.uk/ukxi/2017/571/contents/made> [Checked 11/10/2018].

⁹ Town and Country Planning Act 1990, [online]. Available at: <https://www.legislation.gov.uk/ukpga/1990/8/contents> [Checked 23/08/2018].

¹⁰ Environmental Protection Act 1990, [online]. Available at: <http://www.legislation.gov.uk/ukpga/1990/43> [Checked 12/02/2018].

¹¹ Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223705/pb13735cont-land-guidance.pdf [Checked 28/09/18].

- ▶ *'A contaminant is a substance which is in, on or under the land and which has the potential to cause significant harm to a relevant receptor, or 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; and*
- ▶ *A pathway is a route by which a receptor is or might be affected by a contaminant.'*
- *Water Resources Act 1991¹² and Environmental Permitting (England and Wales) Regulations 2016⁶ (hereafter referred to as 'EPR'): For sites where contamination of controlled waters is a potential issue, in addition to the provisions of Part 2A, consideration should also be given to the Water Resources Act (WRA) 1991. Parts of the Act have been replaced by the EPR, although some of the core definitions (e.g. controlled waters) still refer to the WRA.*

The two aspects of the EPR so far as controlled waters are concerned are:

- ▶ Schedule 21: Water discharge activities – these are concerned with discharges to surface waters, that are controlled waters, of any poisonous, noxious or polluting matter; waste matter; trade effluent or sewage effluent; and
- ▶ Schedule 22: Groundwater activities – these are concerned with discharges of pollutants, or other discharges that may lead to input of a pollutant, to groundwater.

The "activities" relate both to those that require a permit and activities that are unlawful (e.g. causing pollution to controlled waters), with only a small number of activities being exempt, although even these need to be registered with the EA. However, a "passive" release of pollutants, such as may occur to groundwater from land where the original cause of pollution has ceased is not considered to be an activity requiring permitting.

Under the WRA, the EA still has the power to remediate pollution of controlled waters by means of Anti-Pollution Works Notices, via Section 161A of the WRA.

The provisions of the WRA and EPR (and the consequent powers of the EA) can apply when the land is not Statutory Contaminated Land under the terms of Part 2A. The EA has indicated that in general Part 2A will be applied in preference to WRA powers if it is applicable (i.e. passive discharges are occurring); and

- *Building Regulations 2010, Approved Document C Site Preparation and Resistance to Contaminants and Moisture 2013¹³*: Indicates the need for risk assessment and remediation to be undertaken to ensure safe development.

Planning policy context

10.3.2

There are a number of policies and guidance documents at the national and local level that are relevant to the Bristol Airport Limited (BAL) ES. In addition to policy referenced in **Chapter 5: Legislative and Policy Overview**, policy directly applicable to this technical specialism is listed in **Table 10.1**.

¹² Water Resources Act (1991). [online]. Available at: <https://www.legislation.gov.uk/ukpga/1991/57/contents> [Checked 23/02/2018].

¹³ The Building Regulations (2010). [online]. Available at: <https://www.gov.uk/government/publications/site-preparation-and-resistance-to-contaminates-and-moisture-approved-document-c> [Checked 23/08/2018].

Table 10.1 Planning policy issues relevant to Land Quality

Policy reference	Implications
National Planning Policy Framework (NPPF) 2018¹⁴	
Paragraph 118	Requires decisions to support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.
Paragraph 170	Requires decisions to contribute to and enhance the natural and local environment by: <ul style="list-style-type: none"> e) <i>"preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability"; and</i> f) <i>"remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate".</i>
Paragraph 178	Requires decisions to ensure that: <ul style="list-style-type: none"> a) <i>"a site is suitable for its proposed use taking account of the suitability of the site for its proposed use, taking account of ground conditions, 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)".</i> b) <i>"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".</i> c) <i>"Adequate site investigation information, prepared by a competent person, is available to inform these assessments".</i>
Paragraph 179	Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.
North Somerset Council (NSC) Core Strategy January 2017¹⁵	
CS3 – Environmental impacts and flood risk management	Development that, on its own or cumulatively, would result in air, water or other environmental pollution or harm to amenity, health or safety will only be permitted if the potential adverse effects would be mitigated to an acceptable level by other control regimes, or by measures included in the proposals, by the imposition of planning conditions or through a planning obligation.
Airports National Policy Statement¹⁶	
	<p>The government issued the Airports National Policy Statement (NPS): new runway capacity and infrastructure at airports in the South East of England in June 2018). Whilst this document focuses on the potential for an expanded Heathrow Airport, it provides policy guidance as to how the impacts of airport development upon Land Quality should be considered.</p> <ul style="list-style-type: none"> ● Land use including open space, agricultural land, green infrastructure and Green Belt: <ul style="list-style-type: none"> ▶ Section 5.108: <i>"Best and most versatile agricultural land is land which is most flexible, productive and efficient in response to inputs and which can best deliver future crops for food and non-food uses such as biomass, fibres and pharmaceuticals. The National Planning Policy Framework sets out how local planning authorities should take into account the economic and other benefits of best and most versatile agricultural land. Planning practice guidance for the</i>

¹⁴ Ministry of Housing, Communities and Local Government (2018). National Planning Policy Framework, [online]. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2> [Checked 29/08/2018].

¹⁵ North Somerset Council (2017). Core Strategy, [online]. Available at: <https://www.n-somerset.gov.uk/wp-content/uploads/2015/11/Core-Strategy-adopted-version.pdf> [Checked 30/03/18].

¹⁶ Department for Transport (2018). Airports National Policy Statement: New Runway Capacity and Infrastructure at Airports in the South East of England, [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/714106/airports-nps-new-runway-capacity-and-infrastructure-at-airports-in-the-south-east-of-england-web-version.pdf [Checked 23/08/2018].

Policy reference	Implications
	<p><i>natural environment provides additional guidance on best and most versatile agricultural land and soil issues”.</i></p> <ul style="list-style-type: none"> ▶ Section 5.109: “Development of land will affect soil resources, including physical loss of and damage to soil resources, through land contamination and structural damage. Indirect impacts may also arise from changes in the local water regime, organic matter content, soil biodiversity and soil process”. ▶ Section 5.110: “Construction and operation of airport facilities is a potential source of contaminative substances (for example, through de-icing or leaks and spills of fuel). Where pre-existing land contamination is being considered through development, the objective is to ensure that the site is suitable for its intended use. Risks would require consideration in accordance with the contaminated land statutory guidance as a minimum”. ▶ Section 5.115: “The applicant should take into account the economic and other benefits of best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, the applicant should seek to use areas of poorer quality land in preference to that of a higher quality. The applicant should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed”. ● Water quality and resources: <ul style="list-style-type: none"> ▶ Section 5.174: “Development may result in an increased potential for impacts on the water environment, especially the quality of the surface and groundwater through the discharge of waters contaminated with de-icer along with hydrocarbons and other pollutants”; and ▶ Section 5.173: “The applicant should make sufficiently early contact with the relevant regulators, including the EA, for abstraction licensing and environmental permitting, and with the water supply company likely to supply the water. Where the proposed development is subject to an Environmental Impact Assessment and the development is likely to have significant adverse effects on the water environment, the applicant should ascertain the existing status of, and carry out an assessment of, the impacts of the proposed project on water quality, water resources and physical characteristics as part of the environmental statement”.

Technical guidance

10.3.3 A summary of the relevant technical guidance is given in **Table 10.2**.

Table 10.2 Technical guidance relevant to Land Quality

Technical guidance reference	Summary of guidance
EA Contaminated Land Report (CLR) 11, Model Procedures for the Management of Land Contamination, 2004¹	Provides the technical framework for structured decision making about land contamination.
EA Groundwater Protection: Principles and Practice (GP3)¹⁷	Outlines the regulator’s framework for the management and protection of groundwater.

¹⁷ Environment Agency (2013). Groundwater protection: principles and practice GP3, [online]. Available at: <https://www.gov.uk/government/publications/groundwater-protection-principles-and-practice-gp3> [Checked 23/08/2018].

Technical guidance reference	Summary of guidance
Guidance for the safe development of housing on land affected by contamination, R&D publication 66: 2008¹⁸	Framework for assessment of contaminated land for development based on CLR11.
British Standards (BS) 10175:2011+A1 2013¹⁹	Investigation of Potentially Contaminated Sites - Code of Practice.
Construction Industry Research and Information Association (CIRIA) Report C532²⁰	Control of Water Pollution from Construction Sites.
CIRIA Report C692²¹	Environmental Good Practice on Site.
Health and Safety Executive (HSE) HSG66²²	Protection of workers and the general public during the development of contaminated land.
BS8485:2015²³	Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings.
BS8576:2013²⁴	Guidance on Investigations for Ground Gases, Permanent Gases and Volatile Organic Compounds (VOCs).
CIRIA Report C665²⁵	Assessing Risks Posed by Hazardous Ground Gases to Buildings.
BS6031:2009²⁶	Code of Practice for Earthworks: Best practice guidance on geotechnical aspects of earthworks and on working practices.
CL:AIRE (2011)²⁷	The Definition of Waste: Development of Industry Code of Practice.
CIRIA Report 132²⁸	A guide for safe working practices on contaminated Sites.

¹⁸ NHBC, Environment Agency and Chartered Institute of Environmental Health (2008). Guidance for the safe development of housing on land affected by contamination, R&D Publication 66: 2008, [online]. Available at: <http://www.nhbc.co.uk/NHBCpublications/LiteratureLibrary/Technical/filedownload,33595,en.pdf> [Checked 23/08/2018].

¹⁹ British Standard (2013). Investigation of Potentially Contaminated Sites – Code of Practice, [online]. Available at: <http://bailey.persona-pi.com/Public-Inquiries/M4-Newport/C%20%20Core%20Documents/12.%20Geology%20and%20Soils/12.2.13%20%20BS10175%20Code%20of%20Practice%20for%20Investigation%20of%20Potentially%20Contaminated%20Sites%20%28inc.%202013%20Amendment%29.pdf> [Checked 23/08/2018].

²⁰ CIRIA (2001). Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors, [online]. Available at: <http://www.orkneywind.co.uk/advice/SEPA%20Pollution%20Advice/ciria%20c532.pdf> [Checked 23/08/2018].

²¹ CIRIA (2010). PUB C692 Environmental Good Practice on Site, [online]. Available at: <https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=296239> [Checked 23/08/2018].

²² Health and Safety Executive, NBS (1991). HSG66: Protection of Workers and the General Public during the development of contaminated land (no longer current by cited in Building Regulations), [online]. Available at: <https://www.thenbs.com/PublicationIndex/documents/details?Pub=HSE&DocID=81882> [Checked 23/08/2018].

²³ British Standard (2015). BS 8485; 2015 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings, [online]. Available at <https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocID=310951> [Checked 23/08/2018].

²⁴ British Standards (2013). BS 8576:2013 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs), [online]. Available at: <http://bailey.persona-pi.com/Public-Inquiries/M4-Newport/C%20%20Core%20Documents/12.%20Geology%20and%20Soils/12.2.12%20%20BS8576%20Guidance%20on%20Investigations%20of%20Ground%20Gas.pdf> [Checked 23/08/2018].

²⁵ CIRIA (2007). Assessing Risks posed by hazardous ground gases to buildings, [online]. Available at <https://www.ciria.org/ProductExcerpts/C665.aspx> [Checked 23/08/2018].

²⁶ British Standards Institution (2009). BS 6031; 2009, [online]. Available at: <https://geotechnicaldesign.info/download/bs6031-2009.pdf> [Checked 23/08/2018].

²⁷ CL:AIRE (2008). The Definition of Waste: Development Industry Code of Practice, [online]. Available at: <https://www.claire.co.uk/projects-and-initiatives/dow-cop/28-framework-and-guidance/111-dow-cop-main-document> [Checked 23/08/2018].

²⁸ Steeds, J, Shepherd, E and Barry, P (1996). A Guide to Safe Working on Contaminated Sites: R132. CIRIA, PP232.

Technical guidance reference	Summary of guidance
CIRIA guidance C681²⁹	Unexploded Ordnance (UXO), a guide for the construction industry. Provides a set and defined process for the management of risks associated with UXO.
Ministry of Agriculture, Fisheries and Food (MAFF), 1988³⁰	Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land.
Department for Environment, Food and Rural Affairs (Defra), 2009³¹	Safeguarding our Soils; a Soil Strategy for England.
Government Circular 06/2005 'Biodiversity and Geological conservation'³²	Statutory obligations and their impact within the planning system.
CIRIA Technical Bulletin TB17³³ 2018	Guidance on ground gas monitoring and 'worst-case' conditions to ensure that sufficient data has been collected to cover critical variation in barometric pressure.
Building Research Establishment BR211, 2015³⁴	Guidance on protective measures for new buildings from radon.

10.4 Data gathering methodology

Study area

- 10.4.1 The Proposed Development is defined by the areas presented in **Figure 2.1**.
- 10.4.2 The Land Quality Zone of Influence (ZoI) for the Proposed Development for which searches have been completed extends up to 250m from the boundary of each of the Proposed Development areas. This corresponds with the study area for which the Phase 1 Land Quality Assessment (**Appendix 10A**) is focussed, which comprises the land required for the Proposed Development and a surrounding buffer area extending 250m outwards from the Proposed Development.

Desk study

- 10.4.3 A summary of the organisations and sources from which Land Quality information has been obtained, together with the nature of that data, is presented in **Table 10.3**.

²⁹ CIRIA (2009). Guidance C681, Unexploded Ordnance (UXO), a guide for the construction industry.

³⁰ Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land, MAFF 1988.

³¹ Defra (2009). Safeguarding our Soils: A Strategy for England, [online]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69261/pb13297-soil-strategy-090910.pdf [Checked 23/08/2018].

³² Office of the Deputy Prime Minister (2005). Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their impact within the Planning System, [online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7692/147570.pdf [Checked 29/08/2018].

³³ CL:AIRE (2018). Ground Gas Monitoring and 'Worst-Case' Conditions. Technical Bulletin 17, [online]. Available at: <https://www.claire.co.uk/home/news/1089-cl-aire-publishes-new-technical-bulletin-tb17-on-ground-gas-monitoring> [Checked 07/09/2018].

³⁴ BR211 (2015). Radon: Guidance on protective measures for new buildings. Building Research Establishment, 2015.

Table 10.3 Sources of Information

Topic	Aspect	Source of Information
Geology	Solid and drift geology	British Geological Survey (BGS) 1:50,000 Series Geology maps. British Geological Survey, 2004. Sheet 264, Bristol, Solid and Drift Edition BGS Geology of Britain Viewer ³⁵
Topography and Land-use	Ground elevation and gradient	Ordnance Survey (OS) 1:50,000, Landranger Sheet 182 Weston-super-Mare OS 1:50,000, Landranger Sheet 172 Bristol & Bath OS 1:25,000, Explorer Sheet 154 Bristol West & Portishead Online maps and aerial photography ³⁶
Hydrology and Hydrogeology	Aquifers, river networks/surface water and location of springs	Defra MAGIC database ³⁷ and information from the Landmark Envirocheck Report ³⁸
	Groundwater abstractions and discharges	Information from the Landmark Envirocheck Report ³⁸ and checked against records held by the EA (Licensed abstractions and discharge) and NSC (Private water supplies).
	Hydrogeology of Bristol Airport	AEA Technology, 2000, <i>Hydrogeology of Bristol International Airport: Desk Study</i> . AEAT/ENV/R/0447
Geology and Contaminated Land	Ground conditions	Phase 1 Land Quality Assessment (Appendix 10A). Information on current land use, potential geotechnical constraints associated with this use, evidence of contamination / potential sources of contamination, an indication of potential receptors (on and off-site) and an assessment of potential risks to receptors.
	Ground conditions	Entec UK Ltd, 2011 ³⁹ . <i>Phase 1 Contaminated Land Desk Study</i> . Information on land use, potential geotechnical constraints, evidence of contamination / potential sources of contamination, assessment of potential risks to receptors, preliminary unexploded ordnance (UXO) assessment.
	Ground conditions	Capita Symonds, 2008 ⁴⁰ . <i>Proposed Hotel Site Geo-environmental Report</i> . Assessment of ground conditions for a proposed hotel site in the north-western area of the application site.
	Ground conditions	Capita Symonds, 2011 ⁴¹ . <i>Ground Investigation Report Western Apron</i> . Assessment of ground conditions at a proposed western apron extension at the application site.
	Ground conditions	Capita Symonds <i>Bristol Airport Silver Zone Car Park Reception Geo-environmental Report</i> , 2015 ⁴² . Assessment of ground conditions at the Silver Zone Car Park at the south of the application site.
	Ground conditions	Capita Symonds <i>Bristol Airport Cogloop Car Park Development Geo-environmental Report</i> , 2016 ⁴³ . Assessment of ground conditions at the proposed Cogloop Car Park at the south of the application site.

³⁵ British Geological Survey (2018). British Geological Survey Geology of Britain Viewer, [online]. Available at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> [Checked 21/08/2018].

³⁶ On-line maps and aerial photography, [online]. Available at: <https://www.bing.com/maps> [Checked 29/08/2018].

³⁷ Defra (2018). MAGIC database, [online]. Available at: <http://magic.defra.gov.uk/> [Checked 29/08/2018].

³⁸ Envirocheck Report (2017). Ref. 128842570_1_1, 16 June 2017.

³⁹ Entec UK Limited (2011). Post Planning Application Conditions: Phase 1 Contaminated Land Desk Study, Report Reference 28770 RR002i4.

⁴⁰ Capita Symonds (2008). Proposed Hotel Site Geo-environmental Report, Bristol International Airport, Report Reference CS\34238.

⁴¹ Capita Symonds (2011). Ground Investigation Report Western Apron, Bristol Airport, Report Reference CS\47683.

⁴² Capita Symonds (2015). Bristol Airport Silver Zone Car Park Reception Geo-environmental Report, Reference CS\080696.

⁴³ Capita Symonds (2016). Bristol Airport Cogloop Car Park Geo-environmental Report, Reference CS\086676.

Topic	Aspect	Source of Information
	Ground conditions	Capita Symonds <i>Bristol Airport Stand 7N Extension Geo-environmental Report, 2017</i> ⁴⁴ . Assessment of ground conditions at the proposed Stand 7N Extension.
	Ground conditions	Ricardo Energy & Environment, 2018 ⁴⁵ . <i>Eastern Terminal Extension – 2017 Annual Report</i> . Results from annual monitoring of boreholes installed to investigate and monitor hydrocarbon (kerosene) contamination identified to the east of the terminal building, underneath the Eastern Terminal Extension.
Plans	Historical and recent plans	Landmark Envirocheck Report ³⁸
Environmental Database	Environmental database information	Landmark Envirocheck Report ³⁸
Risk Assessment	Assessment methodology of receptor sensitivity from Contamination	<i>Guidance for the Safe Development of Housing on Land Affected by Contamination</i> R&D66: 2008 ¹⁸ .
UXO	UXO risk assessment	Zetica, 2018 ⁴⁶ . <i>UXO Desk Study & Risk Assessment</i> .
Agriculture	Agricultural land classification	Soil Environment Services Ltd, 2018. <i>Agricultural Land Classification Survey of the proposed extension to the Silver Zone Car Park (Phase 2)</i> . September 2018. Presented in Appendix 10B .

10.4.4 A Phase 1 Land Quality Assessment (**Appendix 10A**) was undertaken in accordance with EA CLR 11¹. The purpose of this study was to assist in understanding environmental risks and liabilities associated with land quality and potential geotechnical hazards, in order for the Proposed Development to support the safe and economic development of the application site. The definitions for the qualitative risk assessment have been taken from the *Guidance for the Safe Development of Housing on Land Affected by Contamination* report¹⁸ that states:

"The guidance, whilst written to be relevant to housing development on such sites, is also generally applicable to other forms of development, to existing developments and to undeveloped land, where such sites are on land affected by contamination".

10.4.5 The Phase 1 Land Quality Assessment (**Appendix 10A**) comprised of the following scope of works:

- Review of any existing information, including information obtained from sources such as Landmark Information Group's Envirocheck Report³⁸ (refer to **Table 10.3**);
- Review of previous reports (refer to **Table 10.3**);
- Site walkover;
- The development of a Conceptual Site Model and a preliminary Qualitative Risk Assessment (QRA), according to the Source-Pathway-Receptor (SPR) model;
- Identification of information gaps relating to land contamination and any requirements for further assessment; and
- Geotechnical assessment to identify potential hazards and constraints.

⁴⁴ Capita Symonds (2017). Bristol Airport Stand 7N Extension Geo-environmental Report, Reference CS/093133.

⁴⁵ Ricardo Energy & Environment (2018). Eastern Terminal Extension – 2017 Annual Report, Report Reference ED 10127, Issue No. 1.

⁴⁶ Zetica (2018). Bristol Airport – UXO Desk Study & Risk Assessment, Report Reference P7872-18-R1, Rev A.

- 10.4.6 As part of the Phase 1 Land Quality Assessment (**Appendix 10A**), an UXO Desk Study Risk Assessment⁴⁶ was completed in accordance with the requirements of *CIRIA guidance C681*²⁹. The UXO assessment was completed for the entire application site, including the Proposed Development and surrounding areas.

Survey work

- 10.4.7 A site walkover was undertaken by a consultant from Wood in March 2018 to obtain additional visual information about the application site's current setting and any potential land quality issues. The findings of the walkover were incorporated into the Phase 1 Land Quality Assessment (**Appendix 10A**).
- 10.4.8 An Agricultural Land Classification (ALC) Survey was completed in September 2018 (**Appendix 10B**) within the Silver Zone Car Park Extension (Phase 2) in accordance with the MAFF 1988 guidelines³⁰ and with reference to Defra 2016³¹ guidance. The ALC (Provisional) for England shows this area of the Proposed Development as being classified as Grade 3 agricultural land. However, the provisional mapping does not differentiate between Grade 3a (which is classified as Best and Most Versatile (BMV) land) and Grade 3b (which is not BMV). The ALC survey was completed to confirm the classification.

10.5 Overall baseline

Current baseline

Geology and hydrogeology

- 10.5.1 Desk study information presented in the Phase 1 Land Quality Assessment (**Appendix 10A**) indicates that the majority of the Proposed Development is underlain by Made Ground associated with the existing infrastructure, which in turn is underlain by superficial deposits of clay of up to approximately 9.0m in thickness (typically 2.0m to 5.0m in thickness), overlying bedrock of the Carboniferous Black Rock Limestone subgroup. An area to the south of the application site, associated with the Silver Zone Parking and Bristol and Wessex Aeroplane Club, and to the very north-west, covering the north of Tall Pines Golf Club, is underlain by bedrock geology of the Brockley Down Limestone. There is also a small area in the south-west of Bristol Airport where the Westbury Formation and Cotham Member (undifferentiated) are found.
- 10.5.2 The majority of the application site is underlain by a Principal Aquifer (the Black Rock Limestone), with relatively thin and intermittent drift cover (unproductive superficial strata). The Brockley Down Limestone at the northwest is a Secondary A Aquifer.
- 10.5.3 The majority of the application site lies within a Zone 2 outer Source Protection Zone (SPZ), associated with the designated outer catchment of Bristol Water's Chelvey Well abstraction, which is approximately 3.4km to the north-east of the application site.
- 10.5.4 There is evidence, as outlined in the Phase 1 Land Quality Assessment (**Appendix 10A**), that historical limestone quarrying has taken place at the application site.
- 10.5.5 The Phase 1 Land Quality Assessment (**Appendix 10A**) indicates that lead and calamine (zinc oxide) workings are evident within the vicinity of the Proposed Development at the north and the south of the application site.
- 10.5.6 A number of collapse features and voids, associated with the natural geology that underlies this area, are identified in the Phase 1 Land Quality Assessment (**Appendix 10A**) to be present across

the application site. Further details of the geology and hydrogeology are outlined in **Chapter 13: Groundwater**.

Hydrology

- 10.5.7 There are no surface water features reported by the Envirocheck Report³⁸ within the vicinity of the Proposed Development. There are no surface watercourses present and none are recorded above the 150m Above Ordnance Datum (AOD) contour of Broadfield Down. Below this level, a number of springs are recorded which are likely to be fed by discharge from the limestone aquifer underlying the application site, as outlined in **Chapter 13: Groundwater**.
- 10.5.8 A SPZ lies to the west of application site and this has been defined for the surface water catchment to Bristol Water's Winford Brook source.
- 10.5.9 Further details regarding the hydrology of the application site are outlined in the **Chapter 12: Surface Water and Flood Risk**.

Sensitive land use

- 10.5.10 The Envirocheck Report³⁸ has been used to review the presence of sensitive ecological land uses. A Local Nature Reserve is present at Felton Common, located adjacent to the north eastern extent of the Proposed Development. No other sensitive land uses are identified within the ZoI of the Proposed Development.
- 10.5.11 Further details regarding sensitive ecological land uses within the area of the application site are outlined in **Chapter 11: Biodiversity**.
- 10.5.12 Other sensitive land uses, such as residential, recreational and commercial land uses are adjacent to the application site. Further details are presented within the Phase 1 Land Quality Assessment (**Appendix 10A**).
- 10.5.13 Agricultural land is present to the south of the application site and forms the area of the Silver Zone Car Park Extension (Phase 2). Further details are outlined in paragraph 10.5.25.

Previous reports

- 10.5.14 An annual report prepared in 2017⁴⁵ reviews monitoring data and a groundwater risk assessment associated with hydrocarbon contamination from a historical spill of kerosene within an area around the Eastern Terminal Extension (ETE) of the terminal building. The contamination was identified to be associated with a former transit shed that was demolished in the 1980s. This found hydrocarbon contamination within shallow perched groundwater immediately beneath the ETE area. Following the discovery, BAL undertook further investigation and initiated a monitoring programme. The results of the monitoring programme were used to inform a Groundwater Risk Assessment (GWRA), which was published and agreed with the EA. The results of the monitoring of the aquifer underneath the spill area and perimeter indicated that no contamination was present in the principal aquifer. The report concluded that monitored natural attenuation was an appropriate means to remediate the contamination.
- 10.5.15 A Ground Investigation Interpretative report published in 2008⁴⁰ assesses ground conditions based on nine machine-dug trial pits to a maximum depth of 1.2m below ground level (bgl). All pits found clayey gravel beneath existing tarmac surfacing and terminated on limestone bedrock. Contamination test results indicated elevated concentrations of arsenic and lead, most likely due to the natural geology beneath the site. This report is likely to be generally indicative of ground conditions specifically to the north and north-west of the existing terminal building on the application site.

- 10.5.16 A Ground Investigation Interpretative published in 2011⁴¹ assesses ground conditions at the proposed western apron extension site based on 31 No. machine-dug trial pits and four window-sample boreholes to a maximum depth of 3.0m bgl. All pits encountered natural or reworked gravelly clay and terminated on limestone bedrock at various depths. Contamination test results indicated elevated concentrations of arsenic and lead. Detailed appendices were missing from the report as provided, although in this case exploratory hole location plans were included. This report is likely to be generally indicative of ground conditions immediately south of the western apron extension. Details of ground conditions for specific exploratory holes are not available within the report as provided.
- 10.5.17 A Ground Investigation Interpretative report published in 2015⁴² assesses ground conditions at the existing Silver Zone Car Park in the southern part of the application site, based on 13 No. machine-dug trial pits to a maximum depth of 3.2m bgl. This report covers a site close to the east of the Silver Zone Car Park Extension (Phase 2). The report includes a site specific BGS Radon Report which states that the property is in a radon affected area with an estimated probability of 10-30% (higher probability) of the property being above the Action Level for radon. The BGS Radon Report states that full radon protective measures are required for any new buildings within the area.
- 10.5.18 A Ground Investigation Interpretative report published in 2016⁴³ assesses ground conditions at the proposed Cogloop car park (i.e. prior to its construction) (referred to as the Silver Zone Car Park Extension (Phase 1) extension in this ES) based on 23 No. machine-dug trial pits to a maximum depth of 2.0mbgl. All pits encountered natural sand and gravel and terminated on limestone bedrock at various depths. Two pits encountered Made Ground. Contamination test results indicated slightly elevated concentrations of arsenic and lead, most likely due to the natural geology beneath the site. In one location, asbestos (chrysotile) was observed in the form of loose fibres in a topsoil sample, which subsequent laboratory quantification testing reported a concentration below the method detection limit of <0.001 % weight by weight (w/w). This report covers a site immediately north of the Silver Zone Car Park Extension (Phase 2).
- 10.5.19 A Ground Investigation Interpretative report published in 2017⁴⁴ assesses ground conditions at the proposed Stand 7N site (the proposed Eastern Apron extension to the east of the East Terminal Building) based on four machine-dug trial pits to a maximum depth of 1.0m bgl. All pits encountered firm to stiff silty gravelly clay beneath the existing tarmac surfacing and terminated in that material. Contamination test results indicated elevated concentrations of arsenic and lead, most likely due to the natural geology beneath the application site. Slightly elevated concentrations of organic contaminants were also detected, possibly due to the existing tarmac surfacing and/or fuel spillages. Detailed appendices including trial pit location plans were included in the report. This report is likely to be generally indicative of ground conditions in the Proposed Development areas east and north-east of the existing terminal building.

Current / historic land use

- 10.5.20 Desk study information presented in the Phase 1 Land Quality Assessment (**Appendix 10A**) indicates that Bristol Airport was first developed as an airfield in 1941 for use during World War Two (WWII), known as Royal Air Force (RAF) Lulsgate Bottom. After WWII, in 1946, the airfield was abandoned by the RAF. During the next ten years the airfield was used by Bristol Gliding Club and motor race meetings were held at the airfield.
- 10.5.21 In 1955 work began on airport terminal facilities. The new aerodrome, known as Bristol (Lulsgate) Airport, opened in 1957. Extensions were made to the terminal building in 1965 and work to lengthen the main runway to the west was completed in 1963.
- 10.5.22 The central apron was developed in three phases between 1984 and 1992.

- 10.5.23 In 2000 a new terminal building opened, the new control tower was completed and the Category III all-weather landing system (which required diversion of the A38 main road) was installed.
- 10.5.24 Desk study information presented in the Phase 1 Land Quality Assessment (**Appendix 10A**) indicates that raising of ground levels occurred during both the runway extension and the construction of the current terminal building.

Agricultural land quality

- 10.5.25 An ALC assessment (**Appendix 10A**) was completed on 4 September 2018 for the Silver Zone Carpark Extension (Phase 2) area. The assessment classifies the 5.4-hectare (ha) area as 3.2ha of Grade 3a land (Good quality BMV agricultural land) and 2.2ha of Grade 3b land (Moderate quality).

Soils

- 10.5.26 Soilscape summary data, available on the Magic.gov website³⁷, indicates that soils on and directly surrounding the application site are classed as loamy freely draining slightly acid soils with natural high fertility.

Waste disposal / landfilling

- 10.5.27 The Envirocheck Report³⁸ identifies one Licensed Waste Management Facility within 500m of the Proposed Development, located at Lulsgate Quarry, approximately 100m to the north-west of the application site. The licence is reported to be for inert landfill and is licensed to Churngold Recycling Limited.
- 10.5.28 An area of "unknown filled ground" is identified by the Envirocheck Report³⁸, located between the runway and the existing terminal building. The approximate location corresponds with the historical former Lulsgate Farm Quarry.
- 10.5.29 The Phase 1 Land Quality Assessment (**Appendix 10A**) indicates that other former quarries, lead workings and an old limekiln are noted within the application site, which may have been subject to infilling with contaminated, putrescible or biodegradable materials.
- 10.5.30 It further reports that there is a large area of level-raising at the west of the application site, associated with former expansion of the runway. The level-raising materials that were used are not identified in the information that has been made available.

Unexploded ordnance

- 10.5.31 A UXO Desk Study Risk Assessment was published in 2018⁴⁶. The UXO assessment concluded UXO hazard level at the application site to be Low. An assessed hazard level of Low is defined by Zetica as:
- "there is no positive evidence that UXO is present, but its occurrence cannot be totally discounted".*
- 10.5.32 The report includes a UXO risk assessment, which assesses a Low risk at the application site. An assessed Low risk is defined by Zetica as:
- "tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to".*
- 10.5.33 The Phase 1 Land Quality Assessment (**Appendix 10A**) included consultation with NSC regarding UXO. NSC confirmed that they do not hold any records of UXO at, or in the vicinity of, the application site.

Radioactive contamination

- 10.5.34 Former RAF bases may have a legacy of radioactive contamination arising from ad hoc disposal of, for example, radium luminised cockpit instruments dating from the mid-20th century, which were incinerated at a 'burning ground'. A Phase 1 Contaminated Land Desk Study Report published in 2011³⁹ indicates that wartime site layout plans identify a "refuse destructor" within the current sewage treatment plant, located to the north of Downside Road (to the north of the application site). The report indicates that it is considered likely that any luminised cockpit instruments that were burnt would have been within this area and the likelihood of any radioactive contamination being present within the application site is considered to be Low.
- 10.5.35 The Phase 1 Land Quality Assessment (**Appendix 10A**) included consultation with NSC regarding radioactive contamination. NSC confirmed that they do not hold any records of radioactive contamination at, or in the vicinity of, the application site.

Radon

- 10.5.36 The Envirocheck Report³⁸ reports that the application site is located in a "higher probability radon area" (10% to 30% of homes are estimated to be at or above the Action Level) and full radon protective measures are necessary in the construction of new dwellings or extensions.

Land quality preliminary risk assessment

- 10.5.37 In line with the approach set out in CLR11¹ the data from the Phase 1 Land Quality Assessment (**Appendix 10A**) has been used to undertake a Preliminary Risk Assessment in order to develop a Conceptual Site Model (CSM).
- 10.5.38 The CSM identifies the potential contaminant linkages between contaminants (sources) and receptors present in a given scenario (known as SPR Linkages), as outlined in **Section 10.7**.

Potential sources of contamination

- 10.5.39 Plans showing the locations of the potential contamination sources at the application site, are included in the Phase 1 Land Quality Assessment (**Appendix 10A**), based on the following historical and current potential contaminant sources and poor ground conditions:
- Made Ground from landfills, level-raising and infilling of features (such as historical quarries);
 - Former sewage works;
 - Potentially contaminative WWII site uses;
 - Electricity substations;
 - Bulk oil and fuel storage;
 - Hydrocarbon contaminated shallow groundwater;
 - Aircraft operation and maintenance facilities (including mechanical maintenance, fire training areas and grounds maintenance);
 - Historical quarrying;
 - Historical lead workings;

- Geological hazards including collapse features and voids (including “swallets” marked on geological map) and geological fault lines (at the northern and southern extent of the application site);
- Naturally occurring radon gas; and
- Other potentially contaminative land uses (such as farm buildings, possible domestic fuel tanks etc.).

Potential contaminants

- 10.5.40 A review of baseline information indicates that there are potential sources of contamination within areas of the application site where components of the Proposed Development will be constructed, particularly the Made Ground associated with former development, the historical use as an airport and a RAF base, infilling or level-raising activities on-site, and bulk fuel storage. Potential contaminants include:
- Historical land uses: There are a number of historical land uses within areas of the application site where components of the Proposed Development will be constructed. These may add a constraint to development associated with ground and groundwater contamination and geotechnical implications. Such historical land uses include: former widespread small-scale mine workings and quarrying; WWII airfield and subsequent airfield use; fire-fighting training; farmland; and buildings. Contaminants associated with historical land uses may include but are not limited to: asbestos containing materials; fuels, oils; volatile contaminants; polyaromatic hydrocarbons; heavy metal contamination; pesticides; herbicides; de-icers (e.g. glycols); fire-fighting foams (e.g. perfluorooctane sulfonate and perfluorooctanoic acid); surfactants; UXO; and putrescible wastes. In addition, historical land uses may have caused poor geotechnical ground conditions in areas such as former mine workings, quarrying and areas of Made Ground, such as ad-hoc disposal of materials;
 - Current land use: It is assumed that current site uses will be operated in accordance with contemporary legislation, guidance and best practice. However, there is the potential for constraints to arise from poor practice whereby impact to land quality may occur. There is the potential for contaminants to exist and these may include but are not limited to: fuels; oils; polyaromatic hydrocarbons; asbestos containing materials; heavy metals; volatile contaminants; pesticides; herbicides; de-icers; fire-fighting foams; and surfactants; and
 - Geology: The ground (limestone bedrock) is vulnerable to dissolution and may pose a constraint through collapsing ground and sinkholes. Several sinkholes are recorded on database records. Two geological fault lines are present at the northern and southern extent of the application site which may require geotechnical foundation design considerations. Radon levels are indicated to be naturally elevated within BAL's land ownership boundary.

Future baseline

- 10.5.41 The current baseline will be used for the purpose of this assessment, as in the absence of the Proposed Development there are no known trends or factors that are expected to affect the current baseline conditions.
- 10.5.42 Climate change will have an effect on the conditions at the application site throughout the operational phase of the Proposed Development and is described in the Design and Access Statement. Hotter, drier summers and wetter, warmer winters will be experienced.

10.6 Consultation

- 10.6.1 Consultation has been carried out with the EA, NSC, Natural England (NE) and Wessex Water (WW). **Table 10.4** provides a summary of the issues regarding the Proposed Development that have been raised by consultees and the responses given.
- 10.6.2 The EA are responsible for the protection of groundwater quality and resources and the EA response in this regard is presented in **Chapter 13: Groundwater**.
- 10.6.3 In addition to contaminated land, NSC are concerned about potential impacts on groundwater quality feeding springs around the edge of Broadfield Down and on private water supplies. The NSC response to consultation in this regard is presented in **Chapter 12: Surface Water and Flood Risk**.

Table 10.4 Summary of issues raised during consultation regarding land quality

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
EA – Waste. <i>“The scope should consider waste arisings from the development and how these will be managed. Any contaminated land must be identified. The scope needs to consider waste management options with aims to minimise waste arisings. The scope should consider if any permits or exemptions will be required during the development.”</i>	EA	<p>Waste Management, including the consideration of waste arising during the construction phase, is discussed in Chapter 2: Description of the Proposed Development.</p> <p>The Proposed Development will be subject to a Construction Environmental Management Plan (CEMP) for the construction phase, which will outline how construction will be undertaken to avoid, minimise or mitigate effects on the environment and surrounding area, including the management of waste arisings. A CEMP is presented in Appendix 2B.</p> <p>The components which collectively form the Proposed Development will be subject to intrusive investigation to identify the presence or absence of contamination so that appropriate measures can be incorporated into the construction phase. This will be secured by planning conditions attached to any planning permission granted.</p>	Section 10.8
NSC – None. <i>“The scope and methodology for assessment is acceptable.”</i>	NSC	N/A	N/A
NE – Section 2.3. Regionally and Locally Important Sites. <i>“The EIA will need to consider any impacts upon local wildlife and geological sites. Local Sites are identified by the local wildlife trust, geoconservation group or a local forum established for the purposes of identifying and selecting local sites. They are of county importance for wildlife or geodiversity. The Environmental Statement should therefore include an assessment of the likely impacts on the wildlife and geodiversity interests of such sites. The assessment should include proposals for mitigation of any impacts and if appropriate, compensation measures.”</i>	NE	<p>The Phase 1 Land Quality Assessment (Appendix 10A) does not identify any geological sites that will be impacted by the Proposed Development.</p> <p>The nearest geological Site of Special Scientific Interest (SSSI) is located at Lulsgate Quarry, approximately 600m to the north-west of the application site and any impact on the SSSI is considered to be very unlikely from the Proposed Development.</p>	N/A
NE – Section 5. Soil and Agricultural Land Quality. <i>“Impacts from the development should be considered in light of the Government’s policy for the protection of the best and most versatile (BMV) agricultural land. It is also recommended that soils should be considered under a more general heading</i>	NE	<p>There is one area of the application site that comprises agricultural land. This area is described as the Silver Zone Car Park Extension (Phase 2) and is located at the south of the application site.</p>	Chapter 2: Description of the Proposed Development and CEMP (Appendix 2B)

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
<p><i>of sustainable use of land and the ecosystem services they provide as a natural resource.</i></p> <p><i>The applicant should consider the following issues as part of the Environmental Statement:</i></p> <ul style="list-style-type: none"> ● <i>The degree to which soils are going to be disturbed/harmed as part of this development and whether 'best and most versatile' agricultural land is involved.</i> ● <i>If required, an agricultural land classification and soil survey of the land should be undertaken. This should normally be at a detailed level, e.g. one auger boring per hectare, (or more detailed for a small site) supported by pits dug in each main soil type to confirm the physical characteristics of the full depth of the soil resource, i.e. 1.2 metres.</i> ● <i>The Environmental Statement should provide details of how any adverse impacts on soils can be minimised. Further guidance is contained in the Defra Construction Code of Practice for the Sustainable Use of Soil on Development Sites."</i> 		<p>An ALC Survey has been completed for the agricultural land within the application site (Appendix 10B), which classifies the land as Grade 3a (Good quality agricultural land) and Grade 3b (Moderate quality).</p> <p>Waste Management is discussed in Chapter 2: Description of the Proposed Development. Adverse impacts on soil will be minimised through the retention and reuse of soils. The Proposed Development will be subject to a CEMP for the construction phase, which outlines how construction will be undertaken to avoid, minimise or mitigate effects on the environment and surrounding area, including the management of soil arisings. A CEMP is presented in Appendix 2B which includes reference to the requirement for a Soil Management Strategy.</p>	

10.7 Scope of the assessment

Spatial scope

- 10.7.1 The spatial scope of the assessment comprises the Proposed Development areas within the application site, together with the ZoI that has formed the basis of the study area described in **Section 10.4**.

Temporal scope

- 10.7.2 The temporal scope of the assessment is consistent with the period over which the Proposed Development would be carried out and therefore covers the construction and operational periods (refer to **Chapter 2: Description of the Proposed Development**).

Potential receptors

Approach to identifying receptors

- 10.7.3 The identification of receptors is based on relevant guidance (e.g. CLR11¹) and the professional judgement of a qualified technical specialist who has undertaken a Phase 1 Land Quality Assessment (**Appendix 10A**) of the relevant areas where components of the Proposed Development will be constructed on the application site.
- 10.7.4 In some cases, even without quantified information, it is reasonable to assume that some potential receptors will not experience significant effects. This can be concluded where tried and trusted mitigation measures have been incorporated into the Proposed Development design, which might reasonably be expected to be effective (refer to embedded mitigation in **Section 10.8**).
- 10.7.5 The following considerations have been taken into account when identifying potential receptors:
- The extent to which the receptor will be affected by changes that are expected to result from the Proposed Development;
 - The sensitivity of the receptors to the changes that are likely to occur;
 - The likely magnitude, duration and other characteristics of the effects;
 - The importance or value of the receptor at a local, regional and national level; and
 - Relevant best practice and guidance where specialist methodologies have been developed.

Human health

- 10.7.6 Potential on-site human health receptors (i.e. within the Proposed Development), during both the construction phase and operational phase, comprise current and future site users, members of the public and commercial site users. Construction workers are considered to be potential receptors during the construction phase only.
- 10.7.7 Potential off-site human health receptors (i.e. outside the Proposed Development), during both the construction phase and operational phase, comprise neighbouring site users, including members of the public and commercial site users.

Controlled Waters

- 10.7.8 Potential Controlled Water receptors include the Principal Aquifer underlying the application site and nearby SPZ.

Property

- 10.7.9 Potential property receptors comprise current and future buildings, infrastructure and buried services.

Soils

- 10.7.10 Soils are considered to be a potential receptor during both the construction phase and the operation phase.

Likely significant effects

- 10.7.11 The receptors that have been taken forward for assessment are summarised within **Table 10.5**.

Table 10.5 Land Quality receptors scoped in for further assessment

Receptor	Relevant assessment criteria	Likely significant effects
Construction		
Principal aquifer and surface water receptors	<i>Environmental Liability Directive (2004/35/EC)</i> ² .	Mobilisation of contamination via numerous pathways (including groundwater migration, surface water migration, leaching from soils etc.) resulting in contamination of controlled waters.
	EPR 2016 ⁶ .	
	<i>Water Framework Directive (WFD) (2000/60/E)</i> ⁴ .	Accidental spillages and leaks resulting in ground and groundwater contamination.
	<i>EA Groundwater Protection: Principles and Practice (GP3)</i> ¹⁷ .	
	<i>CIRIA Report C532</i> ²⁰ . Control of Water Pollution from Construction Sites.	
Residents, adjacent commercial workers and airport users, adjacent public open space / amenity users	<i>CIRIA Report C692</i> ²¹ . Environmental Good Practice on Site.	Mobilisation of contamination via numerous pathways (including groundwater migration, surface water migration, leaching from soil, migration of vapours and windblown dusts, explosion) resulting in health impacts.
	<i>EA Contaminated Land Report (CLR) 11, Model Procedures for the Management of Land Contamination, 2004</i> ¹ .	
	<i>NHBC, EA and Chartered Institute of Environmental Health Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008</i> ¹⁸ . Assessment methodology of receptor sensitivity from contamination.	
	<i>HSE HSG66</i> ²² . Protection of workers and the general public during the development of contaminated land.	
	<i>CIRIA Report C665</i> ²⁵ . Assessing Risks Posed by Hazardous Ground Gases to Buildings.	Build-up of gases in confined spaces in existing or newly constructed infrastructure on and beyond the land required for the Proposed Development, leading to potentially explosive atmospheres, property damage and human health risk.

Receptor	Relevant assessment criteria	Likely significant effects
	<i>BS8576:2013</i> ²⁴ . Guidance on Investigations for Ground Gases. Permanent Gases and Volatile Organic Compounds (VOCs).	
Construction workers	<p><i>HSE HSG66</i>²². Protection of workers and the general public during the development of contaminated land.</p> <p><i>CIRIA Report C692</i>²¹. Environmental Good Practice on Site.</p> <p><i>CIRIA Report 132</i>¹⁹. A guide for safe working practices on contaminated Sites.</p> <p><i>CIRIA guidance C681</i>²⁹. Unexploded Ordnance UXO), a guide for the construction industry.</p>	<p>Exposure to contamination via direct contact, inhalation and/or ingestion of soils and dusts, explosion resulting in health impacts.</p> <p>Unstable ground conditions and risks to human health during construction.</p>
Permanent infrastructure for the Proposed Development	<i>BS6031:2009</i> ²⁶ . Code of Practice for Earthworks: Best practice guidance on geotechnical aspects of earthworks and on working practices.	<p>Damage to newly constructed infrastructure from aggressive ground conditions (such as sulphate attack on concrete), explosion.</p> <p>Damage to newly constructed infrastructure associated with unstable ground conditions during construction.</p>
Soils and agricultural land quality	<p><i>CIRIA Report C692</i>²¹. Environmental Good Practice on Site.</p> <p><i>NHBC, EA and Chartered Institute of Environmental Health Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008</i>¹⁸.</p> <p><i>MAFF, 1988</i>³⁰. <i>Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land.</i></p> <p><i>Defra, 2009</i>³¹. <i>Safeguarding our Soils; a Soil Strategy for England.</i></p>	<p>Accidental spillages and leaks resulting in ground and groundwater contamination.</p> <p>Permanent loss of agricultural land, permanent loss of topsoil and changes to soil structure due to inappropriate storage and/or handling of soils.</p>
Operation		
Permanent infrastructure and property associated with the Proposed Development	<p><i>Building Regulations 2010</i>¹³.</p> <p><i>Environmental Liability Directive (2004/35/EC)</i>².</p> <p><i>EPR 2016</i>⁶.</p> <p><i>BS6031:2009</i>²⁶. Code of Practice for Earthworks: Best practice guidance on geotechnical aspects of earthworks and on working practices.</p> <p><i>BS8485:2015</i>²³. Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings.</p>	<p>Damage to infrastructure from aggressive ground conditions unstable ground conditions, settlement and explosion.</p> <p>Damage to infrastructure associated with unstable ground conditions and settlement.</p> <p>Build-up of gases in confined spaces in existing or newly constructed infrastructure on and beyond the development boundary, leading to potentially explosive atmospheres, property damage and human health risk.</p> <p>Accidental spillages and leaks resulting in ground and groundwater contamination leading to damage to property.</p>

Receptor	Relevant assessment criteria	Likely significant effects
	<p><i>BS8576:2013</i>²⁴. Guidance on Investigations for Ground Gases. Permanent Gases and VOCs.</p> <p><i>CIRIA Report C665</i>²⁵. Assessing Risks Posed by Hazardous Ground Gases to Buildings.</p>	
Principal aquifer, SPZ and surface water receptors	<p><i>The EPR 2016</i>⁶.</p> <p><i>Water Framework Directive (WFD) (2000/60/E)</i>⁴.</p> <p><i>EA Groundwater Protection: Principles and Practice (GP3)</i>¹⁷.</p>	Accidental spillages and leaks resulting in ground and groundwater contamination.
Proposed Development users, workers and adjacent site users including airport users	<p><i>Building Regulations 2010</i>¹³.</p> <p><i>BR211, 2015</i>³⁴. Radon: Guidance on protective measures for new buildings.</p> <p><i>Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008</i>¹⁸.</p> <p><i>BS8485:2015</i>²³. Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings.</p> <p><i>CIRIA Report C665</i>²⁵. Assessing Risks Posed by Hazardous Ground Gases to Buildings.</p> <p><i>BS8576:2013</i>²⁴. Guidance on Investigations for Ground Gases. Permanent Gases and VOCs.</p> <p><i>BS6031:2009</i>²⁶. Code of Practice for Earthworks: Best practice guidance on geotechnical aspects of earthworks and on working practices.</p>	<p>Risks to human health from accumulation of gases and vapours, including radon gas, within unprotected buildings and structures.</p> <p>Risks to human health from damage to infrastructure associated with unstable ground conditions and settlement.</p> <p>Accidental spillages and leaks resulting in ground and groundwater contamination, leading to risks to human health</p>
Soils	<p><i>Environmental Liability Directive (2004/35/EC)</i>².</p> <p><i>The EPR 2016</i>⁶.</p>	Accidental spillages and leaks resulting in ground and groundwater contamination.

Preliminary risk assessment

- 10.7.12 A number of potential sources of contamination at the application site are identified in paragraph 10.5.38, associated with current and historical land uses and associated with the natural geology. No specific intrusive investigation information within the relevant areas where components of the Proposed Development will be constructed is available to identify or quantify potential contaminants.
- 10.7.13 A preliminary conceptual model and Preliminary Risk Assessment is presented in the Phase 1 Land Quality Assessment (**Appendix 10A**), which has identified potential contaminant linkages to sensitive receptors during the construction and operational phases including site users, off-site adjacent site users, property and controlled waters.

- 10.7.14 The Preliminary Risk Assessment of the linkages identified in the preliminary conceptual model range from Low to Moderate. The Preliminary Risk Assessment recommends that risks should be assessed and revised as more information becomes available.
- 10.7.15 The following potential source has been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant:
- Based on the information that is currently available it is considered that potential radioactive contamination does not require further assessment and is scoped out. NSC has confirmed that they do not hold any records of radioactive contamination at, or within the vicinity, of the application site. The risk from potential radioactive contamination will be reviewed should any new information become available, including actual ground conditions encountered during Ground Investigation and subsequent development.

10.8 Environmental measures embedded into the development proposals

- 10.8.1 A range of environmental measures have been embedded into the development proposals as outlined in **Chapter 2: Description of the Proposed Development**, specifically **Section 2.5. Table 10.6** outlines how these embedded measures will influence Land Quality assessment.

Table 10.6 Summary of the embedded environmental measures

Receptor	Changes and effects	Embedded measures
Construction phase		
Residents, adjacent commercial workers and airport users, adjacent public open space or amenity users.	Mobilisation of contamination via numerous pathways (including groundwater migration, surface water migration, leaching from soil, migration of vapours and windblown dusts, explosion) resulting in health impacts.	The works will be carried out in accordance with relevant <i>Construction Design Management (CDM) Regulations 2015</i> ⁴⁷ .
Construction Workers	Build-up of gases in confined spaces in existing or newly constructed infrastructure on and beyond the land required for the Proposed Development, leading to potentially explosive atmospheres, property damage and human health risk.	An intrusive investigation will be carried out prior to the commencement of the construction of the Proposed Development and the results assessed to determine potential risk to human health, the findings of which will inform the package of measures to be included within the detailed design prior to the commencement of construction.
	Accidental spillages and leaks resulting in ground and groundwater contamination.	A CEMP (Appendix 2B) is being submitted as part of the planning application and includes measures to address the following issues:
	Discovery and potentially explosion of UXO associated with construction process.	<ul style="list-style-type: none"> For site workers and visitors, the potential for exposure to contaminants will be mitigated by the <i>Control of Substances hazardous to Health (COSHH) Regulations 2002</i>⁴⁸ and the <i>Management of Health and Safety at Work Regulations 1999</i>⁴⁹ and controlled through good construction practices such as site induction, good hygiene practices, dust suppression

⁴⁷ The Construction (Design & Management) Regulations (2015). [online] Available at: <http://www.legislation.gov.uk/ukxi/2015/51/contents/made> [Checked 07/09/2018].

⁴⁸ Control of Substances Hazardous to Health (COSHH) (2002). [online]. Available at: <http://www.hse.gov.uk/nanotechnology/coshh.htm> [Checked 07/09/2018].

⁴⁹ The Management of Health and Safety at Work Regulations (1999). [online]. Available at: <http://www.legislation.gov.uk/ukxi/1999/3242/contents/made> [Checked 07/09/2018].

Receptor	Changes and effects	Embedded measures
		<p>(especially in loading or unloading bays and tracks), requirement for suitable Personal Protective Equipment (PPE) to prevent exposure and/or restricted access during higher risk activities;</p> <ul style="list-style-type: none"> ● A watching brief will be in place during demolition, ground and construction works. If unexpected contamination is encountered or suspected, the works will cease in that area and assessment by a suitably qualified land contamination specialist will be made to determine appropriate actions. Soil, soil vapour and groundwater samples will be collected and analysed as appropriate. The risks associated with contamination will be assessed. When required, a remediation strategy will be designed and agreed following consultation with the EA and NSC as appropriate before implementation; ● Any construction activity with the potential to produce or release dusts will be assessed and avoided through design. If unavoidable, this will be controlled on-site using construction good practice to prevent site users and neighbouring site occupiers being exposed to contaminants; ● Site access points will be regularly cleaned to prevent build-up of dust and mud; ● Any imported landscaping material will be clean and free of contaminants and of suitable thickness; and ● If any existing structures are present within the relevant areas where components of the Proposed Development will be constructed that may have materials containing asbestos, a survey (pre-site preparation survey as defined by the HSE) and removal of any asbestos containing materials, and other materials and structures contaminated with asbestos fibres, will be performed by a competent or licensed contractor prior to any demolition works. <p>A UXO risk assessment ⁴⁶ was carried out in accordance with <i>CIRIA C681</i>²⁹. It identified a Low risk at the application site. Residual UXO risks will be managed through the provision of UXO awareness briefings to all construction staff prior to any intrusive works (such as a ground investigation and re-development) and implementation of a discovery protocol.</p>
Controlled Waters (Principal aquifer, SPZ and surface water receptors).	Pollution incidents resulting from the release of contaminants from construction activities.	The risks from pollution incidents and accidental spillages or leaks during construction activities will be mitigated by pollution prevention measures and good

Receptor	Changes and effects	Embedded measures
	Accidental spillages and leaks from the handling of chemicals and fuels resulting in ground and groundwater contamination.	<p>working practices in accordance with current guidelines, as defined in the CEMP (Appendix 2B).</p> <p>An intrusive investigation will be carried out prior to the commencement of the construction of the Proposed Development and the results assessed to determine potential risk to controlled waters. The findings will inform the package of measures to be included within the detailed design. Any contaminated soil will be identified by ground investigation prior to construction and either treated onsite and reused or removed – subject to risk-based assessment - and disposed of off-site by a suitably licensed waste disposal operator.</p> <p>During the site works tendering process the expected level of environmental control will be included in the tender documents, so that all contractors allow for mitigation measures in their work scope. These environmental controls will be included within the final CEMP and implemented in the construction works.</p> <p>Suitably qualified and experienced geo-environmental engineers will be used to supervise the ground works.</p> <p>Designated washdown areas with fully contained drainage will be used for plant, vehicles or equipment in contact with contaminated soils to avoid contaminants being moved around the site or taken off-site.</p> <p>Foundation excavations will be dewatered by pumping if required. The water will be collected in suitable tanks and held on site for collection by a licensed waste contractor. No water from foundation dewatering operations will be discharged directly to ground. If required, any discharge would occur under the appropriate regulator's consent.</p> <p>Impermeable concrete will be specified to the appropriate British Standard (depending on the ground conditions) to minimise any potential adverse impacts.</p> <p>Any mixing and handling of wet concrete that is required on-site will be undertaken in designated areas. A designated area, will be used for any washing down or equipment cleaning associated with concrete or cementing processes and facilities provided to remove sediment prior to disposal to foul sewer.</p> <p>Measures such as cut-off trenches will be put in place to prevent any potentially polluted run-off from within the site entering any excavations</p> <p>Measures to control spillages from the construction process will be implemented to control contamination migration including:</p> <ul style="list-style-type: none"> Wherever possible, plant and machinery will have drip trays beneath oil tanks, engines, gearboxes and hydraulics which will be checked and

Receptor	Changes and effects	Embedded measures
		<p>emptied regularly and correctly disposed of via a licensed waste disposal operator;</p> <ul style="list-style-type: none"> • Oils and hydrocarbons will be stored in designated locations with specific measures to prevent leakage and release of their contents, including the siting of the storage area away from the drainage system on an impermeable base, with an impermeable bund that has no outflow and is of adequate capacity to contain 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use; • A Spillage Environmental Response Plan will be produced, which site staff will have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material.
Property	<p>Damage to property (as defined in paragraph 10.7.9) due to mobilisation of contamination and gases as a result of the inappropriate mitigation measures and construction techniques.</p> <p>Damage to infrastructure associated with unstable ground conditions and settlement associated with the construction phase.</p> <p>Discovery and potentially explosion of UXO associated with construction process.</p>	<p>The intrusive investigation will inform whether remediation is required and the package of measures to be included within the detailed design and CEMP (Appendix 2B) to minimise the potential for damage to infrastructure associated with unstable ground conditions, settlement and potential mobilisation of contaminants including gases during the construction phase.</p> <p>A UXO risk assessment ⁴⁶ was carried out in accordance with <i>CIRIA C681</i>²⁹.</p> <p>It identified a Low risk at the application site. Residual UXO risks will be managed through the provision of UXO awareness briefings to all construction staff prior to any intrusive works (such as a ground investigation and redevelopment) and implementation of a discovery protocol.</p>
Soils	<p>Permanent loss of agricultural land, including BMV.</p> <p>Inappropriate use or disposal of soils.</p>	<p>An ALC Survey (Appendix 10B) has confirmed the presence of BMV within the Silver Zone Car Park Extension (Phase 2) area of the Proposed Development. Permanent loss of agricultural land, including 3.2ha of BMV, will occur within this area. Other components of the Proposed Development do not coincide with agricultural land and the overall area of BMV is limited to approximately 58% of the Silver Zone Car Park Extension (Phase 2) area.</p> <p>Adverse impacts on soil will be minimised through the retention and reuse of soils. The Proposed Development will be subject to a CEMP (Appendix 2B) for the construction phase and Soil Management Plan, which outlines how the construction project will avoid, minimise or mitigate effects on the environment and surrounding area, including the management and reuse of arisings. Soils to be re-used will be controlled under the <i>CL:AIRE Definition of Waste: Development Industry Code of Practice</i>⁵⁰.</p>

Receptor	Changes and effects	Embedded measures
Operational phase		
Permanent infrastructure and property associated with the Proposed Development.	<p>Build-up of gases in confined spaces in existing or newly constructed infrastructure on and beyond the development boundary, leading to potentially explosive atmospheres and property damage.</p> <p>Damage to property due to residual contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the construction phase.</p> <p>Damage to infrastructure associated with unstable ground conditions and settlement.</p>	<p>Following the site investigation, buildings will be designed to comply with <i>The Building Regulations 2010</i>¹³ including, where necessary, ground gas and vapour protection measures such as gas vapour membranes and sub-floor ventilation in buildings and ensuring appropriate ventilation exists in any confined spaces.</p> <p>Soils to be re-used will be controlled under the CL:AIRE Definition of Waste: Development Industry Code of Practice⁵⁰ to confirm they are suitable both chemically and geotechnically. Any imported landscaping material will be clean, free of contaminants and of suitable thickness. The intrusive investigation will inform the package of measures to be included within the detailed design to minimise the potential for damage to infrastructure associated with unstable ground conditions and settlement during the operational phase.</p>
Proposed Development users, workers and adjacent site users including airport users.	<p>Disturbance and mobilisation of contamination via numerous pathways (including groundwater migration, surface water migration, leaching from soil, migration of vapours and windblown dusts, explosion) resulting in health impacts.</p> <p>Impacts to human health from damage to property or infrastructure associated with unstable ground conditions and settlement.</p> <p>Build-up of gases in confined spaces in existing or newly constructed infrastructure on and beyond the development boundary, leading to potentially explosive atmospheres, property damage and human health risk.</p> <p>Impacts to human health due to residual contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the construction phase.</p> <p>Impacts to human health associated with unstable ground conditions and settlement.</p>	<p>The site investigation and subsequent risk assessment will identify whether any further remediation is required.</p> <p>The health and safety file for the construction, as required by <i>CDM2015 Regulations</i>⁴⁷, will include information on ground conditions and any known ground contamination. The health and safety file will be kept and used to develop a risk assessment and method statement including mitigation measures to address these risks in line with health and safety legislation during the operational phase.</p> <p>Following the site investigation, buildings will be designed to comply with <i>The Building Regulations 2010</i>¹³ including, where necessary, ground gas and vapour protection measures such as gas vapour membranes and sub-floor ventilation in buildings and ensuring appropriate ventilation exists in any confined spaces.</p> <p>The Proposed Development is located in a "higher probability radon area" (10 to 30% of homes are estimated to be at or above the Action Level) and <i>BR211, 2015</i>³⁴ indicates that full radon protective measures are necessary in the construction of new dwellings or extensions. Where applicable, buildings or extensions associated with the Proposed Development will include full protection measures as outlined in <i>BR211, 2015</i>³⁴, installed in accordance within <i>The Building Regulations 2010</i>¹³.</p> <p>Soils to be re-used will be controlled under the CL:AIRE Definition of Waste: Development Industry Code of Practice⁵⁰ to confirm they are suitable both chemically</p>

⁵⁰ CL:AIRE (2011). The Definition of Waste: Development Industry Code of Practice. Version 2, [online]. Available at: <https://www.claire.co.uk/projects-and-initiatives/dow-cop/28-framework-and-guidance/111-dow-cop-main-document> [Checked 07/09/2018].

Receptor	Changes and effects	Embedded measures
		and geotechnically. Any imported landscaping material will be clean, free of contaminants and of suitable thickness. The intrusive investigation will inform the package of measures to be included within the detailed design to minimise the potential for impacts to human health associated with unstable ground conditions and settlement during the operational phase.
Controlled Waters (Principal aquifer, SPZ and surface water receptors).	Accidental spillages and leaks resulting in ground and groundwater contamination. Disturbance and mobilisation of contamination via numerous pathways, including groundwater migration, surface water migration, leaching from, migration resulting in impacts to controlled water.	Design measures will be incorporated into the detailed design of the Proposed Development to mitigate impact to ground and groundwater from accidental spillages and leaks.

- 10.8.2 The above proposed measures are standard industry practice for addressing Land Quality risks. In accordance with best practice, site investigation will be completed within the Proposed Development areas, the results of which may require additional site-specific mitigation measures to be included in the CEMP (**Appendix 2B**) and embedded into the detailed design.

10.9 Assessment methodology

- 10.9.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 4: Approach to the Environmental Statement**, specifically in **Sections 4.5 to 4.7**. However, whilst this has informed the approach that has been used in this Land Quality assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this Land Quality assessment.

Methodology for assessing predicted effects

Potential effects

- 10.9.2 The potential effects of contaminated land issues are usually assessed by undertaking a contaminated land risk assessment. The risk assessment process is based on a tiered framework in accordance with *CLR 11*¹. The preliminary risk assessment approach is:
- Development of a CSM;
 - Preliminary Risk Assessment examining potential contaminants, pathways and receptors to identify the potential 'contaminant linkages'; and
 - Identification of further risk assessment requirements.
- 10.9.3 The CSM presented in the Phase 1 Land Quality Assessment (**Appendix 10A**) represents the characteristics of the application site (i.e. Bristol Airport) and indicates the possible relationships between contaminants, pathways and receptors, where:
- A contaminant is a substance which is present in, on, or under the land and has the potential to cause harm;

- A receptor is something which could be adversely affected by the contaminant, for example, human beings, animals, plants, buildings and controlled waters; and
- A pathway is a route or means by which a receptor could be exposed to, or affected by, a contaminant.

- 10.9.4 For a potential risk to exist at a site, all three of the above elements must be present and linked together so that a contaminant has been identified, a receptor is located on or near the site and there is an exposure pathway that links the contaminant to the receptor. The term 'contaminant linkage', is used to describe a particular combination of contaminant pathway-receptor relationship.
- 10.9.5 The potential risk associated with each contaminant linkage has been assessed by considering the nature of the contaminant, the degree of potential exposure of a receptor to a contaminant, the likelihood of the exposure and the sensitivity of the receptor.
- 10.9.6 A detailed explanation of the methodology is provided in Appendix C of the Phase 1 Land Quality Assessment (**Appendix 10A**).
- 10.9.7 Where potential sources of contamination have been identified, each of the receptors has been considered. However, where a plausible pathway cannot be established from source to receptor, a risk is not deemed to be present and therefore the potential effect is not considered further and is scoped out from further assessment.

Sensitivity of receptor

- 10.9.8 The categories and definitions of value and/or sensitivity that will be used in the assessment are displayed in **Table 10.12**. Where a receptor could reasonably be placed within more than one value and sensitivity rating, professional judgment has been used to determine which rating would be applicable.

Table 10.7 Land Quality definition of receptor sensitivity

Sensitivity	Definition
Very High	Receptor of very high sensitivity (e.g. sensitive individuals, Principal Aquifer with significant public and or private water supply abstractions and/or within Catchment SPZ). All contaminant releases to the ground environment of concern. High quality watercourse within close proximity (less than 250m) of the site or with potential for rapid transmission of pollutants to that watercourse via a fissured aquifer. Or interconnected unclassified drain or stream.
High	Receptor of high sensitivity and high intrinsic value (e.g. humans, ecological receptors with international or national designations, strategically important or high value buildings and built environment, Principal Aquifer without significant public water supply abstractions, high value or sensitive surface watercourses). Most contaminant releases to the ground environment of concern. Best and most versatile (BMV) agricultural land comprising Soil Grade 1 (extremely good quality), Grade 2 (very good quality) and/or Soil Grade 3a (good quality) agricultural land or soil classification, when considering crop productivity and yields.
Medium	Receptor of medium sensitivity and value, i.e. possesses key distinctive characteristics (e.g. important buildings to be constructed on-site with moderate value, habitats or ecology of regional importance; Secondary A or B Aquifer with significant water supply abstractions, water quality of receptor supports high biodiversity (not designated)); receptor has low capacity to accommodate change to water quality status; water quality of receptor waterbody classified under WFD as good ecological status/potential). Soil Grade 3b (moderate quality) agricultural land or soil classification, when considering crop productivity and yields.

Sensitivity	Definition
Low	Receptors of low sensitivity and value, (e.g. low value or sensitivity built environment e.g. hardstanding, drains or sewers; ecology or ecosystem with only local and/or no designations or protection; Secondary A or B Aquifers without abstractions or Unproductive Aquifers; surface waters where baseline conditions define an environment that has a high capacity to accommodate proposed change to water quality status due, for example, to the large relative size of receiving water feature and effect of dilution; surface waters where specific water quality conditions of receptor water feature likely to be able to tolerate proposed change with very little or no impact upon the baseline conditions; water quality of receptor could be expected to be classified under the WFD as moderate to poor). Soil Grade 4 or 5 (poor and very poor quality) agricultural land or soil classification, when considering crop productivity and yields.

Magnitude of effect

- 10.9.9 This is based on the assessment of the scale of change and the consequences the Proposed Development would have upon sensitive receptors. The scale of change would be considered both spatially and/or temporally when categorising the magnitude of an effect and would be categorised as high, medium, low or negligible. The definitions of the magnitude of an effect are provided in **Table 10.8**.

Table 10.8 Land Quality definition of magnitude of effect

Magnitude	Human health	Controlled Water	Property structures / crops, soils and animals	Examples
High	<i>Adverse</i> Highly elevated concentrations likely to result in "significant harm" to human health as defined by the <i>Environmental Protection Act 1990</i> , Part 2A ⁵¹ , if exposure occurs.	<i>Adverse</i> Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality, leading to closure of a potable abstraction point, major impact on amenity value or major damage to agriculture or commerce.	<i>Adverse</i> Catastrophic damage to crops, buildings or property. Permanent loss of all soils with no re-use, or inappropriate re-use.	Significant harm to humans is defined in <i>Defra circular 01/2006</i> ⁵¹ – contaminated land as death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of hazardous or priority substances present in groundwater close to small potable abstraction (high sensitivity).
	<i>Beneficial</i> Removal of all identified contaminant linkages that pose a risk to receptors.	<i>Beneficial</i> Removal of all identified contaminant linkages that pose a risk to receptors.	<i>Beneficial</i> Removal of all identified contaminant linkages that pose a risk to receptors.	Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).
Medium	<i>Adverse</i> Elevated concentrations which could result in "significant harm" to human health as defined by the <i>Environmental Protection Act 1990</i> , Part 2A ⁵¹ , if exposure occurs.	<i>Adverse</i> Equivalent to EA Category 2 pollution incident including significant effect on water quality, notification required to abstractors, reduction in amenity value or significant damage to agriculture or commerce.	<i>Adverse</i> Significant damage to crops, buildings or property. Loss of soils with some beneficial re-use.	Significant harm to humans is defined in <i>Defra circular 01/2006</i> ⁵¹ – contaminated land as death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.
	<i>Beneficial</i> Removal of the majority of identified contaminant linkages so that risks to receptors are reduced.	<i>Beneficial</i> Removal of the majority of identified contaminant linkages so that risks to receptors are reduced.	<i>Beneficial</i> Removal of the majority of identified contaminant linkages so that risks to receptors are reduced.	Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.

⁵¹ Defra (2006). Circular 01/2006 Environmental Protection Act 1990: Part 2A Contaminated Land, [online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69309/pb12112-circular01-2006-060817.pdf [Checked 09/09/2018].

Low	<i>Adverse</i> Exposure to human health unlikely to lead to "significant harm".	<i>Adverse</i> Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality, marginal effect on amenity value, agriculture or commerce.	<i>Adverse</i> Minor damage to crops, buildings or property. Minor loss of soils and appropriate re-use.	Exposure could lead to slight short-term effects (e.g. mild skin rash). Surface spalling of concrete.
	<i>Beneficial</i> N/A	<i>Beneficial</i> N/A	<i>Beneficial</i> N/A	
Negligible	<i>Adverse</i> No measurable effects on humans.	<i>Adverse</i> Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	<i>Adverse</i> Repairable effects of damage to buildings, structures and services. No loss or insubstantial loss of soils.	The loss of low-value plants in a landscaping scheme. Discoloration of concrete.
	<i>Beneficial</i> N/A	<i>Beneficial</i> N/A	<i>Beneficial</i> N/A	

Notes: The ecological sensitivity with respect to Land Quality has been assessed as low in the Phase 1 Land Quality Assessment Report (**Appendix 10A**) and is not considered further here. Assessment of potential adverse and beneficial magnitude of effect to ecological receptors (such as protected species and potential habitat loss) is presented in **Chapter 11: Biodiversity**.

Significance evaluation methodology

- 10.9.10 The significance level attributed to each effect has been assessed based on the magnitude of change due to the Proposed Development and the sensitivity of the affected receptor (as displayed in **Table 10.9**). Magnitude of change is assessed on a scale of high, medium, low and negligible, whilst the sensitivity of the affected receptor is assessed on a scale of very high, high, medium, and low.
- 10.9.11 The effects can be of major, moderate, minor or negligible significance. In addition, effects are judged to be adverse or beneficial and temporary or permanent. The assessment of the significance of the effect is judged on the relationship of the magnitude of effect to the sensitivity of the receptor and likelihood of the effect.

Table 10.9 Land Quality significance criteria

		Magnitude of change			
		High	Medium	Low	Negligible
Sensitivity	Very High	Significant	Significant	Significant	Not significant
	High	Significant	Significant	Not significant	Not significant
	Medium	Significant	Not significant	Not significant	Not significant
	Low	Not significant	Not significant	Not significant	Not significant

10.10 Assessment of Land Quality effects on human receptors

Baseline conditions

Current baseline

- 10.10.1 The current baseline is set out in **Section 10.5**.

Predicted future baseline

- 10.10.2 The predicted future baseline is set out in **Section 10.5**. The current baseline will be used for the purpose of this assessment, as in the absence of the Proposed Development there are no known trends or factors that are expected to affect the current baseline conditions.

Predicted effects and their significance

Construction phase

- 10.10.3 The potential effects on human receptors that could occur during the construction phase comprise:
- Health hazard due to direct contact, inhalation and ingestion of soils and dusts which have the potential to contain concentrations of various contaminants;
 - Health hazard due to inhalation of asbestos fibres;
 - Health hazard due to direct contact with impacted groundwater;
 - Health hazard due to spillages;
 - Health hazard due to the disturbance of UXO;
 - Health hazard due to residual contamination being present as a result of the inappropriate re-use or use of contaminated material; and
 - Health hazard associated with poor ground conditions and inappropriate design or construction resulting collapse of damage to construction, services and infrastructure.
- 10.10.4 The construction phase will involve disturbance of soils which have the potential to contain concentrations of various contaminants as outlined in **Section 10.5**. Spillages of oils and other chemicals can also occur during the construction activities. The construction phase therefore has the potential to have an adverse effect on human receptors through direct contact, ingestion and/or inhalation of impacted soils. The receptors' sensitivity has been assessed as high, however measures outlined within the CEMP (**Appendix 2B**) are designed to mitigate risks.
- 10.10.5 Environmental measures and construction good practices to control exposure and prevent spreading of contamination have been incorporated into the CEMP (**Appendix 2B**), which will be implemented in the construction phase. In addition, an intrusive investigation will be undertaken before construction to determine if there is any evidence of contamination, the programme and scope of these investigations will be agreed following consultation with NSC and other stakeholders, as deemed appropriate. This will allow the incorporation of any additional mitigation measures. With the embedded measures in place, there is a high degree of certainty that the effects on human receptors would be **negligible** (i.e. combination of a **high** receptor sensitivity and **negligible** magnitude of effect) and therefore effects would be **not significant** during the construction phase.
- 10.10.6 The discovery and potential for explosion of UXO could occur during the construction activities. The receptor sensitivity has been assessed as **high**. A UXO desk study and risk assessment⁴⁶ has assessed a Low risk (as outlined in **Section 10.5**), which is defined by Zetica as "*tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to*". A requirement for UXO awareness briefings and a discovery protocol will be included in the CEMP (**Appendix 2B**) and delivered to all construction workers prior to any ground works. Future work relating to UXO will follow CIRIA guidelines²⁹. With the Low assessed risk and these measures in place during the construction phase, there is a high degree of certainty that the effects on human receptors would be **negligible** (i.e. combination of a **high** receptor sensitivity and **negligible** magnitude of effect) and therefore **not significant** during the construction phase.
- 10.10.7 A summary of the results of the assessment of the Land Quality effects on human receptors is provided in **Table 10.10**.

Operational phase

- 10.10.8 The potential effects on human receptors that could occur during the operational phase comprise:
- Health hazard due to ingress and accumulation of ground gas resulting in explosion or asphyxiation for users of site buildings;
 - Health hazard due to ingress and accumulation of radon gas;
 - Health hazard due to future maintenance works (particularly any in-ground maintenance works such as works on buried services) that may disturb any residual contamination;
 - Health hazard due to spillages;
 - Health hazard due to residual contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the construction phase;
 - Health hazard associated with poor ground conditions and inappropriate design or construction resulting collapse of damage to construction, services and infrastructure; and
 - Permeation of plastic pipes by contaminants.
- 10.10.9 With the environmental measures outlined in **Table 10.6**, the planned intrusive site investigation and assessment of risks in accordance with best practice (*CLR11*¹); the health and safety file, Construction Phase Plan and CEMP (**Appendix 2B**) for the construction in place; and the necessary control measures, including those in the *Building Regulations*¹³, it is considered that the effects on human receptors would be **negligible** and therefore not significant during the operational phase (i.e. combination of a **high** receptor sensitivity and **negligible** magnitude of effect).
- 10.10.10 A summary of the results of the assessment of the Land Quality effects on human receptors is provided in **Table 10.10**.

10.11 Assessment of Land Quality effects on controlled water receptors

Baseline conditions

Current baseline

- 10.11.1 The current baseline is set out in **Section 10.5**.

Predicted future baseline

- 10.11.2 The predicted future baseline is set out in **Section 10.5**. The current baseline will be used for the purpose of this assessment, as in the absence of the Proposed Development there are no known trends or factors that are expected to affect the current baseline conditions.

Predicted effects and their significance

Construction phase

- 10.11.3 The construction phase has the potential to have an adverse effect on controlled waters through:
- Disturbance of soils (earthworks) and mobilisation or leaching of existing contamination;
 - Pollution from spillages of oils and other chemicals; and

- Pollution incident due to the creation of pathways for the migration of potential contamination to surface water receptors and to groundwater.

- 10.11.4 The detailed design of the new infrastructure and foundations, would be completed following the geoenvironmental and geotechnical site investigations which would be conducted prior to construction. The investigations will inform the final design of construction of the new infrastructure and foundations, appropriate construction techniques and controls will be employed to mitigate any significant effects.
- 10.11.5 The groundwater sensitivity has been assessed as **Very High** due to the presence of a Principal Aquifer and Zone 2 outer SPZ, with important public water supply abstraction at the Chelvey Well. Environmental measures are incorporated into the CEMP (**Appendix 2B**) and will be implemented at the construction phase (**Table 10.6**).
- 10.11.6 Information from the intrusive site investigation and the environmental measures outlined in **Table 10.6** will be incorporated into the CEMP (**Appendix 2B**) and will inform the package of embedded measures to be included in the detailed design to be protective of the underlying aquifer. Construction work will be completed in accordance with best practice and technical guidance, as outlined in **Table 10.2**. With these embedded measures in place, it is concluded that the aquifer will be adequately protected and due to the distance of the Chelvey Well public water supply abstraction site from the Proposed Development, there will be a **negligible** magnitude of effect upon a **Very High** receptor sensitivity, and therefore **not significant** during the construction phase.
- 10.11.7 It is expected that with these measures in place, the effects on groundwater would be **negligible** and therefore **not significant** (i.e. a combination of a **Very High** receptor sensitivity and **negligible** magnitude of effect).
- 10.11.8 A summary of the results of the assessment of the Land Quality effects on controlled water receptors is provided in **Table 10.10**.

Operational effects

- 10.11.9 The following operational phase effects have been identified:
- Pollution incident due to future maintenance works (particularly any in ground maintenance works) that may disturb and mobilise any residual contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the construction phase;
 - Pollution incident due to spillages; and
 - Pollution incident due to residual contamination being present, as a result of the inappropriate re-use or use of contaminated fills and soils during the construction phase.
- 10.11.10 The receptor sensitivity has been assessed as **Very High**. With the environmental measures outlined in **Table 10.6**, including embedded pollution prevention measures and best working practices in accordance with current guidelines outlined in **Table 10.2** that have been incorporated into the CEMP (**Appendix 2B**), and the design informed with the findings of the intrusive site investigation to include embedded mitigation measures, it is considered that the effects on groundwater would be negligible and therefore **not significant** during the operational phase (i.e. combination of a **High** receptor sensitivity and **negligible** magnitude of effect).
- 10.11.11 A summary of the results of the assessment of the Land Quality effects on controlled water receptors is provided in **Table 10.10**.

10.12 Assessment of Land Quality effects on soils

Baseline conditions

Current baseline

- 10.12.1 The current baseline is set out in **Section 10.5**.

Predicted future baseline

- 10.12.2 The predicted future baseline is set out in **Section 10.5**. The current baseline will be used for the purpose of this assessment, as in the absence of the Proposed Development there are no known trends or factors that are expected to affect the current baseline conditions.

Predicted effects and their significance

Construction phase

- 10.12.3 The effects on groundwater from pollution that have been identified for the construction phase apply also for soils. The environmental measures (refer to **Table 10.6**) that are incorporated into the CEMP (**Appendix 2B**) will be implemented to ensure that there are no potentially significant effects during the construction phase.
- 10.12.4 Adverse impacts on soil will be minimised through the retention and reuse of soils and the management and reuse of arisings controlled under the *CL:AIRE Definition of Waste: Development Industry Code of Practice*⁵⁰ to confirm they are suitable both chemically and geotechnically. Any imported landscaping material will be clean, free of contaminants and of suitable thickness. Landscaping material will be suitable for future climate conditions as described in the Design and Access Statement. With these measures secured by the CEMP it is expected that the effects on soils from pollution would be negligible during the construction phase and adverse impacts on soil minimised to a low magnitude, acknowledging that it may not be possible to re-use all soils, and therefore **not significant** (i.e. combination of a **high to medium** receptor sensitivity and **low** magnitude of effect).
- 10.12.5 There will be permanent loss of agricultural land associated with the Proposed Development. An ALC Survey (**Appendix 10B**) of the 5.4ha Silver Zone Car Park Extension (Phase 2) area classifies the Proposed Development as comprising 3.2ha of Grade 3a land (good quality BMV agricultural land) and 2.2ha of Grade 3b land (moderate quality agricultural land).
- 10.12.6 As outlined in **Table 10.7**, the receptor sensitivity of BMV is considered to be **high** and the receptor sensitivity of Grade 3b is considered **medium**. Whilst the Proposed Development will result in the permanent loss of agricultural land, the amount of agricultural land that will be lost in the context of the local region and current/likely future land use if undeveloped should be considered when assessing significance. The ALC guidelines³⁰ gives a high grading to land which allows more flexibility in the range of crops that can be grown (its 'versatility') and which requires lower inputs, but also takes into account ability to produce consistently high yields of a narrower range of crops. Due to the relatively minor area of BMV that will be lost (3.2ha from the Proposed Development) and its current/likely use if undeveloped as grazing land, rather than for crop production, the loss of this land for the Proposed Development is considered to have a **low** magnitude and is assessed as **not significant**.
- 10.12.7 A summary of the results of the assessment of the Land Quality effects on soil receptors is provided in **Table 10.10**.

Operational phase

- 10.12.8 The effects on groundwater from pollution that have been identified for the operational phase apply also for soils. The environmental measures (refer to **Table 10.6**) that will be implemented to protect the groundwater environment will ensure that there are no potentially significant effects in the operation phase. With these embedded measures in place it is expected that the effects on soils from pollution would be negligible during the operational phase and therefore **not significant** (i.e. a combination of a **high to medium** receptor sensitivity and **low** magnitude of effect).
- 10.12.9 A summary of the results of the assessment of the Land Quality effects on soil receptors is provided in **Table 10.10**.

10.13 Assessment of Land Quality effects on property

Baseline conditions

Current baseline

- 10.13.1 The current baseline is set out in **Section 10.5**.

Predicted future baseline

- 10.13.2 The predicted future baseline is set out in **Section 10.5**. The current baseline will be used for the purpose of this assessment, as in the absence of the Proposed Development there are no known trends or factors that are expected to affect the current baseline conditions.

Predicted effects and their significance

Construction phase

- 10.13.3 The construction phase has the potential to have an adverse effect on property through:
- Damage to property from the mobilisation or leaching of contamination, including gases;
 - Damage to property from poor ground conditions; and
 - Damage to property from poor construction methods and geotechnical design.
- 10.13.4 The detailed design of the construction activities would be completed following the geoenvironmental and geotechnical site investigations, which would be conducted prior to construction. The investigations will inform remediation and mitigation requirements in the CEMP (**Appendix 2B**) and will inform the final design of construction of the new infrastructure, foundations and buildings or extensions, to ensure appropriate construction techniques and controls will be employed to mitigate any significant effects.
- 10.13.5 The discovery and potential explosion of UXO could occur as a result of the construction activities. The sensitivity of property, such as buildings and services, to UXO has been assessed as **high** (the effects on human health from UXO have been assessed in **Section 10.10**). A UXO desk study and risk assessment⁴⁶ has been completed that has assessed a Low risk (as outlined in **Section 10.5**), which is defined by Zetica as *"tolerable to the client as engineering activity need not alter if UXO related procedures and controls are strictly adhered to"*. UXO awareness briefings and a discovery protocol will be delivered to all construction workers prior to any ground works. Future work relating to UXO will follow CIRIA guidelines²⁹. The final CEMP (**Appendix 2B**) will be informed by

the findings of the site investigation and updated with findings and proposed mitigation from the site investigation. With these measures in place, there is a high degree of certainty that the effects on property would be **negligible** during the construction phase (i.e. a combination of a **high** receptor sensitivity and **negligible** magnitude of effect) and therefore would be **not significant**.

- 10.13.6 A summary of the results of the assessment of the Land Quality effects on property receptors is provided in **Table 10.10**.

Operational Phase Effects

- 10.13.7 The potential effects on property that could occur during the operational phase comprise:
- Damage to building and services due to ingress and accumulation of ground gas resulting in explosion of site buildings; and
 - Damage to property due to residual contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the construction phase.
- 10.13.8 The property receptors are considered as strategically important or high value buildings and their sensitivity has therefore been assessed as **high**. The environmental measures outlined in **Table 10.6** and the intrusive site investigation that will inform the package of measures to be included in the detailed design are considered sufficient to ensure the effects on buildings and services would be negligible (i.e. a combination of a **high** receptor sensitivity and **negligible** magnitude of effect) and therefore **not significant** during the operational phase.
- 10.13.9 A summary of the results of the assessment of the Land Quality effects on property receptors is provided in **Table 10.10**.

Table 10.10 Summary of significance of Land Quality effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
<p>Humans: Mobilisation of and exposure to existing potential contamination through soil disturbance, generation of dust during construction activities, exposure to contaminants, or pollution incidents resulting from spillages of oils and other chemicals.</p> <p>Discovery and potentially explosion of UXO associated with construction process.</p> <p>Health hazard due to due to ingress and accumulation of vapour, radon gas or ground gas resulting in health hazard from vapour or explosion or asphyxiation for users of site.</p> <p>Health hazard due to contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the operational phase.</p> <p>Health hazard due to future maintenance works (particularly any in ground maintenance works) that may disturb any residual contamination.</p>	High	Negligible	Not Significant	<p>Environmental measures and construction good practices described in Table 10.6 to control exposure and prevent spreading of contamination have been included in the CEMP (Appendix 2B) for implementation in the construction phase as embedded measures.</p> <p>A UXO desk study and risk assessment⁴⁶ has been completed that has assessed a Low risk. UXO awareness briefings and a discovery protocol are included in the CEMP (Appendix 2B) and will be delivered to all construction workers prior to any ground works. Future work relating to UXO will follow CIRIA guidelines²⁹. The CEMP (Appendix 2B) will be informed by the findings of the site investigation and updated with findings and proposed mitigation from the site investigation as embedded measures for the construction phase.</p> <p>Following the site investigation, buildings will be designed to comply with <i>The Building Regulations 2010</i>¹³ last amended 2013: Document C Site preparation and resistance to contaminants.</p> <p>The environmental measures described in Table 10.6 will be implemented and are incorporated into the CEMP (Appendix 2B) to ensure the appropriate re-use or use of materials.</p> <p>The Health and Safety File will inform future maintenance and ground workers of any residual contamination that may be present to allow appropriate mitigation measures to be employed.</p>
<p>Property: Discovery and potentially explosion of UXO associated with construction process.</p>	High	Negligible	Not Significant	<p>A UXO desk study and risk assessment⁴⁶ has been completed that has assessed a Low risk. UXO awareness briefings and a discovery protocol are included in the CEMP (Appendix 2B) and will be delivered to all construction workers prior to any ground works. Future work relating to UXO will follow CIRIA guidelines²⁹.</p>

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
<p>Damage to property due to ingress and accumulation of vapour or ground gas resulting in explosion.</p> <p>Damage to property due to residual contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the operational phase.</p>				<p>The CEMP (Appendix 2B) will be informed by the findings of the site investigation and updated with findings and proposed mitigation from the site investigation as embedded measures for the construction phase.</p> <p>Following the site investigation, buildings will be designed to comply with <i>The Building Regulations 2010</i> last amended 2013: Document C Site preparation and resistance to contaminants.</p> <p>The environmental measures described in Table 10.6 will be implemented and are incorporated into the CEMP (Appendix 2B) to ensure the appropriate re-use or use of materials.</p>
<p>Controlled Waters: Pollution incidents, leaching and migration of pollutants resulting from the release of contaminants from disturbing existing contamination, building materials or construction activities, maintenance and from accidental spillages.</p> <p>Impact to Controlled Waters due to contamination being present as a result of the inappropriate re-use or use of contaminated fills and soils during the operational phase.</p>	Very High	Negligible	Not Significant	<p>Environmental measures described in Table 10.6 will be implemented and are incorporated into the CEMP (Appendix 2B).</p> <p>Chelvey Well is located approximately 3.5km from the Proposed Development. Travel time to the receptor is likely to be long, allowing time for attenuation of contaminants before they reach the receptor.</p>
<p>Soils: Permanent loss of agricultural land.</p> <p>Adverse impacts on soils.</p>	High	Low	Not Significant	<p>There will be permanent loss of 5.4ha of agricultural land within the area of the Silver Zone Car Park Extension (Phase 2) of the Proposed Development. An ALC Survey (Appendix 10B) has confirmed the presence of 3.2ha of BMV. Environmental measures described in Table 10.6 will be implemented and are incorporated into the CEMP (Appendix 2B) and Soil Management Plan. Adverse impacts on soils will be minimised through the retention and reuse of</p>

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor ¹	Magnitude of change ²	Significance ³	Summary rationale
				<p>soils, which shall follow the principles of the <i>Construction Code of Practice for the Sustainable Use of Soils on Construction Sites</i>⁵².</p> <p>The Proposed Development will result in the permanent loss of BMV. Whilst receptor sensitivity of BMV is considered to be high, the magnitude of change is considered in the context of the local region and current/likely future land use if undeveloped should be considered when assessing significance. The ALC³⁰ gives a high grading to land which allows more flexibility in the range of crops that can be grown (its 'versatility') and which requires lower inputs, but also takes into account ability to produce consistently high yields of a narrower range of crops. Due to the relatively minor area of BMV that will be lost (3.2ha from the Proposed Development) and its current or likely use if undeveloped as grazing land, rather than for crop production, the magnitude of the change is considered to be low and loss of this land for the Proposed Development is assessed as not significant.</p>
Soils: Pollution incidents and migration of pollution to soils resulting from the release of contaminants from building materials or construction activities, maintenance and from accidental spillages.	High	Negligible	Not Significant	Environmental measures described in Table 10.6 will be implemented and are incorporated into the CEMP (Appendix 2B).

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 10.9** above and is defined as low, medium, high or very high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 10.9** above and is defined as negligible, low, medium, or high.
3. The significance of the environmental effects is based on the combination of the sensitivity of a receptor and the magnitude of change and is expressed as significant or not significant, subject to the evaluation methodology outlined in **Section 10.9**.

⁵² Defra (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, [online]. Available at: <https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites> [Checked 25/10/2018].

10.14 Consideration of optional additional mitigation or compensation

- 10.14.1 No additional mitigation measures are proposed to further reduce the Land Quality effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals, assessed above in this chapter, and these measures are considered to be likely to be effective and deliverable, and address the likely significant effects of the Proposed Development.

10.15 Conclusions of significance evaluation

- 10.15.1 This assessment has concluded that there are no significant effects on Land Quality from the development after taking into account the embedded mitigation measures.

10.16 Implementation of environmental measures

- 10.16.1 **Table 10.11** summarises the environmental measures embedded into the development proposal and the means by which they will be implemented, i.e. they will have been secured through the planning conditions and by adhering to the relevant compliance mechanism.

Table 10.11 Summary of environmental measures to be implemented – relating to Land Quality

Environmental measure	Responsibility for implementation	Compliance mechanism	ES section reference
Intrusive investigation	Developer/Contractor	Planning condition and/or CEMP (Appendix 2B)	Section 10.8
Pollution control measures	Developer	Planning conditions, CEMP (Appendix 2B) and Environmental Permit	Section 10.8
Soil retention, reuse and imported materials	Developer/Contractor	Planning condition, CEMP (Appendix 2B) and <i>CL:AIRE Definition of Waste: Development Industry Code of Practice</i> (version 2)	Section 10.8
Soil gas, vapour and radon gas protection	Developer/Contractor	Planning condition, building control and CEMP (Appendix 2B)	Section 10.8
UXO briefing and discovery protocol	Developer/Contractor	CEMP (Appendix 2B) and CDM 2015	Section 10.8