13. Ground Conditions

Purpose of the Assessment

13.1 This chapter will identify the existing soil and geological conditions and development constraints, evaluate the potential for contamination and assess the potential effects on ground conditions during both the construction, operation and decommissioning phases of the Proposed Development.

13.2 The Proposed Development includes the Main SRFI Site (including A43 access and all rail infrastructure); J15a works; and minor highways works.

13.3 The Proposed Development is described in **Chapter 5**. There are, however, three aspects of the 'other minor highway works' described in Chapter 5 that have not been included in this assessment, due to their late identification as appropriate mitigation for the Proposed Development. These are:

- PL29 – A43/St John's Road (signage and road surfacing scheme on the A43),
- PL 31 – A43 Northampton Road (signage scheme); and,
- Pedestrian/Cycle Way along Northampton Road and between Barn Lane to the junction of Collingtree Road (widening of existing footpaths, provision of new footpath and dropped kerbs, and realignment of the carriageway).

13.4 The first two elements listed above require no physical works to alter the footprint of the road. The pedestrian/cycle way is located within Highways land and will involve minimal disturbance of existing verges. Assessment of all three aspects will be included in the assessment undertaken for the final DCO submission.

13.5 The assessment involves consideration in terms of the naturally occurring geological conditions and any man-made deposits, known as Made Ground. Consideration is given to the physical nature of the rocks, soils and Made Ground, together with information on existing chemical contamination arising from the former and existing uses of the site. The hydrogeological regime, comprising the groundwater in any permeable deposits (rock, soil or Made Ground) beneath the site, and the hydrological regime (surface water), are described in so much as they interact with land contamination. However, it should be noted that flood risk and drainage are not covered in this chapter and are covered in the Hydrology, Drainage and Flood Risk chapter (**Chapter 14**).

13.6 Earthworks and geotechnical requirements of the Enablement Phase works is also assessed, as the geotechnical characteristics of the soils are one of the factors to determine if excavated soils can be re-used at the site.

13.7 The potential impacts of the future climate upon the ground conditions during the design, construction, operation and decommissioning have also been considered. A separate Climate Change chapter is provided as **Chapter 23**. Should any potential impacts be

identified then appropriate mitigation in the form of adaptation and resilience measures have also been recommended.

13.8 A range of impacts associated with the design, construction, operation and decommissioning of the Proposed Development will be considered, including potential ground contamination, mineral safeguarding and impact on mineral resources, ground improvement, earthworks, foundation solutions, slope stability and associated geotechnical issues.

13.9 This chapter identifies the legislative and policy context for the assessment; summarises the extent of the Study Area; summarises relevant consultation; describes the baseline surveys and data, and baseline conditions; describes the methods used to assess the effects of the Proposed Development; identifies relevant embedded mitigation; provides an assessment of likely significant effects during construction, operation and decommissioning, and provides a cumulative assessment (inter and intra project). The chapter also identifies the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been adopted. Monitoring is identified where necessary, and a summary of the assumptions and limitations of the assessment is also provided.

13.10 This chapter is supported by the following appendices:

- Appendix 13.1: Hydrock Consultants Limited. April 2015, Updated February 2018. 'Milton Malsor Northamptonshire - Desk Study Report', Ref R/151171/001 Issue 8.
- Appendix 13.2: Hydrock Consultants Limited. April 2015, Updated February 2018. 'Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main SRFI Site', Ref R/151171/002 Issue 4.
- Appendix 13.3: Hydrock Consultants Limited. July 2017, Updated February 2018. 'Rail Central, Milton Malsor. Ground Conditions Desk Study Report, M1 Junction 15a Improvements', Ref R/151171/003 Issue 2.
- Appendix 13.4: Hydrock Consultants Limited. February 2018. Rail Central SRFI Northamptonshire. Construction Environmental Management Plan', Ref. RCL-HYD-XX_VAL-RP-GE-5001-S2-P4.
- Appendix 13.5: Hydrock Consultants Limited. February 2018. 'Rail Central SRFI Northamptonshire. Materials Management Plan', Ref. RCL-HYD-XX_REM-RP-GE-3001-S2-P4.
- Appendix 13.6: Tim O'Hare Associates LLP. July 2017.'Rail Central Development, Milton Malsor, Northamptonshire. Soil Resource Survey.
- Appendix 13.7 – Hydrock Consultants Limited. September 2017, Updated February 2018. 'Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main Strategic Rail Freight Interchange - Conceptual Geotechnical Design', Ref R/151171/005 Issue 3.

- Appendix 13.8 – Hydrock Consultants Limited. September 2017, Updated February 2018. 'Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main Strategic Rail Freight Interchange - Remediation Method Statement', Ref R/151171/006 Issue 3.

- Appendix 13.9 Hydrock Consultants Limited. February 2018. 'Rail Central SRFI Northamptonshire. Pollution Prevention Method Statement, Ref. Hydrock Ref. RCL-HYD-XX_REM-RP-GE-3003-S2-P4.

13.11 It should be noted that the site area as indicated in the Ground Conditions Desk Study Report, M1 Junction J15a Improvements (**Appendix 13.3**) was correct at the time of the desk study, but has since changed. Since completion of the desk study, the J15a site area has changed, namely: the land to the north of the M1 and east of the A43 has reduced to just the A43 and immediate surrounds; the land to the north of the M1 and west of the A43 has reduced to just the A43 and immediate surrounds, the M1 off/on ramp and the canal; the land to the south of the M1 and east of the A43 has reduced significantly; and the land to the south of the M1 and west of the A43 has reduced along the M1, but has been increased along the A43 due to the addition of an ecological mitigation area. Several features identified as a potential contaminant source in the desk study have been removed from this Chapter due to the site boundary changes noted above. Where relevant this has been noted within this Chapter.

Legislation, Policy and Good Practice

13.12 The development will be guided by the following legislation, policy, guidance and best practice relevant to this chapter.

13.1: Relevant legislation, policy and guidance

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
National Policy Statement for National Networks 2014 (NPS NN). (Ref 13.1)	With reference to land instability, the NPS NN (Ref 13.1) states: *Where necessary, land stability should be considered in respect of new development, as set out in the National Planning Policy Framework and supporting planning guidance.* *A preliminary assessment of ground instability should be carried out at the earliest possible stage before a detailed application for development consent is prepared.*	Addressed throughout chapter and specifically at **Paragraph 13.74, 13.131, 13.137, 13.163, 13.172** and **Appendix 13.7**.
	Furthermore, the NPS NN (Ref 13.1) recommends that liaison	Addressed

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	with the Coal Authority should take place if necessary (NPS NN (Ref 13.1) paragraphs 5.117 to 118).	specifically at **Table 13.5, Table 13.6, Appendix 13.1** and **Appendix 13.3**.
	Paragraph 4.55 advises that in the case of potentially polluting developments, undertakers must ensure that, the relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework; and the effects of existing sources of pollution in and around the project are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits. Paragraph 5.168 refers specifically to developments on previously developed land, but nevertheless emphasises the need to ensure that the risk posed by land contamination is addressed. NPS NN (Ref 13.1) paragraph 5.179 goes on to highlight the importance of good design principles including the layout of the proposed development and the protection of soils during construction. Applicants should identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed. Para 5.169 goes on to reference the safeguarding of any mineral resources.	Addressed throughout chapter and specifically at **Paragraph 13.75 to 13.90, 13.124, 13.136, Table 13.23, Appendix 13.2, Appendix 13.4, Appendix 13.5**, **Appendix 13.**8 and **Appendix 13.9**. With regards to mineral safeguarding, addressed specifically at **Paragraph 13.68 to 13.72, 13.127 to 13.129, 13.158 to 13.160** and in **Appendix 13.1** and **Appendix 13.2**.

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	With reference to water quality, the NPS NN (Ref 13.1) states that an ES should describe: • *the existing quality of waters affected by the proposed project;* • *existing water resources affected by the proposed project and the impacts of the proposed project on water resources;* • *existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project, and any impact of physical modifications to these characteristics;* • *any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions; and* • *any cumulative effects.*	Addressed throughout chapter and specifically at **Paragraph 13.44 to 13.50, 13.82 to 13.87, 13.104 to 13.118, Table 13.11**, **Appendix 13.1, Appendix 13.2 and Appendix 13.3**.
The National Planning Policy Framework (March 2012). (NPPF) (Ref 13.2)	The National Planning Policy Framework (Ref 13.2) requires that development plans should minimise pollution and other adverse effects on the local and natural environment. Specifically: *"The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…" (Paragraph 109)* Pollution is defined as 'anything that affects the quality of land, water or soils'. In relation to ground conditions the National Planning Policy Framework (Ref 13.2) states that: *"Planning policies and decisions should also ensure that the*	Addressed throughout chapter and specifically at **Paragraph 13.75 to 13.9013.91, 13.124, 13.136, Table 13.23, Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix 13.8** and **Appendix 13.9**.

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that mitigation." (Paragraph 121)	Land Instability addressed specifically at **Paragraph 13.74, 13.131, 13.137, 13.163, 13.172** and **Appendix 13.7**. Pollution addressed specifically at **Paragraph 13.75 to 13.90, 13.124, 13.136, Table 13.23, Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix 13.8** and **Appendix 13.9.**
Planning Practice Guidance (PPG). (Ref 13.3)	PPG (Ref 13.3) on Land affected by contamination notes that failure to deal adequately with contamination could cause harm to human health, property and the wider environment. It could also undermine compliance with European Directives such as the Water Framework Directive. PPG (Ref 13.3) on Water Supply, wastewater, and water quality advocates the need to protect surface water and groundwater, with a requirement to steer potentially polluting development away from the vicinity of potable water supplies.	Addressed at **Paragraph 13.82 to 13.87**, and **Appendix 13.2**.
Part 2A of the Environmental Protection Act	Part 2A of the Environmental Protection Act 1990 (Ref 13.4), as inserted by Section 57 of the Environment Act 1995 (Ref 13.19), was brought into force on 1 April 2000.	Addressed at **Paragraph 13.75 to 13.90, 13.124, 13.136,**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
1990. (Ref 13.4)	The legal definition of contaminated land (as of April 2012 from Section 78A(2) of Part 2A of the Environmental Protection Act 1990) (Ref 13.4) is: ' …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 the significant possibility of such harm being caused; or • significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused. Controlled waters include all surface watercourses or bodies, including those which are man-made, and also groundwater. Development of land will have to take into account Part 2A as to alter the use of the land may bring the development inside the statutory definition of contaminated land.	**Appendix 13.2**, and **Appendix 13.3**.
The Environment Agency Groundwater Protection Policy (GP3) (August 2013). (Ref 13.5)	This document describes the Environment Agencies approach to the management and protection of groundwater in England and Wales. It provides a framework within which the EA will with others to manage and protect groundwater. GP3 (Ref 13.5) is intended to be used by anyone interested in groundwater and those whose activities may impact on groundwater or could do so. A 2017 update contains position statements which provide information about the EA's approach to managing and protecting groundwater.	Addressed at **Paragraph 13.82 to 13.87**, **Appendix 13.2**, **Appendix 13.4 Appendix 13.8** and **Appendix 13.9.**
The Water Resources Act 1991 (Ref. 13.6), as amended by the Water Act 2003 and 2014 (Ref	Water resources in England and Wales are protected by law under the Water Resources Act 1991 (Ref 13.6) and the Environmental Protection Act 1990 (as amended by the Environment Act 1995) (Ref 13.19). The Water Act 2003 (Ref 13.7) amends the Water Resources Act 1991 (Ref 13.6) to improve long term water resource management, specifically with regard to the regulation of	Addressed at **Paragraph 13.44 to 13.50, 13.82 to 13.87, 13.105 to 13.119, Table 13.11**, **Table 13.23**.**Appendix**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
13.7).	water abstraction and impoundment. The Water Act 2014 (Ref 13.7) contains further amendments relating to water resources and environmental regulation.	**13.1, Appendix 13.2 and Appendix 13.3**.
Water Framework Directive (2000/60/EC and daughter directive 2006/118/EC as amended by 2013/39/EU). (Ref 13.8).	The purpose of the Water Framework Directive (Ref 13.8) is to establish a framework for the protection of inland surface waters, estuaries, coastal waters and groundwater. The framework for delivering the Directive is through River Basin Management Planning. The UK has been split into several River Basin Districts (RBDs). Each River Basin District has been characterised into smaller management units known as Water Bodies. The surface Water Bodies may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive of protecting all Water Bodies, Environmental Objectives have been set. These Environmental Objectives are reported for each water body in the River Basin Management Plan (RBMP). It follows that developments within individual RBDs must be such that the Environmental Objectives are not compromised.	Addressed at **Paragraph 13.44 to 13.50, 13.83, 13.114 to 13.119, Table 13.11**, **Table 13.23**.**Appendix 13.1, Appendix 13.2 and Appendix 13.3**.
Waste Framework Directive (2006/12/EC) and daughter directive 2006/118/EC as amended by 2013/39/EU (Ref 13.9).	Collectively, these Directives set the basic concepts and definitions related to waste management in the EU, such as definitions of waste, recycling, and recovery. The Directive lays down some basic waste management principles: it requires that waste be managed without endangering human health and harming the environment, and in particular without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest. These principles have been implemented through applicable UK legislation that must be complied with. Of particular relevance to the proposed works is compliance with Environmental Permitting (England and Wales) Regulations 2016 (Ref 13.20), Schedule 10 (should any remediation works be required) and compliance with the Definition of Waste Code of Practice (Ref 13.21) should re-use of materials on site be required.	Addressed at **Paragraph 13.172, 13.204, Table 13.12**, **Table 13.23**, **Appendix 13.4, Appendix 13.5, Appendix 13.8 and Appendix 13.9**.

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
The Water Supply (Water Quality) Regulations (2016) Ref 13.10.	This legislation sets out the physical and chemical requirements for a public water supply organisation intended for human consumption. The ES will assess whether there are any implications of the proposed works with regards to public water supplies.	Addressed at **Paragraph 13.44 to 13.50, 13.82 to 13.87, 13.105 to 13.119, Table 13.11**, **Table 13.23**.**Appendix 13.1, Appendix 13.2 and Appendix 13.3**.
Environmental Permitting (England and Wales) Regulations 2016 Ref 13.20)	For England and Wales, the principal water pollution offences are contained in the Environmental Permitting (England and Wales) Regulations 2016: regulations 38(1) and 12(1). The offences are similar to ones that used to be set out in section 85 of the Water Resources Act 1991 (Ref 13.6). Under regulation 12(1) and 38(1) it is an offence to, except if authorised by an environmental permit, "cause or knowingly permit a water discharge activity or groundwater activity". The Environmental Permitting Regulations (2016) requires those carry out a wide range of activities to undertaken an environmental permit, including those activities that involve the release of emissions to land, air and water, or that involve waste. With respect to the release of substances to groundwater, under schedule 22 (Regulation 35(1)), the regulator must take all necessary measures to "(a) to prevent the input of any hazardous substance to groundwater, and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater".	Addressed at **Paragraph 13.172, 13.204, Table 13.12**, **Table 13.23**, **Appendix 13.4, Appendix 13.5, Appendix 13.8 and Appendix 13.9**.
The Private Water	This legislation sets out the physical and chemical requirements for private supplies of water intended for	Addressed at **Paragraph**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
Supplies (England) Regulations (2016) (Ref 13.12).	human consumption. The ES will assess whether there are any implications of the proposed works with regards to private water supplies.	**13.41, 13.48, 13.82 to 13.86, 13.112, 13.118, Table 13.11, Appendix 13.1, Appendix 13.2** and **Appendix 13.3.**
West Northamptonshire Joint Core Strategy Local Plan (Part 1) (Ref 13.13)	This document from the West Northamptonshire Joint Planning Unit and its Partner Councils (Daventry District, Northampton Borough, South Northamptonshire and Northamptonshire County Council) forms Part 1 of the suite of Local Plans in West Northamptonshire. This document is stated to comprise a "*guide the evolution of Northampton, Daventry and South Northamptonshire in the years that lie ahead"*. Its aim is to provide "*a long-term vision and broad planning strategy for the area with an overall framework in which more detailed plans will be drawn up and decisions made.*" "Policy S10 – Sustainable Development Principles Development will: … K) Minimise pollution from noise, air and run off." "Policy BN9 - Planning for Pollution Control Proposals for new development which are likely to cause pollution or likely to result in exposure to sources of pollution or risks to safety will need to demonstrate that they provide opportunities to minimise and where possible reduce pollution issues that are a barrier to achieving sustainable development and healthy communities including: ….. *B) Protecting and improving surface and groundwater water quality;*	Addressed throughout chapter, specifically at **Paragraph 13.75 to 13.90, 13.124, 13.136, in** Embedded Mitigation (**Paragraph 13.172)**, the Mitigation section (**Paragraph 13.198 to 13.207** and **Table 13.23)** and **Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	…..	**13.8 and Appendix 13.9**.
	D) Ensuring remediation of contaminated land so as not to pose a risk to health and the environment; and	
	…..	
	Development that is likely to cause pollution, either individually or cumulatively, will only be permitted if measures can be implemented to minimise pollution to a level which provides a high standard of protection for health and environmental quality."	
	"Policy BN10 - ground instability	Addressed throughout chapter and specifically at **Paragraph 13.74, 13.131, 13.137, 13.163** and in Embedded Mitigation (**Paragraph 13.172**) and Mitigation section (**Paragraph 13.205** and **Table 13.23)** and in **Appendix 13.2, Appendix 13.3 and Appendix 13.7**.
	Development will be permitted on sites of unstable or potentially unstable land provided that:	
	1) the nature of the ground stability of the site has been assessed to the satisfaction of the determining planning authority and a ground stability report has been provided and agreed before the application is determined;	
	2) the development does not add to the instability of the site or surrounding land;	
	3) any required remedial works are implemented prior to occupation of development; and	
	4) the development of any required stabilisation measures are environmentally acceptable to the satisfaction of the determining authority.	
	The ground stability report will be required to demonstrate that:	
	A) the degree of instability has been assessed;	
	B) measures to mitigate against the risk have been identified;	
	C) a schedule of mitigation measures is in place;	

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	D) a programme for routine monitoring is in place; and *E) any need for formal environmental assessment arising from any stabilisation works has been identified."*	
Northampton Development Plan 1997 (Ref 13.31)	The adopted Development Plan for Northampton Borough currently comprises the following: Northampton Local Plan Saved Policies - Adopted 1997 Northampton Central Area Action Plan - Adopted 2013, which is not relevant to the proposed development discussed in this Chapter. West Northamptonshire Joint Core Strategy Local Plan Part 1 - Adopted 2014, which is discussed in Table 13.1 (Ref 13.13) Northamptonshire Minerals and Waste Local Plan – Adopted 2014 (since replaced by the Northamptonshire County Council Minerals and Waste Local Plan. (July 2017) (Ref 13.15) With regards the Northampton Local Plan Saved Policies - Adopted 1997, the relevant policies include: *E20 New development (design)* *2.65. The quality of the environment particularly in built-up areas may be harmed by inappropriate new development or changes of use. These may result in emissions including noise, air or water pollutants, all or any of which may be potentially dangerous and may have a detrimental effect upon the environment.*	Addressed throughout chapter, specifically **Paragraph 13.75 to 13.90, 13.124, 13.136,** in Embedded Mitigation (**Paragraph 13.172)**, the Mitigation section (**Paragraph 13.198 to 13.207** and

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
		Table 13.23) and **Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix 13.8 and Appendix 13.9**.
South Northamptonshire Local Plan (Ref 13.14)	"Policy G3 Planning permission will normally be granted where the development: ….. E Is neither of a hazardous nature nor likely to cause problems of pollution, noise, vibration, smell, smoke, discharge or fumes; ….. K Will not adversely affect sites of nature conservation value or sites of geological, geomorphological or archaeological importance; …..	Addressed throughout chapter, specifically at Embedded Mitigation (**Paragraph 13.172)**, the Mitigation section (**Paragraph 13.198 to 13.207** and **Table 13.23) and Appendix 13.4, Appendix 13.5, Appendix 13.8 and Appendix 13.9**. Addressed at **Paragraph 13.67** and **13.126** and In **Appendix 13.1** and **Appendix 13.3**.

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	N Is not on or in proximity to land containing known mineral resources, or, if known resources exist, without first considering the need to safeguard these resources. All proposals for development will be considered in the light of this policy."	Addressed specifically at **Paragraph 13.68 to 13.72, 13.127 to 13.129, 13.158 to 13.160** and in **Appendix 13.2.**
	"Policy EV24 Planning permission will only be granted for development where it will not lead to the loss of, or cause significant harm to, regionally important geological and geomorphological sites and county wildlife sites. Where development is permitted the retention and protection and enhancement of such sites may be secured through planning conditions or obligations."	Geological and geomorphologi cal sites addressed specifically at **Paragraph 13.67 and 13.126** and In **Appendix 13.1 and Appendix 13.3**.
Northamptonshir e County Council Minerals and Waste Local Plan (July 2017) (Ref 13.15)	*"Policy 2: Spatial strategy for mineral extraction.* *The spatial strategy for minerals extraction within Northamptonshire is to focus extraction on the county's pre-glacial and glacial deposits together with the reserves from the river valleys of the Nene (west of Wellingborough) and the Great Ouse."*	Addressed specifically at **Paragraph 13.68 to 13.72, 13.127 to 13.129, 13.158 to 13.159** and in **Appendix 13.1** and **Appendix 13.2.**
	Policy 4: Sites for the provision of sand and gravel. *"A supply of sand and gravel to contribute to meeting the provision of sand and gravel will be provided for by: productio since 1 January 2011, sites with planning permission as at 1 January 2016 and the following allocated sites.*	Addressed specifically at **Paragraph 13.68 to 13.72, 13.127 to 13.129, 13.160** and in **Appendix 13.1**

Legislation/policy/ guidance	Key provisions		Relevant section of chapter where key provisions are addressed
	Pre-glacial and glacial areas		and **Appendix 13.2.**
	M1: Milton Malsor	*1.2 million tonnes (approximately)*	
	M2: Strixton - Bozeat	*1.5 million tonnes (approximately)*	
	Central Nene Valley		
	M3: Heyford	*1.4 million tonnes (approximately)*	
	M4: Earls Barton West Extension	*2.6 million tonnes (approximately)*	
	Great Ouse Valley		
	M5: Passenham Extension South	*0.2 million tonnes (approximately)*	
	Other locations		
	M6: Elton Extension	*0.85 million tonnes (approximatel)*	
	Policy 9: Development criteria for borrow pit extraction *Proposals for the development of borrow pits for mineral extraction must demonstrate that the:* • *borrow pit is in close proximity to the construction project it is intended to supply,* • *use of the mineral would not constitute an inappropriate use of high quality materials,* • *mineral can be transported with minimal use of the public highway,* • *site will be satisfactorily restored either through progressive restoration or as soon as possible following cessation of the construction project it serves, and* • *inert waste arising or extracted from the construction project is utilised in restoration works (of the borrow pit).”*		Addressed specifically at **Paragraph 13.163** and **Appendix 13.5, Appendix 13.7** and **Appendix 13.8**.

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	Policy 28: Minerals Safeguarding Areas *Mineral resources of economic importance will be safeguarded from sterilisation by incompatible non-mineral development through the designation of Minerals Safeguarding Areas.* *Development of a significant nature within Minerals Safeguarding Areas will have to demonstrate that the sterilisation of proven mineral resources of economic importance will not occur as a result of the development, and that the development would not pose a serious hindrance to future extraction in the vicinity. If this cannot be demonstrated, prior extraction will be sought where practicable.* *Development of a non-mineral related nature within the Mineral Safeguarding Areas which is incompatible with the safeguarding of minerals should not proceed unless:* • *it can be clearly demonstrated to the satisfaction of the Mineral Planning Authority that the mineral concerned is no longer of any value, or potential value, or that substantial (economically viable) deposits of a similar quality exist elsewhere in the county, or* • *the mineral can be extracted, where practicable, prior to the development taking place, or* • *the incompatible development is of a temporary nature and can be completed with the site restored to a condition that does not inhibit extraction within the timescale that the mineral is likely to be needed, or* • *the development is of a minor nature which would not inhibit extraction of the mineral resource, or* • *there is an overriding need for the development.*	Addressed specifically at **Paragraph 13.68 to 13.72, 13.127 to 13.129, 13.158 to 13.160** and in **Appendix 13.1** and **Appendix 13.2.** **.**
South Northamptonshire Council	This indicates that SNC adopts a "suitable for use" policy, which consists of three elements:	Addressed specifically at **Paragraph**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
Contaminated Land Strategy (Ref 13.16)	a. *ensuring that land is suitable for its current use;* b. *ensuring that land is made suitable for any new use; and* *c. limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought.*	**13.75 to 13.90, 13.124, 13.136, in** Embedded Mitigation (**Paragraph 13.172)**, the Mitigation section (**Paragraph 13.198 to 13.207** and **Table 13.23)** and **Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix 13.8 and Appendix 13.9**.
Northants Contaminated Land Group, Contaminated Land Requirements for Planning Applications (Ref 13.17).	The Environmental Health team for South Northamptonshire Council and the Northampton Borough Council (along with other councils in the region) provide a joint statement with regards to assessment of contaminated land. This document is titled "Contaminated Land Requirements for Planning Applications". This document clarifies the requirements for applications on land that may be affected by contamination and states: • *"The policy statement confirms that land contamination is a material planning consideration.* • *The developer is responsible for determining whether land is suitable for a particular development and to this end should carry out an adequate investigation to inform the assessment of risk.* • *The assessment of contamination due to human activities and natural sources is covered by this requirement including the presence of elevated levels of arsenic associated with certain types of geology commonly*	Addressed specifically at **Paragraph 13.75 to 13.90, 13.124, 13.136, in** Embedded Mitigation (**Paragraph 13.172)**, the Mitigation section (**Paragraph 13.198 to 13.207** and **Table 13.23)** and **Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix 13.8 and**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
	occurring in Northamptonshire. • *Where development is proposed on land that may be affected by contamination a risk assessment should be submitted to the LPA for consideration before the application is determined.* • *Where practicable developers of potentially contaminated sites should arrange pre application discussions with the LPA including initially the Environmental Health and Building Control Sections of the Council.* • *The applicant should provide information on a phased or tiered approach as detailed in CLR11 Model Procedures for the Management of Land Contamination. This document is available at http://www.environment-agency.gov.uk/commondata/105385/model_procedures_881483.pdf* *….".*	**Appendix 13.9**.
Northants Contaminated Land Group, Contaminated Land - A Guide for Developers and their advisors 2003 (Ref 13.18)	The Environmental Health team for South Northamptonshire Council and the Northampton Borough Council (along with other councils in the region) provide a joint statement with regards to assessment of contaminated land. This document is titled "Contaminated Land - A Guide for Developers and their advisors" (Ref 13.18) and is dated November 2003. This document indicates the three key components of Environmental Risk Management are: Risk Assessment; Options Appraisal; and the Implementation of the Remedial Strategy. This guidance also indicates that works should be undertaken in accordance with CLR11 (Ref 13.22) and the first step is a preliminary risk assessment.	Addressed specifically at **Paragraph 13.75 to 13.90, 13.124, 13.136, in** Embedded Mitigation (**Paragraph 13.172)**, the Mitigation section (**Paragraph 13.198 to 13.207** and **Table 13.23)** and **Appendix 13.2, Appendix 13.4, Appendix 13.5, Appendix 13.8 and**

Legislation/policy/ guidance	Key provisions	Relevant section of chapter where key provisions are addressed
		Appendix 13.9.

13.13 In addition, in accordance with best practice, the following published guidance documents will also be used in the contaminated land assessment:

- Association of Ground Investigation Specialists. 2006. Guidelines for Good Practice in Site Investigation. Issue 2. AGS, Beckenham.
- British Standards Institute. 2000. Investigation of potentially contaminated sites, Code of Practice. BS10175. BSI, London.
- British Standards Institute. 2007. Code of practice for the characterization and remediation from ground gas in affected developments. BS 8485. BSI, London.
- British Standards Institute. 2015. Code of practice for Site Investigations. BS 5930:2015. BSI, London.
- Card, G., Wilson, S. and Mortimer, S. 2012. A pragmatic approach to ground gas risk assessment. CL:AIRE Research Bulletin RB17. CL:AIRE, London.
- Environment Agency. 2015. Waste classification. Guidance on the classification and assessment of waste (1st Ed.) Technical Guidance WM3. The Environment Agency.
- Mallett, H., Cox, L., Wilson, S., and Corban, M. 2014. Good practice on the testing and verification of protection systems for buildings against hazardous ground gases. CIRIA Report C735. CIRIA, London.
- Miles, J. C. H., Appleton, J. D., Rees, D. M., Green, B. M. R., Adlam. K. A. M. and Myres. A. H. 2007. Indicative Atlas of Radon in England and Wales. Health Protection Agency and British Geological Survey. Report HPA-RPD-033.
- Scivyer, C. 2015. Radon: Guidance on protective measures for new buildings. Building Research Establishment Report BR 211. BRE, Garston.
- UKTAG. November 2013 (updated January 2014). Updated recommendations on environmental standards. River Basin Management (2015-21). UK Technical Advisory Group on the Water Framework Directive.
- Water UK HBF. January 2014. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation. 12pp.

- WFD-UKTAG. July 2014. UKTAG River & Lake Assessment Method, Specific Pollutants (Metals), Metal Bioavailability Assessment Tool (M-BAT). Water Framework Directive – United Kingdom Technical Advisory Group. Stirling.

- Wilson, S., Oliver, S., Mallett, H., Hutchings, H. and Card, G. 2007. Assessing risks posed by hazardous ground gases to buildings. CIRIA Report C665. CIRIA, London. 182pp.

13.14 It should be noted that the above documents are used in the assessments and referred to in the Appendix documents where necessary. However, are not referenced directly in this Chapter.

13.15 In accordance with best practice, the following published guidance documents will also be used in the geotechnical assessment:

- Building Research Establishment (BRE). 2001. Concrete in aggressive ground. BRE Special Digest 1, Parts 1 to 4. BRE, Garston.

- British Standards Institution. 2004. Eurocode 7 – Geotechnical design - Part 1: General rules. BS EN 1997-1. Incorporating Corrigendum No.1. BSI, London.

- British Standards Institution. 2006. Concrete – complementary British Standard to BS EN 206-1 – Part 1: Method of specifying and guidance to the specifier. BS 8500-1. BSI, London.

- British Standards Institution. 2007. Eurocode 7 – Geotechnical design - Part 2: Geotechnical investigation and testing. BS EN 1997-2. BSI, London.

- British Standards Institution. 2009. Code of practice for earthworks. BS 6031 Incorporating Corrigendum No.1:2010. BSI, London.

- Healy, P.R. & Head, J.M. 1984. Construction over abandoned mine workings. CIRIA Special Publication SP32. CIRIA, London.

- Highways Agency. 2009. Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06. Rev 1. Highway Agency, London.

- Highways Agency. 2014. Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1, Amendment August 2014. Highway Agency, London.

13.16 It should be noted that the above documents are used in the assessments and referred to in the Appendix documents where necessary. However, are not referenced directly in this Chapter.

13.17 Relevant licences and permits required to construct, operate and maintain the development with regards to the ground conditions are summarised in **Table 13.2**.

Table 13.2: Relevant licences and permits required

Licence or Permit
Environmental Permit - for construction works regarding Waste / Water Discharge / Groundwater.
Permit to discharge to sewer.

Scoping and Consultation

13.18 Issues raised within the Scoping Opinion have been reviewed and assessed. The responses are summarised in **Table 13.3**.

Table 13.3: Summary of Scoping Opinion

Consultee	Summary of issues raised	Where in the ES is this addressed?
Scoping Opinion, January 2016 The Secretary of State as per feedback provided in the Scoping in respect of the content of the Environmental Statement	Paragraph 3.47 of the Scoping Opinion states that "*the ES should clarify what is meant by the "*immediate surrounding area*". The Secretary of State also advises that the study area should be agreed with the relevant consultees*".	Noted and addressed within the Study Area section of this chapter. The study area has been discussed and agreed with: the South Northamptonshire Council and Cherwell District Council Environmental Health Department; and the Northampton Borough Council Environmental Health Department.
	Paragraph 3.48 of the Scoping Opinion states that "*The applicant's attention is drawn to the comments made by the Environment Agency (see Appendix 3 of this Opinion) in relation to the location of landfill sites in the vicinity of the application site. The Secretary of State recommends that the applicant considers the potential for land contamination and the existence or creation of pathways which could lead to effects on receptors in the area*."	Noted and addressed within the supporting documents and the ES. See below for response to the specific Environment Agency comments. The potential for land contamination and the existence or creation of pathways which could lead to effects on receptors have been considered.
	Paragraph 3.49 of the Scoping Opinion states that "*Paragraph 11.5 of the Scoping Opinion states that the walkover has been undertaken in accordance with best practice guidance*"; the ES should	Best practice guidance is provided in the Legislation, Policy and Good Practice Section of this Chapter. Best Practice is also referenced in the desk study reports (**Appendix 13.1**

Consultee	Summary of issues raised	Where in the ES is this addressed?
	clearly reference specific guidance.	**and 13.3**).and Site Investigation report (**Appendix 13.2**) used as baseline data.
	Paragraph 3.50 of the Scoping Opinion indicates "*The Secretary of State notes that a number of sources have been used to inform a Phase 1 Desk Study (as detailed in paragraph 11.4 of the Scoping Report). Very limited baseline information has been provided within the Scoping Report; this detail should be provided within the ES. Should previous studies be relied upon, these should be provided as an appendix to the ES."*	Additional detail with regards to baseline data is provided within the Desk Study reports and the Desk Study data has been used to support this assessment For the Main SRFI site, all identified Sources of contamination have been investigated by intrusive site investigation and the site investigation data has been used to support this assessment. Baseline data is summarised in the baseline section of this chapter.
	Paragraph 3.51 of the Scoping Opinion states that "*The applicant's attention is drawn to the comments made by South Northamptonshire Council (see Appendix 3 of this Opinion) in relation to the location of part of the site in a Minerals Safeguarding Area and to the need to consider minerals in the Ground Conditions chapter of the ES*".	Noted and addressed within the Desk Study Report and Site Investigation for the Main SRFI site (**Appendix 13.1 and 13.2**). Also addressed within this chapter **Paragraph 13.158 to 13.159** and in **Appendix 13.1** and **Appendix 13.2.** See below for response to the specific South Northamptonshire Council comments.
	Paragraph 3.52 of the Scoping Opinion states that "*This section of the Scoping Report has not set out what the potential effects of the proposed development would be; the ES should clearly set this out*."	Noted and addressed within this chapter in the assessment of effects section. Specifically: Construction - **Tables 13.17, 13.18 and 13.19** Operation - **Tables 13.20, 13.21 and 13.22**
	Paragraph 3.53 of the Scoping Opinion states that "Paragraph*11.38 of the Scoping Opinion states that the sensitivity of receptors is based on the likelihood that a receptor suffers the impact. Definitions should be provided for the four levels of likelihood (high, moderate, low or unlikely)."*	Addressed within the Method of Assessment section of this chapter and specifically at **Table 13.15**.

Consultee	Summary of issues raised	Where in the ES is this addressed?
	Paragraph 3.54 of the Scoping Opinion states that "*Groundwater is a potential pathway for discharge of liquids to surface waters. The Secretary of State considers that the applicant should demonstrate a clear linkage between groundwater and surface water assessments to ensure that potential significant effects are identified and mitigated".*	Noted and assessed as part of the intrusive site investigation for the Main SRFI site (**Appendix 13.2**). The site investigation data has been used to support this chapter.
	Paragraph 3.55 of the Scoping Opinion states that "*The Secretary of State welcomes the management plans proposed in paragraph 11.48 of the Scoping Report. Any measures that are relied upon in the assessment should be demonstrated to be secured either by means of a suitable requirement or within a draft version of the relevant management plan.* *The Secretary of State advises that drafts of these plans are provided by the applicant and agrees with the comments of the Environment Agency (see Appendix 3 of this Opinion) in relation to details which should be provided within the plan*."	Addressed within the mitigation section of this ES chapter. Draft versions of the plans are provided as **Appendix 13.4, Appendix 13.5**, **Appendix 13.7, Appendix 13.8 and Appendix 13.9**.
	Paragraph 3.56 of the Scoping Opinion states that "*The need for any on-going monitoring should also be addressed and agreed with the relevant authorities to ensure that any mitigation measures are effective*."	Addressed within the mitigation section of this chapter. Draft versions of the monitoring requirements are provided within **Appendix 13.4, Appendix 13.5**, **Appendix 13.7, Appendix 13.8 and Appendix 13.9**.
Environment Agency (as detailed in Appendix 3 of the Scoping Opinion, dated January 2016)	We understand that the Environmental Statement will include information taken from a Phase I Desk Study outlining the previous site uses, potential sources of land contamination, pathways and receptors that may be present. Our records show that there are historical landfill sites present within 250	Noted and the landfills on site and within 250m have been assessed during investigation. The site investigation report forms an Appendix (see **Appendix 13.2**). The landfills (on and off-site) have been assessed within the ES in the assessment of effects section and

Consultee	Summary of issues raised	Where in the ES is this addressed?
	metres of the site.	specifically **Table 13.17** and **Table 13.20**.
	Additionally, Gayton landfill is located approximately 350m to the west of the site. We understand that this historical landfill was determined Contaminated Land under Part IIA of the Environmental Protection Act 1990.	Noted. Assessed as part of the Desk Study for the Main SRFI site and the desk study data (**Appendix 13.1**) has been used to support this chapter.
	The ES should aim to assess any potential risk associated with the landfill sites (including migration of landfill gas) and any risk posed by Brownfield Land to controlled waters.	Noted and the landfill on site (along with the off-site landfills in close proximity to the site) have been assessed as part of the intrusive site investigation (see **Appendix 13.2**) undertaken for the Main SRFI Site. The site investigation data has been used to support this chapter.
	Soakaways should not be located in potentially contaminated ground where this could increase the risk posed to groundwater. The use of infiltration drainage in any Brownfield Land and/or soakaways should be assessed as part of the ES.	Noted and the potential for soakaways to increase the risk posed to Controlled Waters are taken into account within the ES and the design. No soakaways or infiltration drainage will be installed in Made Ground.
	We recommend that developers should: 1. Follow the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination, when dealing with land affected by contamination. 2. Refer to the Environment Agency guiding principles for land contamination for the type of information that is required in order to assess risks to controlled waters from the site. The Local Authority can advise on risk to other receptors, such as human health. 3. Refer to the contaminated land pages on GOV.UK for more information.	Noted and followed in the Desk Studies and the Site Investigation. (see **Appendix 13.1, 13.2 and 13.3**). Best practice guidance is provided in the Legislation, Policy and Good Practice Section of this Chapter. The Desk Studies and the Site Investigation have been used to support this chapter.
South Northamptonshire	*"Part of the application site falls within a Minerals Safeguarding Area, as such a*	Noted and assessed as part of the Desk Study and the Site Investigation

Consultee	Summary of issues raised	Where in the ES is this addressed?
Council (as detailed in Appendix 3 of the Scoping Opinion, dated January 2016)	*minerals assessment should be included within Section 11 Ground Conditions.* *The north-eastern corner of the identified site is within the 300m buffer of MA2: Milton Malsor; a site allocated for sand and gravel extraction in the Northamptonshire Minerals and Waste Local Plan (MWLP) (adopted October 2014).* *The applicants should demonstrate how it meets Policy 34 of the MWLP. Policy 34 relates specifically to preventing land use conflict and ensuring new development adjacent, or in close proximity, to allocated minerals development should only be permitted where it can be demonstrated that it would not prevent or prejudice the use of the site."*	for the Main SRFI Site (see **Appendix 13.1** and **Appendix 13.3**). These documents have been used to support this chapter. Also addressed within this chapter **Paragraph 13.158 to 13.159.** Please note there is a revised plan (issued July 2017) in operation and it should be noted that MA2: Milton Malsor, is noted as M1: Milton Malsor in the updated 2017 MWLP. It should also be noted that the relevant policy is Policy 28 (as set out in **Table 13.1**), not Policy 34, which related to the previous MWLP.

13.19 South Northamptonshire District Council and the Northampton Borough Council were consulted in order to obtain approval for the desk study works and the site investigation strategy. The responses are summarised in **Table 13.4**.

Table 13.4: Consultee Responses

Consultation and date	Summary of Consultation	Where in the ES is this addressed?
South Northamptonshire Council and Cherwell District Council	The relevant Environmental Protection Officer (EHO) has confirmed on behalf of the Council that they are happy with the finding of the desk-top studies and preliminary investigations carried out so far on the parcels of land. The EHO has also confirmed that for land parcels that cannot be currently accessed, it is acceptable to mention these in the Environmental Statement (ES) as long as the provision can be made to obtain access if needed at any point in the future (including the area where there might be a domestic heating oil tank). Within areas where no contamination sources have been identified and no intrusive investigations have been carried out it is acceptable to mention these in the ES as long as further investigations can be if required and	Information used to design the investigation and used in baseline study.

Consultation and date	Summary of Consultation	Where in the ES is this addressed?
	necessary. This includes: Areas where access is restricted within the site; Offsite highway improvements; and Offsite ecological receptor sites. The EHO has also confirmed that the study area as defined in this ES Chapter is acceptable.	
Northampton Borough Council	The relevant Environmental Protection Officer (EHO) has confirmed: The study area as defined in this ES Chapter is acceptable. The proposed baseline data set (a Desk Study for the Junction 15a of the M1 and a high level review of the ground conditions for the minor highway improvements) is acceptable.	Information used to design the investigation and used in baseline study.

Study Area

13.20 The extent of the Ground Conditions study area has been confirmed with the relevant Environmental Health Officer at both the South Northamptonshire District Council and the Northampton Borough Council. The extent of the Ground Conditions study area is the land within the proposed Order Limits and the immediate surrounding area. The immediate area is defined for the purposes of this chapter as land within close proximity to or bordering the relevant part of the site (i.e. less than 250m from the site) and has the potential to be a contaminant source and there is a potential pathway for contaminant migration, which may affect the site or be affected by the site.

13.21 The Ground Conditions study area is shown within the supporting documents (please refer to **Appendix 13.1, 13.2** and **13.3**).

13.22 A full description of the Proposed Development is set out in **Chapter 5**.

Baseline Surveys and Data

Main SRFI Site (including A43 access and all rail infrastructure)

13.23 The information sources used in relation to the Main SRFI site, are listed in **Table 13.5**.

Table 13.5: Baseline Surveys and Data - Main SRFI site

Source	Information
British Geological	Geological map (review included in desk study) (**Appendix 13.1**).

Source	Information
Survey (BGS).	Radon Report. Reference GR_210997_1 (included in desk study) (**Appendix 13.1**).
GroundSure Limited	Database Groundsure Enviro Insight Report. Reference HYDNOR-1981473, dated 25th March 2015 – environmental permits, incidents and registers, landfill and waste, current land use, geology, hydrogeology and hydrology, flood mapping, designated environmentally sensitive sites, natural hazards and mining. Database sources include BGS, EA, the Coal Authority, Public Health England, and the Ordinance Survey (included in desk study) (**Appendix 13.1**).
GroundSure Limited	Database Groundsure Geo Insight Report. Reference HYDNOR-1981474, dated 25th March 2015 – geology, radon, ground workings, mining, extraction & natural cavities, natural ground subsidence, borehole records, estimated background soil chemistry, railways and tunnels. Database sources include BGS, British Gypsum, the Coal Authority, Public Health England, Coal Authority Johnson Poole and Bloomer and the Ordinance Survey (included in desk study) (**Appendix 13.1**).
Historical Ordnance Survey maps.	Historical Ordnance Survey Mapping - 1:10560 and 1:10000 scale (included in desk study) (**Appendix 13.1**).
Hydrock Consultants Limited	Hydrock Report R/151171/001 Issue 8 (Milton Malsor Northamptonshire - Desk Study Report), April 2015, Updated February 2018. Presented as **Appendix 13.1**.
Hydrock Consultants Limited	Hydrock Report R/151171/002 Issue 4 (Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main SRFI Site), January 2017, Updated February 2018. Presented as **Appendix 13.2**.
Peter Brett Associates.	Natural and Mining Cavities Database Search. Reference 34104/CBH/CNE/AD/CW/TH (included in desk study) (**Appendix 13.1**).

J15a

13.24 The information sources used in relation to the J15a Works, are listed in **Table 13.6**. The assessment is based primarily on desk study information sources, which, based on professional judgement is considered suitable for the development of a motorway junction. Intrusive ground investigation and risk assessment will be carried out as part of the detailed design process.

13.25 It should be noted that the site area as indicated in the Ground Conditions Desk Study Report, M1 Junction J15a Improvements (Appendix 13.3) was correct at the time of the desk study, but has since changed. Since completion of the desk study, the J15a site area has changed, namely: the land to the north of the M1 and east of the A43 has reduced to just the A43 and immediate surrounds; the land to the north of the M1 and west of the A43 has

reduced to just the A43 and immediate surrounds, the M1 off/on ramp and the canal; the land to the south of the M1 and east of the A43 has reduced significantly; and the land to the south of the M1 and west of the A43 has reduced along the M1, but has been increased along the A43 due to the addition of an ecological mitigation area. Several features identified as a potential contaminant source in the desk study have been removed from this Chapter due to the site boundary changes noted above. Where relevant this has been noted within this Chapter.

Table 13.6: Baseline Surveys and Data - J15a Works

Source	Information
British Geological Survey (BGS).	Geological map (review included in desk study) (**Appendix 13.3**).
GroundSure Limited	Database Groundsure Enviro Insight Report. Reference GS-4001368, dated 19 Jun 2017 – environmental permits, incidents and registers, landfill and waste, current land use, geology, hydrogeology and hydrology, flood mapping, designated environmentally sensitive sites, natural hazards and mining. Database sources include BGS, EA, the Coal Authority, Public Health England, and the Ordinance Survey (included in desk study) (**Appendix 13.3**).
GroundSure Limited	Database Geo Insight Report. Reference GS-4001369, dated 19 Jun 2017 – geology, radon, ground workings, mining, extraction & natural cavities, natural ground subsidence, borehole records, estimated background soil chemistry, railways and tunnels. Database sources include BGS, British Gypsum, the Coal Authority, Public Health England, Coal Authority Johnson Poole and Bloomer and the Ordinance Survey (included in desk study) (**Appendix 13.3**).
Historical Ordnance Survey maps.	Historical Ordnance Survey Mapping - 1:10560 and 1:10000 scale (included in desk study) (**Appendix 13.3**).
Hydrock Consultants Limited	Hydrock Report R/151171/003 Issue 2 (Rail Central, Milton Malsor. Ground Conditions Desk Study for M1 Junction 15a Improvements), July 2017. Presented as **Appendix 13.3**.

Minor Highways Works

13.26 In relation to the other minor highways works. Based on professional understanding of the works, and the limited nature of the works proposed, no separate stand-alone Desk Studies have been undertaken. Whilst these works are minor in relation to the ground conditions and a full Phase 1 Desk Study has not been undertaken, a preliminary baseline survey (using publically available data) has been undertaken of each of the other minor highways works (where groundworks are proposed) to allow assessment as part of this chapter.

13.27 A full description of the other minor highways works is set out in **Chapter 5**.

13.28 The other minor highways works covered in this preliminary baseline survey are:

- Junction 16 of the M1 (M1/ A4500 (east to Northampton)/ A45 (west to Daventry));
- Junction 15 of the M1 (M1/ A45 (north to Northampton and Wellingborough)/ Saxon Avenue/ A508, Northampton Road (south to Milton Keynes));
- A4500, Weedon Road (east)/ Tollgate Way/ A4500, Weedon Road (west)/ A5076, Upton Way;
- A5076/ A5123/ Upton Way Roundabout (Pineham Park) (Dane Camp Way);
- A5076 (west)/ Hunsbury Hill Avenue/ Hunsbarrow Road/ A5076, Danes Camp Way/ Hunsbury Hill Road;
- Towcester Road/ A5076, Danes Camp Way/ A5123, Towcester Road/ Mere Way/ Tesco Access;
- A45, Nene Valley Way (south); A428, Bedford Road (west)/ A5095, Rushmere Road/ A45, Nene Valley Way (north)/ A428, Bedford Road (east);
- Tove Roundabout (A43, Towcester Bypass (southwest)/ Towcester Road/ A5, (north)/ A43, (northeast)/ A5, Watling Street (southeast));
- Abthorpe Roundabout (Abthorpe Road/ A43, Towcester Bypass (north)/ Brackley Road/ A43, Towcester Bypass (south));
- A5076, Upton Way (south)/ Telford Way/ A5076, Upton Way (north)/ Walter Tull Way/ Dustan Mill Lane;
- A5076, Upton Way (south)/ High Street/ A5076, Upton Way (north)/ Dustan Mill (Stub); and
- A508, Harborough Road (south)/ A5199, Welford Road/ A508, Harborough Road (north)/ Cranford Road/ Kingsland Avenue.

13.29 The Proposed Development is described in Chapter 5. There are, however, three aspects of the 'other minor highway works' described in Chapter 5 that have not been included in this assessment, due to their late identification as appropriate mitigation for the Proposed Development. These are:

- PL29 – A43/St John's Road (signage and road surfacing scheme on the A43),
- PL 31 – A43 Northampton Road (signage scheme); and,
- Pedestrian/Cycle Way along Northampton Road and between Barn Lane to the junction of Collingtree Road (widening of existing footpaths, provision of new footpath and dropped kerbs, and realignment of the carriageway).

13.30 It should be noted that the other minor highway works proposed at the following locations are not included in this Chapter for further assessment as the proposed works do not include works below ground:

- A45, Nene Valley Way (south); A43, Lumbertubs Way/ A45, Nene Valley Way (north)/ Ferris Row; and
- A45 (south)/ Eagle Drive/ A45 (north)/ Caswell Road

13.31 The information sources used in relation to the other minor highways works, are listed in **Table 13.7**.

Table 13.7: Baseline Data - Minor Highways Works

Source	Information
British Geological Survey (BGS).	Geological mapping data.
Environment Agency "What's in my backyard" web site	Hydrogeology and landfill & waste.
Ordnance Survey maps.	Hydrology and general site setting.
Google Maps and Google Street view	General site setting.

Baseline Conditions

13.32 The following section describes the findings of the baseline studies (as detailed above) and has been used to determine the likely contaminant linkages which could give rise to unmitigated environmental effects and the features that could give rise to unmitigated geotechnical effects.

13.33 The conceptual site model has been derived from an understanding of the setting, geology, hydrology and hydrogeology, plus the history of the land use on and around the proposed Order Limits.

13.34 In addition to an assessment of the 2016-17 baseline, a qualitative prediction of how the 2016-17 baseline may be affected by the construction of relevant committed developments in the period between completion of the EIA and the anticipated date of commencement of construction of the Proposed Development has also been undertaken. With regards to the Ground Conditions, it is considered that "the predicted future baseline scenario" will be the same as those identified in the supporting documents (**Appendix 13.1, Appendix 13.2** and **Appendix 13.3**).

Main SRFI site (including A43 access and all rail infrastructure)

Site Setting

13.35 A site description, is presented in **Table 13.8**.

Table 13.8: Site Description

Source	Information
Site area	Approximately 290 ha.
Transport network	The site is bound to the west by the A43, to the south by the West Coast Main Line (main route) and the Northampton Loop Line to the east. The north and the east of the site are accessed by minor roads (Gayton Road, Rectory Lane and Barn Lane). The Grand union Canal borders the southwest corner of the site.
Surface Drainage	The Milton Malsor Brook flows across the western side of the site from south to north. There are a number of small ponds and springs in the west and centre of the site which are drained via agricultural ditches to the Milton Malsor Brook. The Wootton Brook rises in the northeast of the site, flowing northward. The Wootton Brook drains the north and northeastern areas of the site.
Present land use and vegetation	The majority of the site is used for agriculture, predominantly arable but with some grassland supporting livestock. There are two farms, Lodge Farm and Manor Farm, in the east and centre of the site respectively. In addition to the farms there is a horticultural nursery and a private dwelling within the centre and east of the site. There is an historical sand pit in the northwest of the site that was subsequently operated as a landfill receiving inert waste. There is a former sand pit in the north of the site adjacent to Towcester Road. There is a derelict filling station in the west of the site adjacent to the A43. Field boundaries are generally characterised by mature hedgerows and trees with occasional trees within fields. There is a small plantation in the west of the site immediately to the north of the former filling station.
Topography and geomorphological features	Generally the site is located within a shallow south to north orientated valley associated with the Milton Malsor Brook. Higher ground is present in the northwest, north and east associated with variations in the geological conditions, specifically the occurrence of Glaciofluvial sands in the north and Till in the west and east. There are a number of small ponds or springs within the site. Earthworks are present in: the northwest of the site (Rathvilly Farm), where ground levels are raised: the southwest of the site in the form of embankments for the Grand Union Canal and former Great Central Railway; and in the southeast of the site, understood to be arisings deposited following excavation of Roade Cutting which is located to the southeast of the site along the West Coast Main Line.
Services	The site is crossed by overhead power lines at various points. There is a BPA high pressure fuel pipeline crossing the southwestern side of the site. There is a foul sewer crossing the western side of the site, approximately following the course of the Milton Malsor Brook. Connections to the various properties are generally along the existing roads

Source	Information
	(Towcester Road and Northampton Road in the centre of the site, and Barn Lane in the east). However, it is known there are consumer electric lines to the various outbuildings at Lodge Farm. Lodge Farm has its own water supply borehole.
Surrounding land	The site is generally in a rural setting and surrounded by the A43, Gayton Marina and farmland to the west, the village of Milton Malsor to the north, the Northampton Loop Line and farmland to the east, and the West Coast Main Line Main Route and village of Blisworth to the south. Between the southern boundary and the West Coast Main Line, there is a row of terraced houses and a small business park, known as JBJ Business Park, and a small sewage treatment works. The business park includes a workshop, food recycling facility, garage, carpet and caravan sales. An abattoir was formerly located at the business park site. There is a transport yard immediately adjacent to the northwest corner of the site, in what appears to be a former sand pit. The M1 motorway is located approximately 1km to the east.

Site History

13.36 The site has remained mainly as farmland since the earliest map edition of the late 19th century with development essentially limited to:

- a filling station in the west adjacent to the A43 (now disused, the tanks were decommissioned and filled with foam in 2004);
- Lodge and Manor Farms in the centre and east of the site;
- former sand and gravel pits in the north, northwest and northeast of the site;
- embankments carrying the Grand Union Canal and former Great Central Railway in the southwest corner of the site; and
- numerous small isolated farm buildings have been constructed across the site and demolished later in the 20th century.

13.37 Adjacent development includes the existing highways and railways, the transport yard to the northwest and the Business Park and housing to the south.

Geology

13.38 The general geology of the site area is shown on the 1:50,000 geological map of Towcester (Sheet 202) is summarised as:

- Alluvium;
- Oadby Member (Glacial Till);

- Glaciofluvial Deposits;
- Wellingborough Limestone Member;
- Rutland Formation;
- Stamford Member;
- Northampton Sand Formation;
- Whitby Mudstone Formation;
- Marlstone Rock Formation; and
- Dyrham Formation.

13.39 Not all strata are shown to be present in all areas of the site and the ground conditions as proven by investigation are detailed in **Table 13.9**.

Table 13.9: Ground Conditions as Proven During Ground Investigations

Stratigraphic Name	Stratum Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness Range (m)
Topsoil	Topsoil is present over the majority of the site. Generally the topsoil consists of clay and sandy clay. In the north of the site the topsoil is sand where it overlies the Glaciofluvial deposits.	0.00	0.10 – 0.60	0.10 – 0.60
Made Ground (Landfill)	The landfill deposits consist of interbedded deposits of clay and sand with subordinate pockets and cobble and boulder size particles. Locally, deposits of organic clay are present. Constituents include concrete, brick, timber, plastic, ceramic, metal, and occasional ash and slag.	0.20 – 0.35	0.90 – 7.50	0.55 – 7.00
Made Ground (Roade Cutting)	This deposit is understood to comprise arisings from the excavation of Roade Cutting and consist of soft and firm sandy gravelly clay with cobble and boulder size fragments of limestone and concrete, and occasional brick, ash, clinker, terracotta. In places a relict topsoil was identified at the base of the deposit.	0.00 - 0.30	0.30 - >3.00	0.30 - >3.00

Stratigraphic Name	Stratum Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness Range (m)
Made Ground (Rathvilly Farm Pit)	Anecdotally this deposit is understood to consist of arisings from the construction of the M1. The material consists of variable sandy gravelly clay and sandy gravel with cobbles and boulders, and some deposits of ash gravel. Aside from the ash, gravel includes brick, sandstone, concrete, mudstone and occasional timber. Asbestos Containing Materials (ACM) are also present.	0.00 – 4.50	0.50 – 4.50	0.20 – 4.50
Made Ground (Filling Station)	At the former filling station the Made Ground consists of a surface layer of asphalt overlying sandy gravel and gravelly sand fill, in turn overlying a basal layer of reworked natural clay. The strata include material such as concrete, brick, limestone, granite and ironstone. Locally, the clay layer is absent.	0.00	0.70 – 1.70	0.70 – 1.70 (typically 0.90 to 1.20)
Made Ground (Lodge Farm)	Made Ground at Lodge Farm consists of sandy gravelly clay with occasional man-made inclusions, gravelly sand and sandy gravel. Gravel includes ash and clinker and limestone, sandstone, brick and concrete. Locally asbestos containing material is present in the Made Ground at Lodge Farm.	0.00	0.60 – 1.30	0.60 – 1.30
Made Ground (Canal Embankment)	Made Ground is present in the southwest corner of the site at the embankments carrying the canal and former railway. The Made Ground consists of sandy gravelly clay with cobbles. Gravel and cobbles consist of limestone, flint, coal and man-made material such as brick, concrete, glass.	0.00	1.70	1.70
Made Ground (other areas)	Made Ground is present in a number of discrete areas around the site in the form of general detritus associated with farming activities and as hardcore reinforcement placed to gateways. Deposits include sandy gravelly clay, sandy clay and gravelly sand. Man-made inclusions are frequently present including concrete, brick, tile, glass, ash, clinker, metal and timber.	0.00	0.15 – 1.25	0.15 – 1.25

Stratigraphic Name	Stratum Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness Range (m)
Alluvium	In the floodplain of the Milton Malsor Brook centre and south of the site, the Alluvium typically consists of firm clay and sandy clay, with a basal bed of clayey sandy gravel present in places. In the north of the site, at the Milton Malsor Brook (Main and Eastern Arm), the alluvium included deposits of silt, sand and organic clay.	0.10 – 1.20	0.60 – 3.20 (typically 1.50)	0.40 – 3.00 (typically 1.20)
Glaciofluvial Deposits	The Glaciofluvial Deposits are present in the north of the site and consist of sand, in places slightly gravelly and gravelly and with subordinate fines content. Gravel is ironstone and limestone.	0.20 – 4.50	0.75 - >10.00	0.45 - >10.00
Glacial Till (Oadby Till)	Glacial Till is present along the higher ground at the eastern edge of the site and in the northwest corner. At two locations in the centre of the site, relatively thin deposits of Glacial Till were found either near surface or underlying Alluvium. The Glacial Till consists of slightly sandy slightly gravelly and gravelly clay with gravel of flint, limestone, chalk and mudstone.	0.15 – 2.60	0.50 – 3.20 (typically 1.90m)	0.20 – 2.75 (typically 1.30m)
Wellingborough Limestone Member	A thin deposit of clayey gravelly sand was encountered near surface in the southeast corner of the site, including gravel of flint and shell fragments.	0.30	0.60	0.30
Rutland Formation	The Rutland Formation (undifferentiated) was encountered in the southeast corner of the site. The Rutland Formation consists of sandy clay with thin beds of fine sand.	0.60	1.40	0.80
Stamford Member	The Stamford Member is present in the southeast corner of the site. The Stamford Member consists of clay clayey sandy gravel sized residual fragments of sandstone.	0.30 - 1.40	0.50 - 1.80	0.20 - 0.40
Northampton Sand Formation	The Northampton Sand Formation is present in the southeast corner of the site. The Northampton Sand consists of gravelly sand with cobbles and beds of clay. Cobbles are sandstone and ironstone.	0.50 – 1.80	2.50 – 2.70	0.90 – 2.00

Stratigraphic Name	Stratum Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness Range (m)
Whitby Mudstone Formation	The Whitby Mudstone is present over the majority of the site, with the exception of the valley floors in the north. The Whitby Mudstone consists of stiff and very stiff fissured clay with some residual mudstone fragments and lithorelicts and crystals of gypsum.	0.20 - >10.00	0.40 – 7.20 (where fully penetrated)	Not proven
Marlstone Formation	The Marlstone Rock Formation was encountered outcropping in the centre, northwest and extreme northeastern corner of the site only, and underlying the Whitby Mudstone at depth. The Marlstone Formation typically consists of fossiliferous limestone, ironstone and limestone with subordinate sandstone and mudstone beds.	0.35 – 7.20	1.10 – 7.60 (where fully penetrated)	0.20 – 2.00 (typically 0.75m)
Dyrham Formation	The Dyrham Formation was encountered outcropping in the lower ground in the northwest and centre of the site and underlying the Marlstone Rock. The strata consists of stiff clay, sandy clay and mudstone with subordinate beds of sand, sandstone, silt and limestone. Gypsum crystals and fossils are present in places. Generally, the Dyrham Formation is coarser in particle size than the Whitby Mudstone.	0.60 – 13.75 (where encountered)	Not proven	Not proven

Hydrogeology

13.40 The hydrogeological designation for the various strata at the site are is summarised as:

- The Made Ground is not classified. It will have moderate to high porosity because of unconsolidated nature, but permeability likely to be constrained to low or low to moderate because of poor sorting and clay content.
- The Alluvium is classified as a Secondary (undifferentiated) Aquifer and may be a source of groundwater but vertical and lateral variability means these aquifers are locally changeable.
- The Glaciofluvial Deposits are classified as a Secondary A Aquifer and may be a localised source of groundwater.
- The Glacial Till Deposits are classified as Unproductive Strata. Whilst these may be a source of localised groundwater but low permeability and porosity make these poor aquifers and these deposits are likely to behave as an aquiclude.

- The Wellingborough Member is classified as a Secondary A Aquifer, and is likely to be significantly permeable and may be a localised source of groundwater.

- The Rutland Formation (undifferentiated) is classified as a Secondary B Aquifer and is overall likely to be relatively impermeable. However, some of the subordinate units (Wellingborough Limestone) are likely to be permeable and may be confined.

- The Stamford Member is classified as a Secondary A Aquifer and may be a localised source of groundwater.

- The Northampton Sand Formation is classified as a Secondary A Aquifer and may be a localised source of groundwater.

- The Whitby Mudstone Formation is classified as Unproductive Strata. Whilst these may be a source of localised groundwater but low permeability and porosity make these poor aquifers and these deposits are likely to behave as an aquiclude.

- The Marlstone Rock Formation is classified as a Secondary A Aquifer and may be a localised source of groundwater.

- The Dyrham Formation is classified as a Secondary (undifferentiated) Aquifer and may be a source of groundwater but vertical and lateral variability means these aquifers are locally changeable.

13.41 The Main SRFI Site is not within a groundwater Source Protection Zone (SPZ) and there are no groundwater abstraction licences within 1000m of the site.

13.42 The Main SRFI Site is covered by soils of low to high leaching potential.

13.43 With regards to hydrogeology, the investigations have concluded:

- That groundwater is present underlying the Main SRFI site, with a general northward flow direction and is present within all the geological units on site depending on their elevation.

- Within the Whitby Mudstone groundwater is generally found towards the base and may in places be confined within the underlying Marlstone.

- Locally, in some areas of Made Ground and in the Glacial Till in the east, a perched water table is present within the superficial deposits.

- The groundwater is in continuity with the Milton Malsor Brook.

Hydrology

13.44 Milton Malsor Brook crosses the western side of the Main SRFI Site on a south to north course.

13.45 The centre and west of the site is drained by open ditches which ultimately discharge to the Milton Malsor Brook. The ditches appear to originate at the railway, and may collect water from small ponds or springs present within the site at various places along the field boundaries.

13.46 The Wootton Brook rises in a marsh area to the northwest of Lodge Farm.

13.47 The Grand Union Canal is carried on an embankment adjacent to the southwest corner of the site. There is a culvert underneath the canal carrying surface water, presumably originating from pre-existing land drainage constructed prior to the canal and railway. The canal appears to be leaking causing overland flow over the field in the southwest corner of the site.

13.48 There are no recorded surface water abstractions within 1000m of the site.

13.49 There are no active recorded surface water discharge consents in the vicinity of the site.

13.50 Historical surface water discharge consents (no longer active), recorded in the vicinity of the site include:

- Former Garage, located at the trading estate adjacent to the southeast of the site.
- Manhole No.6201, located on site (unknown) for storm water overflow.
- Roseacre Nursery, located west of Barn Lane.

13.51 Sewage discharge was observed during the site walkover as being present on the northern boundary of the site discharging into a tributary of Milton Malsor Brook.

13.52 Flood risk is not considered here, and is considered in **Chapter 14**.

Waste Management and Hazardous Substances

13.53 The following waste management sites are recorded within 500m of the site:

- Gayton Road, Milton Malsor (surrendered), located in the northwest corner of the site and occupies the former gravel pit identified on the historical maps. No details are available on the waste placed here beyond the designation 'Inert'.
- Milton Malsor Landfill - Weldon Plant Ltd (surrendered), located adjacent to Gayton Road, 10m north of site and historically licensed to receive non-biodegradable wastes.
- Milton Sand Pit (surrendered), located adjacent to Gayton Road approximately 90m north of site and historically licensed to receive inert liquid sludge.
- Rothersthorpe (surrendered), located 125m north of site and historically licensed to receive inert waste.

- Gayton Landfill Site (surrendered), located 335m west of site and historically licensed to receive inert, industrial, commercial and household liquid sludge. This site is classified as being Contaminated Land under Part IIA of the Environmental Protection Act 1990.

13.54 A former sand pit is present in the northeast of the site (Rathvilly Farm). Whilst not recorded as a landfill, it is understood from local anecdotal information that this pit was filled with excavated arisings during the construction of the M1.

13.55 The only waste transfer site recorded within 500m of the site is:

- Proposed recycling centre, located at the old Sewage Works 85m west of the site. Planning application for a recycling centre for storage and transfer of hardcore waste and recycled aggregates.

13.56 There have been 2 recorded pollution incidents within 250m of the site.

- A single incident of unspecified hydraulic oil pollution is recorded in 2003 in an area adjacent to the railway line on the southern boundary of the site. This is considered likely to have had only a minor impact on the soils at the site.

- A significant pollution incident occurred at Gayton Marina in June 2015 when kerosene leaked from the BPA pipeline into the Grand Union Canal. There is a small possibility of impact in the southwest as it is anecdotally reported that the canal may have been leaking at the time.

Potential Contamination Sources

13.57 The main potentially contaminative land uses at the site are the former petrol filling station on the A43, agriculture, historical landfilling of former mineral extraction pits on site (or in close proximity), historical spills at Gayton Marina, naturally occurring metals, historical construction and storage of petroleum hydrocarbons and chemicals at farm complexes and buildings.

13.58 Whilst a low risk from modern farming practices. There is the possibility of there being residual agricultural chemicals in the ground, such as pesticides or herbicides from historical farming practices.

13.59 There is a potential for historical spills of fuel from agricultural machinery, although no surface evidence was noted during the walk-over survey.

13.60 There is a potential for historical spills or leaks of fuel from storage tanks in farmyards, although no evidence was noted during the walk-over survey.

13.61 There is a leak in the canal in the southwest of the site. There is the potential for the water leaking from the canal to be contaminated by petroleum hydrocarbons from the historical kerosene leak at Gayton Marina (June 2015) when the BPA pipeline leaked into the Grand Union Canal.

13.62 It is possible that there are elevated concentrations of naturally occurring metals within the soils as a result of the regional geology, but none of the five common metals listed in the baseline study report fall into this category.

13.63 There is the potential; for asbestos to be present in existing buildings on the site.

13.64 Reference to the Indicative Atlas of Radon in England and Wales (Miles et al 2007) and BRE report BR 211 and the British Geological Society (BGS) radon risk report (GR210997/1) indicates that it is in a Radon Affected Area where recorded radon concentrations in 1-3% of homes are above the action level and basic radon protection measures are required for new buildings at this location in line with current guidance. The source of radon at this site is likely to be the Whitby Mudstone Formation.

13.65 There is a risk of ground gases migrating from the historical landfills and filled ground associated with the former sand extraction industry that was prevalent throughout the northern part of the site and off site to the immediate north.

13.66 Gayton Landfill, which is located a significant distance to the west of the site (350m) and is considered to present a low risk to the subject sit. Whilst having been classified as being Contaminated Land under Part IIA of the Environmental Protection Act 1990, this landfill, is located within a separate valley to the site and any groundwater in the area of the landfill is likely to flow to the northwest from the Gayton Landfill towards the un-named stream in the base of the valley, than towards the site. As such, this is not considered further in this chapter.

Site Sensitivity

13.67 The sensitive land use map given in the Groundsure Enviro Insight report (provided in **Appendix 13.1**) indicates there are no environmentally sensitive land uses within 250m of the site. Road Cutting is a Geological SSSI that is between 250m and 500m of the site, but this is significantly outside of any proposed works.

Mining and Mineral Extraction

13.68 There are no underground mining operations (current or historical) within 1000m of the site.

13.69 There are no active mineral extraction operations within 1000m of the site.

13.70 There are two former sand pits onsite in the northwest corner, and in the north immediately to the east of Northampton Road. There is a further pit immediately to the north of Gayton Road beyond the northwest corner of the site. The transport yard located in the to the northwest of the site is at a reduced level which is anticipated to be a continuation of the former sand pit in the northwest of the site itself, now landfilled.

13.71 The northern part of the site is designated as a Mineral Safeguarding Area (MSA) under the Northamptonshire Minerals and Waste Local Plan (MWLP) (adopted May 2017) (Ref 13.5).

13.72 The northeastern corner of the site is within the 300m buffer of an allocated sand and gravel extraction site (M1: Milton Malsor), which relates to a 1.2 million tonne resource at Maple Farm.

Unexploded Bombs

13.73 A non-specialist UXO assessment undertaken by Hydrock and presented in **Appendix 13.1** indicates a low bomb risk.

Geotechnical Hazards

13.74 Potential geotechnical hazards based on the expected ground conditions are listed below.

- The presence of a landfill in the north of the site and the potential for highly variable and poorly compacted landfill soils.
- Backfill of pit in the northeast of the site (not necessary landfill).
- Made Ground leading to excessive settlement of foundations and infrastructure.
- Seasonal shrinkage and swelling of clay leading to settlement and heave of foundations when located within the influence of trees and vegetation.
- The presence of highly variable soils (silt, clay, sand, clay, gravel) associated with the alluvial channels along the streams.
- Low strength and compressible ground causing excessive settlement of foundations and infrastructure elements.
- Hard strata where the Marlstone Rock Formation outcrops at the surface.
- Differential settlements between areas of loose/soft ground and dense/hard/stiff ground.
- Running sands, loose landfill and shallow groundwater, leading to difficulty with excavation.
- Attack of buried concrete by aggressive ground due to potentially sulphate bearing soils.
- Sulphates affecting soil modification by lime addition and potential delays to earthworks programme if the ground conditions are poorly understood.
- Low permeability soils leading to a lack of infiltration for SUDS drainage.
- Made Ground and the impact on SUDS drainage.
- Potential for relict slip surfaces in the Whitby Mudstone Formation and Dyrham Formation.

Soil Contamination

13.75 Investigatory hole locations were determined by reference to the conditions identified in the preliminary risk assessment. Specific features were targeted including:

- landfill area;
- Lodge Farm;
- former filling station;
- former farm buildings;
- areas of fly tipping;
- areas of Made Ground in the southeast of the site;
- an area of unexpected landfilling identified in the northeast of the site (Rathvilly Farm); and
- an area of stockpiled material and Made Ground in the east of the site.

13.76 Based on the desk study information the following chemical analyses were undertaken on soil samples from the site:

- 220 Hydrock default suite of determinands for solids comprising: As, B (water soluble), Be, Cd, Cr (total), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulphide, pH, asbestos fibres, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon. If high total cyanide is detected, this may be re-analysed for 'free' and 'complex' species if appropriate;
- 14 total petroleum hydrocarbons by GC-FID (Hydrock Level 1 suite comprising the following carbon banding: aliphatic - C5-C6, >C6-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C35, aromatic - C5-C7, >C7-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35);
- 39 total petroleum hydrocarbons by GC-FID (Hydrock Level 2 suite comprising aliphatic / aromatic split and the following carbon banding: aliphatic - C5-C6, >C6-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C35, aromatic - C5-C7, >C7-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35) and BTEX;
- 30 Benzene, Toluene, Ethyl benzene, m/p-Xylene, o-Xylene (BTEX)
- 6 volatile organic compounds (VOC target list by GCMSD);
- 6 semi-volatile organic compounds (VOC target list by GCMSD);
- 25 general pesticide screens; and
- 5 asbestos bulk identification

13.77 The assessment of potential soil contamination at the site has been made by comparing soil concentrations with generic assessment criteria protective of human health and of plant life (see Hydrock Report R151171/G002 Issue 4 – **Appendix 13.2**).

13.78 The findings of the risk assessment are moderated by the risk evaluation processes, and the conclusions with respect to human health are based on the future commercial land use. The conclusions are:

- The investigation has not identified any pervasive contamination within the datasets developed from the investigation. However, the following locations should be considered as contaminated and will require further investigation to allow design.
    - At Lodge Farm, petroleum hydrocarbon and PAH contamination has been identified, and asbestos has been found within the soils in the form of free fibres and bound material.
    - At the former filling station, petroleum hydrocarbons have been identified at a number of locations. Whilst the concentrations are generally low in comparison to GACs, it is anticipated that further contamination is likely to be present in the immediate surround of the former tanks.
    - Asbestos and petroleum hydrocarbons have been identified at Rathvilly Farm pit.
    - There is some evidence to suggest the fuel leak at the Grand Union Canal may have had an impact on the field immediately to the north.

13.79 The presence of PAH and petroleum hydrocarbons in excess of the respective trigger values (with regards to potable water pipes), warrant the use of Protectaline or similar proprietary barrier pipework for water supplies which are placed in areas of Made Ground.

13.80 The findings of the risk assessment with respect to plant life are the site does not pose a significant risk and the risk evaluation concluded that no remediation is required with regards to plant and no further consideration was required.

13.81 The above conclusions have been used in conjunction with a consideration of plausible pollution linkages to assess potential environmental impacts in the following section.

Contamination of Controlled Waters

13.82 Based on the desk study information the following chemical analyses were undertaken on groundwater samples from the site:

- 31 Hydrock default water analysis suite comprising: Ag, Al, As, B, Ba, Cd, Co, Cr (III), Cr(VI), Cu, Fe, Hg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sn, Zn, V, cyanide (total), phenols (total), ammonium, bromate, chloride, fluoride, nitrate, nitrite, sulphate, PAH (speciated), pH, EC and hardness;

- 5 total petroleum hydrocarbons by GC-FID (Hydrock Level 1 suite comprising the following carbon banding: aliphatic - C5-C6, >C6-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C35, aromatic - C5-C7, >C7-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35);

- 8 total petroleum hydrocarbons by GC-FID (Hydrock Level 2 suite comprising aliphatic / aromatic split and the following carbon banding: aliphatic - C5-C6, >C6-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C35, aromatic - C5-C7, >C7-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35) and BTEX;

13.83 Based on the desk study information the following chemical analyses were undertaken on surface water samples from the site:

- 4 Hydrock default water analysis suite comprising: Ag, Al, As, B, Ba, Cd, Co, Cr (III), Cr(VI), Cu, Fe, Hg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sn, Zn, V, cyanide (total), phenols (total), ammonium, bromate, chloride, fluoride, nitrate, nitrite, sulphate, PAH (speciated), pH, EC and hardness;

- 4 total petroleum hydrocarbons by GC-FID (Hydrock Level 2 suite comprising aliphatic / aromatic split and the following carbon banding: aliphatic - C5-C6, >C6-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C35, aromatic - C5-C7, >C7-C8, >C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35) and BTEX;

13.84 The hydrogeological model for the site, consists of:

- Groundwater present underlying the site, with a general northward flow direction prevalent.

- Groundwater is present within all the geological units on site depending on their elevation. However, within the Whitby Mudstone groundwater is generally found towards the base and may in places be confined within the underlying Marlstone. Locally, in some areas of Made Ground and in the Glacial Till in the east, a perched water table is present within the superficial deposits.

- The groundwater is in continuity with the Milton Malsor and Wootton Brooks.

13.85 The assessment of potential contamination to controlled waters at the site was performed using the EA (2006) Remedial Targets Methodology (RTM) (Ref 13.22). This form of assessment was chosen because it provides Remedial Target Values (RTVs) that is protective of the water environment.

13.86 Assessment (RTM Level 2) of the chemical testing on the groundwater samples recovered from the site has concluded that whilst there are elevated concentrations of Chemicals of Potential Concern present in groundwater at the site, based on the investigation works undertaken to date and as per agreement with the Environment Agency, Hydrock does not believe the site poses a significant risk to Controlled Water as:

- Metal contaminants, along with chloride and sulphates are natural as opposed to the result of pollution.

- There is little indication under present conditions of pollution of Controlled Waters and conditions following development of the site will not be any worse, indeed they are likely to improve with cessation of agriculture.

- Whilst elevated concentrations of petroleum hydrocarbons and PAH have been found in soils in the landfill, Rathvilly Farm pit and the filling station, and groundwater beneath the landfill, there is no evidence of any impact in the surface water courses.

13.87 The above findings have been used in conjunction with a consideration of plausible pollution linkages to assess potential environmental impacts in the following section.

Soil Gas Contamination

13.88 Reference to the British Geological Society (BGS) radon risk report (GR210997/1) (in **Appendix 13.1**) indicates that it is in a Radon Affected Area where recorded radon concentrations in 1-3% of homes are above the action level and basic radon protection measures are required for new buildings at this location in line with current guidance.

13.89 Landfill gases methane and carbon dioxide were monitored in a number of boreholes between 13th October 2016 and June 2017.

- Concentrations of oxygen are above 18% where methane and carbon dioxide concentrations are correspondingly low and conversely, depleted oxygen levels below 18% occur when methane and carbon dioxide concentrations are elevated.

- Gas flow measurements generally indicated low emission rates, with the majority of monitoring events recording no gas flow recorded greater than the detection limits of the analytical apparatus (0.1l/hr). However, on one occasion an elevated gas flow rate of 4.4 l/hr was monitored. This slightly elevated ground gas flow rates is located at the proposed A43 Bridge.

- the gas monitoring has revealed that concentrations of methane are generally below the detection limits of the analytical apparatus (0.1l/hr). At Rathvilly Farm pit, methane has been detected at a concentration of 26.5% in one borehole (WSBL06), albeit with a corresponding flow rate of <0.1l/hr. When assessed with the low gas flow rates, methane results in a GSV of < 0.7 l/hr which would accord with Gas Regime B / Characteristic Situation 1, i.e. Low Risk. The Rathvilly Farm pit is a significant distance from proposed buildings and no specific consideration is considered necessary.

- the gas monitoring has revealed that concentrations of carbon dioxide range from <0.1% to 5.9% and when assessed with the low gas flow rates, results in a GSV of < 0.07 l/hr which would accord with Gas Regime B / Characteristic

Situation 1, i.e. Low Risk. The only carbon dioxide concentrations measured in excess of 5% are located at Rathvilly Farm pit. As this location is a significant distance from proposed buildings, no specific consideration is considered necessary.

13.90 A summary of findings is the methane and carbon dioxide assessments are consistent in indicating an allocation of the site to Gas Regime B / Characteristic Situation 1 and the above findings have been used in conjunction with a consideration of plausible pollution linkages to assess potential environmental impacts in the following section.

J15a works

13.91 The following describes the findings of the baseline study for the J15a site (as detailed above) and has been used to determine the likely contaminant linkages which could give rise to unmitigated environmental effects and the features that could give rise to unmitigated geotechnical effects.

13.92 It should be noted that the site area as indicated in the Ground Conditions Desk Study Report, M1 Junction J15a Improvements (Appendix 13.3) was correct at the time of the desk study, but has since changed. Several features identified as a potential contaminant source in the desk study have been removed from this Chapter due to the site boundary changes noted above. The previously identified features, now removed as a potential contaminant source are: Shepherds Lodge, and derelict structures and a number of stockpiles of material land to the north of the M1 and east of the A43).

13.93 There is an area of agricultural land added to the south of the M1 and the north of the A43, which is proposed as an ecological mitigation area. Whilst this area was not included in the site area of the original desk study, a preliminary review of the desk study data for this part of the site indicates that the conclusions of the assessments do not change from those presented in the desk study and this Chapter.

13.94 The conceptual site model has been derived from an understanding of the setting, geology, hydrology and hydrogeology, plus the history of the land use on and around the Proposed Development Area.

Site Setting

13.95 A site description for J15a works, is presented in **Table 13.10**.

Table 13.10: Site Description – J15a Works

Source	Information
Site area	Approximately 72 ha.
Present land use and vegetation	Land consists of infrastructure (M1 motorway, A43 dual carriageway and the Grand Union Canal), agricultural land, and open land of no specific use. There are four bridges on site, two carrying the M1 over the canal and A43, and

Source	Information
	two carrying slip roads over the canal. There are stockpiles of material on an area to the south of the M1 and east of the A43. The Grand Union Canal incorporates a flight of locks along the section within the site area. The canal and tow path are used for leisure purposes. The canal passes under the M1 under a bridge immediately north of the bridge carrying the M1 over the A43, with a lock present directly under the motorway bridge. There are densely wooded areas on land between the M1 carriageway and the slip roads. There is an area of relatively dense woodland immediately to the west of the Grand Union Canal on the southern side of the M1. Elsewhere, trees are predominantly confined to field boundaries.
Topography and geomorphological features	The J15a site generally slopes from south to north, with lower ground along the northern, western and eastern edges associated with watercourses. Levels range between approximately 70m OD and 80m OD sloping from north to south.
Surrounding land	Surrounding land is rural, with land to the north encroaching on to Northampton and to the southwest on the village of Rothersthorpe.

Site History

13.96 In summary, the Ordnance Survey data indicates the canal and the London and Northwestern Railway were present on site prior to the earliest available mapping. Other areas have predominantly remained as farmland until the construction of the M1 in the mid-1960s. The A43 was constructed on the former railway in the early 1990s, with subsequent work to dual the route taking place in the late 1990s and early 2000s.

13.97 It is apparent from aerial photography available on the internet (Google Maps) that an area of land to the south of the M1 and east of the A43, adjacent to the southern roundabout has been used in the past as a construction site compound. This is likely to relate to works on either the M1 or A43.

13.98 A number of small stockpiles are present on the area of land to the south of the M1 and east of the A43, which are likely to be arisings from the former construction compound. Aside from the stockpiles, this field consisted of open grassland, with some fencing remaining as a legacy of the construction compound.

13.99 Since the last available mapping, Ham Farm (located off site to the north) has been demolished although demolition arisings remain on site. It is apparent that topsoil has been removed from an area in the north of the Ham Farm land parcel, with material stockpiled adjacent to the excavations. It is anticipated that the stockpiles are of the topsoil removed from the site surface. However, at the time of the walkover the stockpiles were vegetated and therefore it was not possible to determine with certainty what the stockpiled material consists of.

13.100 The surrounding land uses have included potentially contaminative activity including a sewage works, an oil depot and sand and landfilling of former sand pits. Given the distance of the oil depot and sewage works relative to the site, it is unlikely significant impact has occurred. There is a possibility that ground gas could migrate to site from the nearby landfills where they have been infilled with organic or putrescible material. Whilst this may be significant for development of a building it is unlikely to be of concern in relation to the proposed highway improvements.

Geology

13.101 The solid geology over the majority of the site consists of Whitby Mudstone. In the centre and east of the site, the older Marlstone Rock and Dyrham Formation outcrop in the watercourse channels.

13.102 Alluvium is present along the watercourse channels.

13.103 Glacial Till across the majority of the north and centre of the site and Glaciofluvial Deposits at the southern end of the site. There are small areas in the east, west and centre of the area where drift is absent.

13.104 Made Ground is anticipated to be present at the site as a legacy of the construction of the various infrastructure elements, beginning with the canal and in turn the railway, the M1 and the A43. In general the Made Ground is likely to consist of reworked natural soils, however imported materials may be present, for example slag which was commonly used in construction of railway embankments.

Hydrogeology

13.105 The Made Ground is unclassified and likely to be limited in extent and therefore received no formal classification. Generally it would be anticipated to consist of either low permeability reworked natural clays, or coarse soils used in the construction of infrastructure, which in turn would be drained to local surface waters. No significant volumes of water is anticipated to be stored within Made Ground.

13.106 The Alluvium is classified as a Secondary (A) Aquifer, and is likely to consist of low permeability clay, possibly overlying a basal sand and gravel bed, or with discrete layers of sand. As such, lateral permeability is likely to be greater than vertical permeability. Groundwater within the Alluvium is likely to be in hydraulic continuity with the adjacent watercourses.

13.107 The Glaciofluvial Deposits are classified as a Secondary A Aquifer, and are likely to be coarse in nature and permeable both laterally and vertically.

13.108 The Glacial Till Deposits are classified as a Secondary (undifferentiated) Aquifer, dominated by low permeability clay which is interbedded with moderate to high permeability layers of sand with occasional gravel; overall, this unit is likely to be anisotropic in nature with horizontal permeability greater than vertical permeability (i.e. kh>kv).

13.109 The Whitby Mudstone Formation is classified as Non-productive Strata and is likely to be of low permeability both laterally and vertically. Locally, lateral permeability may be increased due to limestone bands or fissuring.

13.110 The Marlstone Rock Formation is classified as a Secondary A Aquifer and is likely to consist of fractured limestone with significant permeability, both laterally and vertically. As the deposits of Marlstone Rock are typically a few metres in thickness under and overlain by relatively low permeability deposits, this unit is likely to be confined and groundwater within it may be under sub-artesian pressure.

13.111 The Dyrham Formation is classified as a Secondary (undifferentiated) Aquifer, and is likely to be of low permeability. Beds of sand may be present within the Dyrham Formation which may increase the permeability, overall the lateral permeability is likely to be greater than the vertical permeability.

13.112 The J15a site is not within a within a groundwater Source Protection Zone (SPZ). There are no licensed groundwater abstractions within 1000m of the site.

13.113 The majority of the J15a site is covered by soils of high leaching potential.

Hydrology

13.114 The site is crossed by two south to north flowing streams which are tributaries of the Wootton Brook and in turn the River Nene.

13.115 The Wootton Brook is immediately adjacent to the north of the site.

13.116 The River Nene is approximately 1130m to the north.

13.117 The Grand Union Canal is present on site, located to the west of A43.

13.118 There is a single surface water abstractions for spray irrigation within 1000m of the site. This occurs upstream on the Wootton Brook and is therefore does not constitute a potential receptor from the perspective of contaminated land.

13.119 Flood risk is not considered here, and is considered in **Chapter 14**.

Waste Management and Hazardous Substances

13.120 Land immediately to the southeast of the site is registered by the environment Agency as a former landfill site. The site was operated by Weldon Plant and received non-biodegradable wastes. The closure date is not reported.

13.121 The former sand pit located 50m to the west of the site is recorded as a former landfill operated by Mixconcrete Aggregates Limited and receiving inert waste. The last date of operation is listed as July 1986. A further historical licence is reported for land immediately to the west of the land pit, approximately 170m from the site. The licence covered deposition of inert waste, liquid waste and sludge and was surrendered in 1979.

13.122 There are no waste treatment, transfer or disposal sites within 500m of the site.

13.123 There are no pollution incidents recorded on site. There are four minor incidents recorded in the environmental data report as having occurred within 500m of the site. These are considered unlikely to have had any impact on the site.

Potential Contamination Sources

13.124 The main potentially contaminative land uses at the J15a site are:

- Made Ground possibly including metals, metalloids, asbestos, PAH and petroleum hydrocarbons.
- Elevated concentrations of ground gases (methane & carbon dioxide) from biodegradable matter in the Made Ground, Alluvium or off-site source.

13.125 It should be noted that the site area as indicated in the desk study was correct at the time of the desk study, but has since changed (refer to paragraph 13.11). As such, several features identified as a potential contaminant source in the desk study have been removed from this Chapter due to the site boundary changes noted above. The previously identified features, now removed as a potential contaminant source are: Shepherds Lodge, and derelict structures and a number of stockpiles of material land to the north of the M1 and east of the A43).

Site Sensitivity

13.126 The sensitive land use map given in the Groundsure Enviro Insight report (provided in **Appendix 13.3**) indicates there are no environmentally sensitive land uses within 250m of the site.

Mining and Mineral Extraction

13.127 There are no underground mining operations (current or historical) within 1000m of the site.

13.128 There are no active mineral extraction operations within 1000m of the site.

13.129 Mineral extraction has been undertaken in the general area, including the brick works, gravel pit and sand pits to the south and southwest of the site. There is no known mineral extraction within the site itself. The sand and gravel pits are associated with the Glaciofluvial Deposits which are present only at the southern edge of the M1 Junction 15a improvements site.

Unexploded Bombs

13.130 A non-specialist UXO assessment undertaken by Hydrock and presented in **Appendix 13.3** indicates a low bomb risk.

Geotechnical Hazards

13.131 Potential geotechnical hazards based on the expected ground conditions of the M1 Junction 15a improvements site are listed below.

- Low strength, compressible ground – excessive settlement of foundations, roads and infrastructure elements.
- Attack of buried concrete by aggressive ground conditions – the development site may contain unknown Made Ground and potentially sulphate bearing soils. The Whitby Mudstone and Dyrham Formation are known to be high in naturally occurring sulphates and may have influenced local superficial deposits.
- Shrink / swell of clay – settlement / heave of foundations when located within the influence of trees and vegetation.
- Running sands and shallow groundwater, leading to difficulty with excavation due to trench collapse.

13.132 The above findings have been used in conjunction with a consideration of plausible pollution linkages to assess potential environmental impacts in the following section.

Minor Highways Works

13.133 The following describes the findings of the baseline study for the Other Minor Highway Works (as detailed above) and has been used to determine the likely contaminant linkages which could give rise to unmitigated environmental effects and the features that could give rise to unmitigated geotechnical effects.

13.134 The conceptual site model has been derived from an understanding of the site setting, geology, hydrology, hydrogeology and landfill history, of the land use on the area of the proposed minor highway improvements.

13.135 The baseline information sources used in relation to the assessment of other minor highways works, are provided in **Table 13.11**. There are, however, three aspects of the 'other minor highway works' that have not been included in this assessment, due to their late identification as appropriate mitigation for the Proposed Development. The assessment will be updated and reviewed post Section 42 Consultation:

- PL29 – A43/St John's Road (signage and road surfacing scheme on the A43),
- PL 31 – A43 Northampton Road (signage scheme); and,
- Pedestrian/Cycle Way along Northampton Road and between Barn Lane to the junction of Collingtree Road (widening of existing footpaths, provision of new footpath and dropped kerbs, and realignment of the carriageway).

Table 13.11: Baseline Information - r Minor Highways Works

Minor Highway Junction	Item	Data Source	Summary of Findings
Junction 16 of the M1 (M1/ A4500 (east to Northampton) / A45 (west to Daventry))	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is elevated over the M1 at approximately 75m OD, with slip roads on embankments. The junction is bordered by grass and trees. The surrounding land comprises farmland.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Alluvium; Glaciofluvial Deposits; and The Dyrham Formation Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Alluvium (Secondary A Aquifer); Glaciofluvial Deposits (Secondary Undifferentiated); and The Dyrham Formation (Secondary B Aquifer). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	The area between the M1 northbound carriageway and the northbound off slip road exit is an historical landfill site ('OS Field No. 0756'). This appears to be located off the carriageway.
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the south towards the River Nene.
Junction 15 of the M1 (M1/ A45 (north to Northampton and Wellingborough)/ Saxon Avenue/ A508,	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The M1 junction approximately 80m OD elevated over the M1, with slip roads in cut down to the M1. Vegetation comprises predominantly grass and some minor shrub and tree vegetation.
	Geology	British Geological	The stratigraphic sequence at the site as indicated by BGS mapping is:

Minor Highway Junction	Item	Data Source	Summary of Findings
Northampton Road (south to Milton Keynes))		Survey (BGS)	Oadby Member; Glaciofluvial Deposits; and Whitby Mudstone Formation Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Oadby Member (Unproductive Strata); Glaciofluvial Deposits (Secondary Undifferentiated); and Whitby Mudstone Formation (Unproductive Strata). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There is no record of a landfill on site.
	Hydrology	Ordnance Survey maps	Surface drainage is anticipated to be to the east (towards a tributary of the River Nene) and then north to the River Nene.
A4500, Weedon Road (east) / Tollgate Way / A4500, Weedon Road (west) / A5076, Upton Way	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is approximately 85m OD. Vegetation comprises areas of grass and mature trees. To the northeast and the southeast is a retail park and industrial estate with numerous Asphalt carparks. Housing developments are present to the southwest and the northwest.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Glaciolacustrine Deposits; The Northampton Sand Formation; and Whitby Mudstone Formation. Made Ground may be present associated with areas of former or current

Minor Highway Junction	Item	Data Source	Summary of Findings
			development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Glaciolacustrine Deposits (Secondary A Aquifer); The Northampton Sand Formation (Secondary A Aquifer); and Whitby Mudstone Formation (Unproductive Strata). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There are no landfills indicated to be present on the site. However Weedon Road landfill and the Upper Nene Playing Fields landfill are present to the south east of the junction.
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the south towards the River Nene.
A5076 / A5123 / Upton Way Roundabout (Pineham Park) (Dane Camp Way)	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is at approximately 65m OD. The Grand Union Canal and the River Nene are located to the north of the roundabout. The site is immediately bordered by trees and open grass areas, with residential development to the southeast and southwest.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Alluvium; Whitby Mudstone Formation; Marlstone Rock Formation; and Dyrham Formation. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in	The recorded aquifer status of the soils below the site is as follows: Alluvium (Secondary A Aquifer); and

Minor Highway Junction	Item	Data Source	Summary of Findings
		your backyard" web site	Whitby Mudstone Formation (Unproductive Strata); Marlstone Rock Formation(Secondary A Aquifer); and Dyrham Formation (Secondary Undifferentiated). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There is no record of a landfill on site.
	Hydrology	Ordnance Survey maps	Surface drainage is anticipated to be to the north towards the River Nene.
A5076 (west) / Hunsbury Hill Avenue / Hunsbarrow Road / A5076, Danes Camp Way / Hunsbury Hill Road	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is present at approximately 90m OD and is bordered by linear vegetation and trees on the edge of the highway. The central reservation of the roundabout comprises sporadic vegetation and grass.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Northampton Sand Formation; and Whitby Mudstone Group. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Northampton Sand Formation (Secondary A Aquifer); and Whitby Mudstone Group (Unproductive Strata) The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency	There is no record of a landfill on site.

Minor Highway Junction	Item	Data Source	Summary of Findings
		"What's in your backyard" web site	
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the north and northwest to River Nene.
Towcester Road / A5076, Danes Camp Way / A5123, Towcester Road / Mere Way / Tesco Access	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is present at approximately 105m OD. Mature trees are present to the northwest and east, with grass and shrub vegetation associated with the borders of the highway. The central reservation of the roundabout comprises sporadic vegetation and grass, with a cycle way underpass.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Oadby Formation; Fault offset block of Blisworth Limestone Formation; Northampton Sand Formation; and Whitby Mudstone Group. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Oadby Formation (Unproductive Strata); Fault offset block of Blisworth Limestone Formation (Principal Aquifer); Northampton Sand Formation (Secondary A Aquifer); and Whitby Mudstone Group (Unproductive Strata) The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your	There is no record of a landfill on site.

Minor Highway Junction	Item	Data Source	Summary of Findings
		backyard" web site	
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the north to River Nene.
A45, Nene Valley Way (south); A428, Bedford Road (west)/ A5095, Rushmere Road / A45, Nene Valley Way (north) / A428, Bedford Road (east)	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The site is approximately 55m OD and comprises the Barnes Meadow roundabout surrounding the A45 interchange.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Alluvium; and Whitby Mudstone Formation. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Alluvium (Secondary B Aquifer); and Whitby Mudstone Formation (Unproductive Strata). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There is no record of a landfill on site.
	Hydrology	Ordnance Survey maps	Surface drainage is directly likely to be to the immediate south and east to the River Nene.
Tove Roundabout (A43, Towcester Bypass (southwest) /	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is at approximately 95m OD. Vegetation comprises sporadic trees and grass. A filling station is present off the A5 southbound. To the northwest of the roundabout is a

Minor Highway Junction	Item	Data Source	Summary of Findings
Towcester Road / A5, (north) / A43, (northeast) / A5, Watling Street (southeast))			Volkswagen car sales showroom. To the southeast of the roundabout is a Porsche car sales showroom. A garden centre is present to the northeast of the roundabout.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Alluvium; Oadby Member; and Whitby Mudstone Formation. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Alluvium (Secondary Undifferentiated Aquifer); Oadby Member (Unproductive Strata); Whitby Mudstone Formation (Unproductive Strata). The site is not within a Groundwater Source Protection Zone.
	Landfill		There is no record of a landfill on site.
	Hydrology	Ordnance Survey maps.	Surface drainage is likely to be to the south towards a tributary of the River Tove.
Abthorpe Roundabout (Abthorpe Road/ A43, Towcester Bypass (north)/ Brackley Road/ A43, Towcester Bypass (south))	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is present at approximately 90m OD. The roundabout is bordered by housing to the east, fields to the west and a McDonalds Restaurant and a service station to the southwest. On the northern side of the roundabout, retaining walls are present on both sides of the A43.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Oadby Member; Blisworth Limestone Formation; Rutland Mudstone Formation;

Minor Highway Junction	Item	Data Source	Summary of Findings
			Wellingborough Limestone Member; Stamford Member; Northampton Sand Formation; and Whitby Mudstone Formation. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Oadby Member (Unproductive Strata); Blisworth Limestone Formation (Principal Aquifer); Rutland Mudstone Formation (Secondary B Aquifer); Wellingborough Limestone Member (Secondary A Aquifer); Stamford Member (Secondary A Aquifer); and Northampton Sand Formation (Secondary A Aquifer); Whitby Mudstone Formation (Unproductive Strata). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There is no record of a landfill on site.
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the south towards a tributary of the River Tove.
A5076, Upton Way (south)/ Telford Way/ A5076, Upton Way (north)/ Walter Tull Way/ Dustan Mill Lane	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The roundabout junction is at approximately 65m OD. Vegetation comprises areas of grass and shrubs. To the northeast is a retail park and Sixfields Stadium with numerous Asphalt carparks. Housing developments are present to the

Minor Highway Junction	Item	Data Source	Summary of Findings
			west.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Glaciolacustrine Deposits; and Whitby Mudstone Formation. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Glaciolacustrine Deposits (Secondary A Aquifer); and Whitby Mudstone Formation (Unproductive Strata). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There are no landfills indicated to be present on the site. However Weedon Road landfill and the Upper Nene Playing Fields are present to the immediate northeast of the junction.
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the south towards the River Nene.
A5076, Upton Way (south)/ High Street/ A5076, Upton Way (north)/ Dustan Mill (Stub)	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The roundabout junction is approximately 62m OD. Vegetation comprises areas of grass and shrubs. Housing developments are present to the northwest. Open ground is present to the east and southwest.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Glaciolacustrine Deposits; and Whitby Mudstone Formation; Marlstone Rock Formation; and Dyrham Formation. Made Ground may be present associated

Minor Highway Junction	Item	Data Source	Summary of Findings
			with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Glaciolacustrine Deposits (Secondary A Aquifer); and Whitby Mudstone Formation (Unproductive Strata). Marlstone Rock Formation(Secondary A Aquifer); and Dyrham Formation (Secondary Undifferentiated). The site is not within a Groundwater Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There are no landfills indicated to be present on the site.
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the east towards the River Nene.
A508, Harborough Road (south)/ A5199, Welford Road/ A508, Harborough Road (north)/ Cranford Road/ Kingsland Avenue	Site Setting	Ordnance Survey maps. Google Maps and Google Street View	The junction is set in an urban environment to the south and west of Kingsthorpe High Street.
	Geology	British Geological Survey (BGS)	The stratigraphic sequence at the site as indicated by BGS mapping is: Northampton Sand Formation. Made Ground may be present associated with areas of former or current development and cut to fill.
	Hydrogeology	Environment Agency "What's in your backyard" web site	The recorded aquifer status of the soils below the site is as follows: Northampton Sand Formation (Secondary A Aquifer). The site is not within a Groundwater

Minor Highway Junction	Item	Data Source	Summary of Findings
			Source Protection Zone.
	Landfill	Environment Agency "What's in your backyard" web site	There is no record of a landfill on site.
	Hydrology	Ordnance Survey maps	Surface drainage is likely to be to the west towards a tributary of the River Nene.

Potential Contamination Sources

13.136 The main potentially contaminative land uses (in relation to the proposed works) with regards to the minor highway works are:

- Made Ground possibly including metals, metalloids, asbestos, PAH and petroleum hydrocarbons.
- Elevated concentrations of ground gases (methane & carbon dioxide) from biodegradable matter in the Made Ground or off-site source.

Geotechnical Hazards

13.137 Potential geotechnical hazards based on the expected ground conditions are listed below.

- Low strength soils due to variable and potentially soft soils / Made Ground – settlement of roads.
- Attack of buried concrete by aggressive ground conditions – the development site may contain unknown Made Ground and potentially sulphate bearing soils. The Whitby Mudstone and Dyrham Formation are known to be high in naturally occurring sulphates and may have influenced local superficial deposits.

13.138 The above findings have been used in conjunction with a consideration of plausible pollution linkages to assess potential environmental impacts in the following section.

The Climate Change Influenced Baseline Conditions

13.139 **Chapter 23** provides the potential future baseline climatic conditions within the East Midlands as a result of the climate change scenario identified as relevant to this assessment.

13.140 Qualitatively, climate change may result in the following future baseline climatic conditions relevant to the Proposed Development:

- An increase in annual average temperature;
- More very hot days particularly during long term operation;
- More intense downpours of rain;
- Increase in winter rainfall; and
- An increase in dry spells particularly in summer months.

13.141 With regards to the Ground Conditions baseline, the potential effects due to climate change have been considered qualitatively and in the context of a low likelihood of occurrence can be summarised as follows;

- The generally low potential for contamination (as indicated by the baseline data) combined with the low probability of severe rainfall suggests that there is minimal risk of additional leaching of contamination from the soils within the development area due to heavy rain, especially as the proposed development will reduce the amount of infiltration into the soils.
- Whilst the higher rainfall and higher temperatures may increase the risk of structures or earthworks being impacted by surface run off, this is mitigated as part of the surface water design, the landscaping design and by good engineering practice, such as design of slopes at stable angles.
- Based on the qualitative assessment above and in combination with professional judgement, there are no significant effects upon the ground conditions identified within the study area from the changes to the future climate baseline. It is therefore not considered necessary to assess this issue further within this ground conditions chapter.

Method of Assessment

Overview

13.142 Environmental effects and mitigation measures identified by this assessment are intended to protect workers on, and end-users of, the Proposed Development. The assessment also contains assessments of any potential impacts of wider extent than the Order Limits. The baseline study will be used to assess any effects as a result of the Proposed Development during the construction, operational and decommissioning phases.

13.143 The potential impacts to the environment arising from construction works and the new use of the Proposed Development as an SRFI will be evaluated. If appropriate, measures will be proposed to mitigate any unacceptable (significant) adverse effects and any mitigation to address significant residual effects will be considered.

13.144 This chapter has also considered the potential impacts of climate change upon the ground conditions in the context of the proposed SRFI.

13.145 One of the requirements of the planning system is to ensure that any new development is safe. This includes the physical integrity of the new development, usually regulated by the Building Control Officer and the chemical integrity of the site, usually regulated by the Environmental Health Officer (but in conjunction with the Environment Agency where the pollution of Controlled Waters is an issue). If pollution of Controlled Waters is an issue, the Environment Agency will also be consulted. The design of new developments is augmented by site investigations and risk assessments to provide assurances that the safety (fitness for purpose) condition is met.

13.146 Chemical issues of development sites are normally related to contaminants remaining from previous land uses either on the site or adjacent to it. The methodology adopted for determining whether or not a site is contaminated is broadly similar to that required under Part IIA of the Environmental Protection Act 1990 (Ref 13.4) and involves the concept of pollution linkages.

13.147 A preliminary assessment of the existing soil and groundwater conditions are assessed in the baseline study by the Phase I assessment (desk study and walk-over survey) (or in the case of the Other Minor Highway Works, a preliminary review), which reviews potential source-pathway-receptor linkages. These potential source-pathway-receptor linkages have then been investigated by undertaking ground investigation works (Phase II site investigation), which conforms or rejects the presence of the potential source-pathway-receptor linkages. Following the site investigation, generic and detailed risk assessments, and risk evaluations are undertaken.

13.148 Ground investigation works have been undertaken for the Main SRFI Site and this assessment will be based upon the Phase 2 Site Investigation for the Main SRFI Site, the Phase 1 Desk Study data for the J15a Improvement works and the preliminary review for the Other Minor Highway Works. Further intrusive ground investigation works will be undertake at all locations to allow detailed design to be undertaken.

13.149 Environmental issues related to ground contamination are considered by preliminary risk assessment of pollution linkages. A pollution linkage is said to exist where three conditions are satisfied:

- There is a source of chemical contaminant with the potential to cause harm to human health, property (including buildings) or the wider environment;
- There is a receptor (e.g. people, property, the environment) which might be harmed by the source of contamination; and
- There is a pathway by which the source can reach the receptor, so that harm can be caused.

13.150 On any particular site, there may be multiple sources, pathways and receptors and each source-pathway-receptor pollution linkage must be examined and the risk assessed. This is usually done in a series of stages or tiers, starting with a general, more conservative approach, but becoming more in-depth and site-specific if a more detailed approach is warranted (usually where the issues are very complex to resolve).

13.151 The stages of assessment are summarised as:

- Hazard identification;
- Generic risk assessment;
- Detailed risk assessment; and
- Risk evaluation.

13.152 The stages of assessment are in detailed **Table 13.12**.

Table 13.12: Risk Assessment Stages

Hazard Identification
The potential pollution linkages are listed, and judgement is used to determine which of these can be considered plausible, i.e. there is a realistic probability that environmental damage might take place. Only the plausible linkages need be considered further, in the generic risk assessment.
Generic Risk Assessment
All the plausible linkages are considered in the light of ground investigation test results. The concentrations of chemicals in the ground are compared, using specified statistical techniques, with published values (Generic Assessment Criteria), which are deemed indicative of minimal risk, for example to human health, plant life or the water environment.
Detailed Risk Assessment
Where concentrations exceed the assessment criteria there is a need to carry out mitigation measures. Mitigation can include more detailed risk assessment using site-specific conditions rather than generic ones. Mitigation measures can also include engineering work (also known as remediation), such as removal or treatment of the contaminant or severing of the pathway between the contaminant and the potential receptor, thereby breaking the linkage. It is not always possible to completely remove an environmental impact and a residual impact may remain, or some secondary impacts may be generated. Accepting a secondary or residual impact may often involve a trade-off, which must be judged to be reasonable. An example of a trade-off might be the removal of contaminated soil from a development site, but the secondary impact would be increased lorry traffic.
Risk Evaluation
Risk Evaluation is used frequently in the decision making process. This may involve more in-depth scientific analysis or professional judgement and local experience and can take place at any stage in the assessment process. The generic criteria are by design very conservative in terms of providing protection to health. Consequently, a moderate exceedance of a criterion does not mean a sudden change from acceptable risk to unacceptable risk. Risk Evaluation takes things like this into account.

13.153 The potential impacts and effects resulting from the construction, operational and decommissioning phases of the Proposed Development will be assessed based on the Preliminary Conceptual Model of geo-environmental site conditions. Impacts will then be identified and options may then be outlined for mitigating any potential adverse impacts from the scheme construction and operation allowing the final impact to be confirmed. Cumulative impacts of the Proposed Development in relation to other known proposed schemes will also be assessed where necessary. Intra-project effects will also be addressed.

13.154 A qualitative risk assessment will be undertaken to confirm the magnitude of the assessed impacts to identified potential receptors which are likely to include human receptors (e.g. people living and working nearby), as well as controlled waters and ecology.

Magnitude of Effect

13.155 The magnitude of effect is judged on the consequences of the impact. In terms of contamination, for example, this would be the degree of exceedance of the assessment criteria and whether this takes place locally or across large areas of the proposed Order Limits. However, in a Phase 1 risk assessment where there are no data to quantitatively determine the extent and level of the contamination, professional judgement is used as to estimate the likely degree of exceedance based on experience from other, similar sites (see **Table 13.13**).

13.156 Classification of magnitude has been undertaken by modifying the classification of consequences as given in CIRIA C552 Tables 6.3. However, there are a number of inconsistencies in the original Table 6.3, in particular relating to 'significant harm or significant possibility of significant harm' (SH/SPOSH). Consequently, the table has been updated by Hydrock in line with current practice and the revision presented in R&D Publication 66, Annex 4 (NHBC and Environment Agency. 2008, and is given in **Table 13.13** below.

Table 13.13: Impact Magnitude

Impact Type	Major	Moderate	Minor	Negligible
General definition with respect to contamination impacts to human health, new planting and Controlled Waters	Concentration of contaminants is likely to (or is known from previous data to) exceed that indicative of unacceptable intake or contact. i.e. much greater than required for "significant harm or the significant possibility of significant harm" under EPA1990 Part 2A. Concentrations are high enough to cause acute (short-term) effects.	Concentration of contaminants is likely to (or is known from previous data to) exceed that indicative of unacceptable intake or contact. i.e. greater than required for "significant harm or the significant possibility of significant harm" under EPA1990 Part 2A.	Concentration of contaminants is likely to (or is known from previous data to) exceed that indicative of no harm but not unacceptable intake or contact. i.e. greater than the GAC screening value but less than that required for "significant harm or the significant possibility of significant harm" under EPA1990 Part 2A.	Concentration of contaminants is likely to (or is known from previous data to) be less than that indicative of no harm. i.e. less than the GAC screening value.
Human health impacts from chemicals in the ground.	Short-term (acute) effects likely to result in significant harm e.g. high concentration of cyanide on the surface of an informal recreational area.	Long-term (chronic) effects likely to result in significant harm e.g. high concentration of contaminants close to the surface of a development site.	Harm but probably not significant harm unless particularly sensitive individual within the receptor group. May be aesthetic/olfactory impacts.	No measurable effects.
New planting impacts from chemicals in the ground.	Complete and rapid die-back of landscaped areas.	Stressed or dead plants in landscaped areas.	Damage to plants in landscaped areas, e.g. stunted growth, discoloration.	No measurable effects.

Impact Type	Major	Moderate	Minor	Negligible
Controlled Waters impacts from chemicals in the ground.	Short-term pollution, e.g. major spillage into controlled water. Substances leaching from contaminated soil cause receiving waters to exceed surface water and groundwater quality indicators (EQS/DWS) over a large area.	Pollution of sensitive water resources, e.g. leaching into major or minor aquifers or rivers. Substances leaching from contaminated soil cause receiving waters to exceed surface water and groundwater quality indicators (EQS/DWS) in limited areas.	Pollution of non-sensitive water bodies e.g. leaching into non-classified groundwater or minor ditches. Substances leaching from contaminated soil cause receiving waters to slightly exceed surface water and groundwater quality indicators (EQS/DWS) (based on professional judgement).	No measurable effects. Substances leaching from contaminated soil do not cause receiving waters to exceed surface water and groundwater quality indicators (EQS/DWS).
Ecosystems impacts from chemicals in the ground.	Short-term risk to a particular ecosystem or organism forming part of that ecosystem in a designated protected area, e.g. by contamination spillage. Damage to a protected area of international significance (e.g. Ramsar site).	Death of species in a particular ecosystem in a designated protected area, e.g. by contamination spillage. Damage to a protected area of national significance (e.g. Site of Special Scientific Interest).	Minor change in a particular ecosystem in a designated protected area, but not significant harm. Damage to a locally important area.	No measurable effects. Plausible pollution linkage but no important or protected area.
Site workers impacts from chemicals in the ground.	Risk assessment required to determine required personal protective equipment (PPE) and this may involve high level of protection similar to USEPA Level A.	Risk assessment required to determine required personal protective equipment (PPE) and this may involve high level of protection similar to USEPA Level B.	Risk assessment required to determine required personal protective equipment (PPE) and this may involve moderate level of protection similar to USEPA Level C.	No measurable effects, but simple personal protective equipment (PPE) required (similar to USEPA Level D protection, i.e. overalls, boots, goggles, hard hat).

Impact Type	Major	Moderate	Minor	Negligible
Buildings etc. impacts from flammable ground gas.	Catastrophic damage, e.g. gas explosion causing collapse.	Damage renders unsafe to occupy.	Damage to sensitive buildings etc.	No measurable effects.
Damage to building products form chemicals in the ground (e.g. sulphate attack of concrete, organic solvent decay of plastics).	Maximum soil concentration exceeds industry accepted trigger value over a large area.	Maximum soil concentration exceeds industry accepted trigger value in limited areas.	Maximum soil concentration slightly exceeds industry accepted trigger value in limited areas.	Maximum soil concentration less than industry accepted trigger value.
Human health impact from ground gases. Such as radon and landfill gas where exceedance of a risk-based trigger indicates the potential for harm.	Pollution linkage identified over a large area.	Pollution linkage identified in limited areas.	Pollution linkage uncertain.	Plausible pollution linkage not established.
Impacts to people, property or infrastructure cause by excessive ground movements.	Major damage involving destruction of buildings or infrastructure, blocking of river courses and major flooding or loss of life.	Significant damage to property or infrastructure, minor damage to river channels, injury to people.	Minor damage to property or infrastructure, minor blocking of river channels.	Minor ground movements but no significant damage to property, infrastructure, river channels or human health.

Sensitivity of Receptor

13.157 The following receptors are considered in the assessment of environmental impacts and effects from land condition for the Main SRFI Site:

- Site preparation and construction workers;
- Off-site population (workers at the immediate adjacent Business Parks and immediately adjacent residents).
- The surrounding ecosystem;
- End users of the Application Site (workers, visitors etc.);

- Structures, and the construction materials used, in the development;
- The groundwater environment;
- The surface water environment; and

13.158 It should be noted that whilst the northern part of the site is designated as a Mineral Safeguarding Area (MSA) under the Northamptonshire Minerals and Waste Local Plan (MWLP) (adopted May 2017) (Ref 13.5). Professional judgement indicates that the mineral resource will not be sterilised by the development (and as such is not a receptor), as:

- The sands and gravel deposits do not extend as far to the south into the site as indicated in the MWLP (Ref 13.5), thus reducing the area of mineral safeguarding.
- As detailed in the Desk Study (**Appendix 13.1**), and as confirmed by site investigation (**Appendix 13.2**) there are a number of former sand pits on site in the northwest, north and northeast (now backfilled as landfill). This indicates that the exploitable resource have been depleted, with little room for significant sand and gravel extraction activates to be undertaken.
- The piecemeal nature of the site ownership and shape of the numerous land holdings across the northern part of the site, means that any potential quarrying operation would be unlikely.
- The location of the remaining small pockets of sand and gravel, which are located close to the southern boundary of Milton Malsor, means that any potential quarrying operation would be unlikely.
- The proposed development is limited in regards to its encroachment onto the Glaciofluvial Deposits in the north of the site.
- As shown by the presence of M1: Milton Malsor allocated sand and gravel resource in the MLWP (Ref 13.5), substantial (economically viable) deposits exist elsewhere in the county.

13.159 Based on the qualitative assessment above, and in combination with professional judgement, it is concluded that the Proposed Development will not result in the sterilisation of exploitable mineral resources of economic importance. It is therefore not considered necessary to assess this issue further within this chapter.

13.160 The northeastern corner of the site is within the 300m buffer of an allocated sand and gravel extraction site (M1: Milton Malsor), which relates to a 1.2 million tonne resource at Maple Farm. However, professional judgement indicates that the Proposed Development does not present a risk to the future viability of M1: Milton Malsor as the allocated sand and gravel extraction site (M1: Milton Malsor) is separated from the proposed SRFI development site by existing residential development and major pre-existing infrastructure in the form of Collintree Road and the Northampton Loop Rail line and there is no viable link between the

proposed SRFI development and M1: Milton Malsor, and, both operations are able to co-exist without impact on the other. As such, based on the qualitative assessment above and in combination with professional judgement, there are no significant impacts upon the potential exploitation of the known mineral resource development (and as such is not a receptor). It is therefore not considered necessary to assess this issue further within this chapter.

13.161 The following receptors are considered in the assessment of environmental impacts and effects from land condition for the J15a Improvement works and the Other Minor Highway Works:

- Site preparation and construction workers;
- End users of the Application Site (workers, visitors etc.);
- Neighbours;
- The surrounding ecosystem;
- Structures, and the construction materials used, in the development;
- The groundwater environment; and
- The surface water environment.

13.162 The sensitivity of these receptors is a matter of professional judgement:

- With respect to human populations, the methodology of CLR11 (Ref 13.22) has been followed in that the most sensitive receptors within a particular group are required to be protected.
- The sensitivity of the water environment depends on whether it is used for human consumption or provides support for aquatic ecosystems. The use of the Drinking Water Standards or Environmental Quality Standards applies.
- The risks associated with the ground gases methane (CH_4) and carbon dioxide (CO_2) will be assessed using guidance provided by BS 8485:2007 (Ref 13.23) which cites the guidelines published in CIRIA C665 (Wilson et al. 2007) (Ref 13.24) and the available desk study information. These guidelines were written so as to be mutually consistent and are based on interpretation of the gas concentrations and the gas flow rates measured in boreholes, amongst other variables. They are compliant with the model procedures of CLR11 (Ref 13.22).
- The risk from radon has been assessed by reference to the radon atlas and other guidance produced by the Health Protection Agency, British Geological Survey and Building Research Establishment.

13.163 The geotechnical risks assessed in this chapter relate to any abnormal ground conditions that might exist. For example, particular aspects such as ground instability arising from excessive ground movements. With regards to geotechnical risks, the following applies:

- It is noted that an earthworks cut and fill will be necessary to allow the scheme to be constructed. This will be designed to achieve, wherever possible and practical, a cut and fill balance, thus minimising the need for off-site disposal and import of materials.

- It is anticipated that these works would be commenced by the removal of topsoil, with this material being either temporarily stockpiled for reuse in landscape and habitat creation areas around the built scheme or being placed directly on areas of the open space.

- It is anticipated that excavation will be undertaken using large excavators which should be able to excavate through the strata, although some ripping or breaking of more massive rock cannot be discounted, however this is expected to be limited to deeper excavations in the eastern and western extents of the SRFI site.

- It is anticipated that all natural arisings from earthworks cutting should be suitable for reuse within general fill operations, provided they are suitably handled.

- Prior to placement of fill, ground improvement may be required in areas of alluvial soils.

- Excavation of borrow pits may be required to obtain high quality structural fill, these borrow pits would be located on the SRFI site, either in areas of proposed car parking (where higher settlements can be tolerated) or in landscape areas. Any soils excavated from borrow pits would be transported on the SRFI site only and the borrow pits would be backfilled with soils from the site, proven as "Suitable for Use" in accordance with the CL:AIRE 'Development Industry Code of Practice - Definition of Waste', to a suitable Specification and restored following construction, either as car parking areas or landscaped open space.

- Where arising's are wet of optimum making them unsuitable for reuse within structural fill they may be reused within non-structural landscaping areas or modified or modified by air drying to allow reuse within structural fill thereby ensuring a cut fill balance is achieved and no export of arising's to landfill will be required.

- Crushing and screening maybe necessary to allow reuse of some granular and rock arisings.

13.164 In this chapter, the sensitivity is taken to be the likelihood that one of the sensitive receptors suffers the effect. This probability is based on experience as listed in **Table 13.14**.

Table 13.14: Classification of Probability (after Rudland et al 2001)

Classification	Definition
High likelihood	There is a contaminant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Medium likelihood	There is a contaminant linkage and all elements are present and in the right place, which means that it is possible that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Negligible	There is a contaminant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

13.165 The sensitivity of other geological receptors where the new development has the potential to destroy or deplete the amenity value, such as mineral resources or sites of geological interest, is judged according to the criteria in **Table 13.15**.

Table 13.15: Sensitivity of Geological Receptors

Classification	Geological Sites	Mineral Resources
High sensitivity	High quality and rarity on regional or national or international scale. Protected by international or EU legislation (e.g. World Heritage).	Nationally important mineral. Large resource.
Medium sensitivity	High quality and rarity on national or local scale (e.g. SSSI).	Medium resource.
Low sensitivity	Medium quality and rarity on a local scale (e.g. Local Geological Site / RIGS).	Small resource.
Negligible	Little or no geological interest.	No mineral resource.

Duration of Effect

13.166 In this chapter, the duration of the effect will also be taken into consideration. The following definitions of timescales will be used:

- Short-term: 0 to 5 years including the construction period and on completion;
- Medium-term: 5 to 15 years including establishment of replacement and proposed mitigation planting; and
- Long-term: 15 years onwards for the life of the Proposed Development.

Significance of Effect

13.167 The significance of a potential impact is based on the combination of the magnitude and sensitivity of that impact as given in the matrix in **Table 13.16**. Note that the degree of 'significance' is not the same as the legal definition of 'significant harm' as defined by the Environmental Protection Act 1990 (Ref 13.4).

Table 13.16: Impact Significance

		Sensitivity / Likelihood			
		High Likelihood	**Medium Likelihood**	**Low Likelihood**	**Negligible**
Magnitude	**Major**	Major significance	Major significance	Moderate significance	Minor significance
	Moderate	Major significance	Moderate significance	Minor significance	Negligible significance
	Minor	Moderate significance	Minor significance	Minor significance	Negligible significance
	Negligible	Minor significance	Negligible significance	Negligible significance	Negligible significance

13.168 Any potential effect rated as 'moderate significance' or higher is considered significant in terms of the EIA and will be assessed further.

13.169 The tables list all effects, including those which have been assessed to be negligible or of minor significance. This is to demonstrate that they have been considered and discounted, although certain actions will be embedded in the design of the Proposed Development and these are mentioned in the tables. Effects deemed to be of moderate significance or above are considered further and relevant to the EIA process and are summarised below.

13.170 In addition, effects are judged to be adverse or beneficial and temporary or permanent.

13.171 Note that the term "toxic etc." is used as shorthand notation to include all likely harmful effects such as toxic, carcinogenic, mutagenic etc.; and the word "artificial" is used to describe the introduction of a substance by site user/construction worker activities.

Embedded Mitigation

13.172 With regards to the ground conditions, the following are likely to comprise embedded mitigation:

- The Health and Safety at Work etc. Act 1974 (Ref 13.30).
- The Control of Asbestos Regulations, 2012 (Ref 13.27).

- All works being undertaken in accordance with an approved Construction Environmental Management Plan (CEMP), including the requirement for an Environmental Permit.

- Geotechnical design to be undertaken to appropriate standards and published guidance documents and all geotechnical construction works to be done in accordance with an appropriate Geotechnical Design Reports and Specifications.

- Remediation design and materials management design to be undertaken in association with geotechnical design and to be undertaken to appropriate standards and published guidance documents and all remediation works and materials management to be done in accordance with an appropriate Remediation method Statements, Materials management Plans and Specifications.

13.173 In addition to the above embedded mitigation. With regards to the ground conditions, the following are likely to comprise embedded mitigation However, as there is further investigation, design and specification works to be undertaken, at this stage, there is no reliance on the following as embedded mitigation:

- All works being undertaken in accordance with a Pollution Prevention Method Statement (PPMS).

- All works being undertaken in accordance with an approved Materials Management Plan (MMP).

- Works undertaken in accordance with Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26).

Assessment of Construction Phase Effects

13.174 The 'reasonable worst case' is back to back processes, where one process is completed across the entire site, before the next process commences. This has the effect of significantly increasing the time that effects may be felt. The assessments below have been undertaken using this reasonable worst case. However, in reality, the processes will not be back to back across all parts of the site, with the processes being undertaken on a rolling basis across the site.

13.175 In addition, it is proposed for the first operation to commence from 2021, whilst construction is still ongoing in other parts of the site. As such, it is recognised that there will be a period of time from 2021 on, when construction and operation could take place in tandem from that point.

13.176 The baseline study has been used to assess any effects as a result of the Proposed Development during construction (Construction Phase). These are given in **Table 13.17** for the Main SRFI Site, **Table 13.18** for J15a and **Table 13.19** for other minor highway works, respectively.

13.177 This includes consideration of the likely effects of the present quality of the land on the Proposed Development and its eventual users, and any effects the Proposed Development and new use of this land might have on the contamination and geotechnical status of the surrounding area.

13.178 It should be noted that with regards to J15a, the site area as indicated in the desk study was correct at the time of the desk study, but has since changed. Several features identified as a potential contaminant source in the desk study (namely Shepherds Lodge, and derelict structures and a number of stockpiles of material land to the north of the M1 and east of the A43) have been removed from this Chapter as they are no longer in the site area.

Table 13.17: Main SRFI Site - Potential Significant Effects from Ground and Hazardous Substances (During Construction)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the soil and Made Ground by heavy metals, metalloids and PAH from: the landfill in the northwest corner of the site. Rathvilly Farm pit.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor. (proven) Moderate (potential)	Adverse. Temporary	Minor significance. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. The chance of contact is extremely small.
Heavy metals, metalloids and PAH in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
			substances.				metals and PAH are not significantly elevated. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source and there are no elevated concentrations of PAH or metal in Milton Malsor Brook. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, this borehole is up-gradient of the landfill and Rathvilly Pit and not considered in connectivity with the soils from the landfill and Rathvilly Pit. No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. There are no elevated concentrations of PAH or metal in Milton Malsor Brook.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							The Aquifers on site are either Secondary Aquifers, or Unproductive Strata.. There is no building construction proposed for the landfill and backfilled pit area and if the layout changes and buildings are proposed in this area, foundations are likely to be pad foundations in re-engineered or ground improved fill, rather than penetrative piles. No infiltration drainage will be placed in brownfield land.
Heavy metals¸ metalloids and PAH in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. There are no surface water abstractions within 1000m of the site. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. There are no elevated concentrations of PAH or metal in Milton Malsor Brook. Unlikely to be significant discharge of untreated water as

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. Made Ground is present at the landfill and backfilled pit and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. Unlikely to be significant discharge of dust as contractors will follow accepted site practices. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices.
Contamination of the soil and Made Ground by heavy metals, metalloids and PAH from the Made Ground located at farmyards, the former petrol filling station and	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor. (proven) Moderate (potential)	Adverse. Temporary	Minor significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated with regards to site worker exposure. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
used as gate fill at field entrances across the site.							However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							mitigation measures detailed above.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Heavy metals, metalloids and PAH in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. Water monitoring has proven that PAH and metals are at low concentrations across the site and there are no elevated concentrations of PAH or metal in Milton Malsor Brook or Wootton Brook. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm,

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							and elevated PAH has been identified at Lodge Farm, no significant groundwater contamination has been noted in the vicinity of Lodge Farm. No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and water monitoring has proven that PAH and metals are at low concentrations across the site. Foundations are likely to be pad foundations in re-engineered or ground improved fill, rather than penetrative piles. No infiltration drainage will be placed in brownfield land.
Heavy metals¸ metalloids and PAH in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site. Wootton Brook flows north, from the northeastern corner of the site. There are no surface water abstractions within 1000m of the site. Made Ground is present at a number of isolated locations

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		groundwater.					across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. Water monitoring has proven that PAH and metals are at low concentrations across the site and there are no elevated concentrations of PAH or metal in Milton Malsor Brook or Wootton Brook. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site. Wootton Brook flows north, from the northeastern corner of the site. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. Unlikely to be significant discharge of dust as contractors will follow accepted site practices. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the soil and Made Ground by Petroleum Hydrocarbons from: The landfill in the northwest corner of the site. Rathvilly Farm pit.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor. (proven) Moderate (potential)	Adverse. Temporary	Minor significance Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							where job specific tasks require them.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated	Toxic etc., effects from mobile contaminants or	Medium likelihood	Minor.	Adverse.	Minor significance. Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		zone.	dissolved substances.			Temporary.	detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. Petroleum Hydrocarbons are present in perched groundwater within the Made Ground. However, whilst this is occasionally elevated, concentrations will attenuate as the groundwater moves away from the site. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, and elevated TPH has been identified at Lodge Farm, no significant groundwater contamination has been noted in the vicinity of Lodge Farm. There are no elevated concentrations of TPH in Milton Malsor Brook or Wootton Brook. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. Petroleum Hydrocarbons are present in perched groundwater within the Made Ground. However, whilst this

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							is occasionally elevated, concentrations will attenuate as the groundwater moves away from the site. The Aquifer is a Secondary Aquifer and there are no groundwater abstractions within 1000m of the site. There is no building construction proposed for the landfill area and if the layout changes and buildings are proposed in this area, foundations are likely to be pad foundations in re-engineered or ground improved fill, rather than penetrative piles. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. There are no surface water abstractions within 1000m of the site. Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. Petroleum Hydrocarbons are present in perched groundwater within the Made Ground. However, whilst this is occasionally elevated, concentrations will attenuate as the groundwater moves away from the site.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							There are no elevated concentrations of TPH in Milton Malsor Brook or Wootton Brook. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. There are no surface water abstractions within 1000m of the site. Made Ground is present at the landfill and backfilled pit and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. Unlikely to be significant discharge of dust as contractors will follow accepted site practices. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices
Contamination of the soil and Made Ground by Petroleum	Site workers.	Ingestion of soil, inhalation of fugitive dust,	Toxic etc. effects.	Low likelihood	Minor. (proven) Moderate (potential)	Adverse. Temporary	Minor significance. The soils in the vicinity of historical tanks at the former filling station do not contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Hydrocarbons associated with the former filling station on the central western boundary of the site,		direct contact.					However, there is the potential for elevated concentrations of Petroleum Hydrocarbons in close proximity to former tanks. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Petroleum Hydrocarbons in	Off-site population.	Inhalation of fugitive dust,	Toxic etc. effects from dust from	Low likelihood	Negligible	Adverse.	Negligible significance. Whilst petroleum hydrocarbons may be present when tanks

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
soils as above.		direct contact	site or passing lorries.			Temporary.	are removed, there is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Whilst petroleum hydrocarbons may be present when tanks are removed, there is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. Chance of contact is extremely small.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. The soils in the vicinity of historical tanks at the former filling station do not contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, there is the potential for elevated concentrations of Petroleum Hydrocarbons in close proximity to former tanks. However, this is likely to be restricted due to the significant clay content of the soils in this section of the site and will attenuate as the groundwater moves away from the site. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, this borehole is up-gradient of the

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							former filling station and not considered in connectivity with the soils at the former filling station. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. The soils in the vicinity of historical tanks at the former filling station do not contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, there is the potential for elevated concentrations of Petroleum Hydrocarbons in close proximity to former tanks. However, this is likely to be restricted due to the significant clay content of the soils in this section of the site and will attenuate as the groundwater moves away from the site. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata. Foundations are likely to be pad foundations in engineered or ground improved fill. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former filling station. However, this is a significant distance removed from the former filling station. There are no surface water abstractions within 1000m of the

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		contaminated groundwater.					site. The soils in the vicinity of historical tanks at the former filling station do not contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, there is the potential for elevated concentrations of Petroleum Hydrocarbons in close proximity to former tanks. There are no elevated concentrations of TPH in Milton Malsor Brook or Wootton Brook. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former filling station. However, this is a significant distance removed from the former filling station. There are no surface water abstractions within 1000m of the site. Unlikely to be significant discharge of dust as contractors will follow accepted site practices. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the soil and Made Ground by Petroleum Hydrocarbons located at farmyards (either in Made Ground or associated with storage tanks).	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor. (proven) Moderate (potential).	Adverse. Temporary	Minor significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Significantly elevated concentrations of contaminates will be excavated and disposed or remediated on site. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Equipment (RPE) where job specific tasks require them.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Significantly elevated concentrations of contaminates will be excavated and disposed or remediated on site. However, there is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Significantly elevated concentrations of contaminates will be excavated and disposed or remediated on site. However, there is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. Chance of contact is extremely small.
Petroleum Hydrocarbons in	Groundwater and possible	Leaching through	Toxic etc., effects from mobile	Unlikely	Negligible	Adverse.	Negligible significance. Made Ground is present at the farmyards and does contain

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
soils as above.	abstractors.	unsaturated zone.	contaminants or dissolved substances.			Temporary.	elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, and elevated TPH has been identified in soil at Lodge Farm, no significant groundwater contamination has been noted in the vicinity of Lodge Farm.
Petroleum Hydrocarbons in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata. Foundations are likely to be pad foundations in engineered or ground improved fill. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in	Surface water and possible	Leaching through	Toxic etc., effects from mobile	Unlikely	Negligible	Adverse.	Negligible significance. Milton Malsor Brook flows south to north through the

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
soils as above.	abstractors or ecosystems.	unsaturated zone, surface run-off, base flow from contaminated groundwater.	contaminants or dissolved substances.			Temporary.	western part of the site and is downgradient of the farms. Wootton Brook is located to the north of the farms. However, these are a significant distance removed from the farms. There are no surface water abstractions within 1000m of the site. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. There are no elevated concentrations of TPH in Milton Malsor Brook or Wootton Brook. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. Milton Malsor Brook flows south to north through the western part of the site and is downgradient of the farms. Wootton Brook is located to the north of the farms.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							However, these are a significant distance removed from the farms. There are no surface water abstractions within 1000m of the site. Unlikely to be significant discharge of dust as contractors will follow accepted site practices. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices
Asbestos in buildings present at the site.	Site workers.	Inhalation of fugitive dust.	Toxic etc. effects.	Low likelihood	Major	Adverse. Permanent	Major significance. Asbestos may be present in buildings at the site and may become airborne during demolition. Workers may be exposed directly to contaminants. If present, the condition of the asbestos is unknown. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the CEMP and the Control of Asbestos Regulations, 2012 (Ref 13.27)), will reduce the possibility of inhalation of fugitive dust. These embedded mitigation measures would include: • Demolition asbestos surveys to be undertaken prior to demolition. • All asbestos in buildings to be removed prior to demolition by appropriately trained contractors who would be required to obtain appropriate licences in accordance with the Control of Asbestos Regulations,

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							2012 (Ref 13.27). • Damping down to be undertaken throughout the works to reduce the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Contamination of the soil and Made Ground by asbestos.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Temporary	Minor significance. Made Ground is present at the site and may contain asbestos. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the Control of Asbestos Regulations, 2012 (Ref 13.27) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Asbestos in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the site and may contain asbestos. Direct exposure will be restricted due to wetting down and hygiene precautions. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small
Asbestos in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground is present at the site and may contain asbestos. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Chance of contact is extremely small.
Asbestos in soils as above.	Surrounding ecosystem.	Fugitive dust.	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Unlikely.	Negligible.	Adverse. Temporary.	Negligible significance. Made Ground is present at the site and may contain asbestos. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the Control of Asbestos Regulations, 2012 (Ref 13.27) and the CEMP), will reduce the possibility of fugitive dust. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels.
The presence of formaldehyde foam used to decommission tanks at the former petrol filling station.	Site workers.	Ingestion, inhalation, direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Temporary	Minor significance. Foam is indicated to be present. Workers during demolition may be exposed during excavation and dismantling tanks. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down to be undertaken throughout the works to reduce the generation of dust. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
The presence of formaldehyde foam as above.	Off-site population.	Inhalation, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Foam is indicated to be present and may be exposed during demolition and disposal of tanks. Chance of contact is extremely small.
The presence of formaldehyde foam as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Foam is indicated to be present and may be exposed during demolition and disposal of tanks. Chance of contact is extremely small.
Ground gases	Construction	Entry into confined	Explosion or asphyxiation in	Low likelihood	Moderate	Adverse.	Minor significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
from the landfill.	workers.	spaces.	confined spaces. Workers in trenches, sewers etc. Workers in houses prior to sale.			Temporary timing but could be permanent effects.	Concentrations of ground gases have been monitored in excess of workplace exposure limits. Risk is low during temporary construction conditions if appropriate Health and Safety assessments are made and followed with regards to ground gases.
Ground gases as above.	Off-site population.	Build-up of gases to greater than Lower Explosive Limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Concentrations of ground gases have been monitored at low concentrations. Gas flow rates are low. Proposed earthworks, are unlikely to cause migration of ground gases.
Spillage of fuel etc. brought to site by contractors.	Groundwater. Surface water.	Direct infiltration. Surface run-off. Base flow from contaminated groundwater.	Contamination of Controlled Waters.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Contractors will use mobile temporary fuel tanks, but likelihood of spills will be reduced if codes of practice are followed. Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26) include requirements such as the bunded storage of any chemicals or fuel kept on site, the introduction of petrol interceptors to filter run off from areas of hardstanding created for construction plant.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Nearest water course is a ditch on site.
Silt particles from exposed soil during site preparation works.	Surface water.	Surface run-off. Fugitive dust.	Physical effects from silt in the water courses.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Environmental protection during construction will be achieved by following industry standard codes of practice such those explained in the Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26). However, nearest water course is 160m away.
Unexploded bombs.	End users of the site and nearby off-site population.	Contact.	Explosion.	Unlikely	Minor	Adverse. Temporary	Negligible significance. The site is assessed as having a low risk of UXO.
Adverse geotechnical ground conditions.	New structures etc.	Adverse ground movements.	Damage to structures.	Low likelihood	Minor	Adverse. Permanent.	Minor significance. The ground conditions comprise Made Ground and Alluvial clay in places, which will require improvement to allow construction. Cut to fill works are likely to be required to allow construction. This will ensure adverse ground movements are minimised. Appropriate ground improvement to be designed to reduce total and differential settlements. Works to be done in accordance with an appropriate Geotechnical Design Reports and Specifications.

Table 13.18: J15a - Potential Significant Effects from Ground and Hazardous Substances (During Construction)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the Made Ground soil arisings by heavy metals, metalloids and PAH.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Moderate.	Adverse. Temporary	Minor significance. Made Ground may be present and may contain elevated metals and PAH. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							where job specific tasks require them.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Heavy metals, metalloids and PAH in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no groundwater abstractions within 1000m of the site. No infiltration drainage will be placed in brownfield land.
Heavy metals,	Groundwater.	Artificial	Toxic etc.,	Low likelihood	Negligible	Adverse.	Negligible significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
metalloids and PAH in soils as above.		Pathway due to Construction.	effects from mobile contaminants or dissolved substances			Temporary.	Made Ground may be present and may contain elevated metals and PAH. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no groundwater abstractions within 1000m of the site. Foundations are likely to be pad foundations in re-engineered or piled. If piled CFA or rotary bored piles are likely. No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. The Grand Union Canal is located on site and a tributary of Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site. Made Ground may be present and may contain elevated metals and PAH. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Heavy metals and PAH in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete etc. from PAHs and metals.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Pervasive contamination potentially exists where concentrations exceed tolerable limits. It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							clean soils.
Heavy metals and PAH in soils as above.	Landscape planting on site.	Root uptake.	Inhibition of plant growth.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is likely to be present. However, the concentrations of metals and PAH are not expected to be significantly elevated.
Contamination of the soil and Made Ground by Petroleum Hydrocarbons.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Moderate	Adverse. Temporary	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands,

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Medium likelihood	Minor.	Adverse. Temporary.	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no groundwater abstractions within 1000m of the site.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. The Aquifer is a Secondary Aquifer and there are no groundwater abstractions within 1000m of the site. Foundations are likely to be pad foundations in re-engineered or piled. If piled CFA or rotary bored piles are likely. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. The Grand Union Canal is located on site and a tributary of Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. It is possible for services to come into contact with

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
			etc. from PAHs and metals.				contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Contamination of the soil and Made Ground by asbestos.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Temporary.	Minor significance. Made Ground may be present at the site and may contain asbestos. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the Control of Asbestos Regulations, 2012 (Ref 13.27) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							where job specific tasks require them.
Asbestos in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from contaminated dust or water leaving the site, including during earthworks or on lorries removing soil.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present at the site and may contain asbestos. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small and direct exposure will be restricted due to embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the Control of Asbestos Regulations, 2012 (Ref 13.27) and the CEMP), will reduce the possibility of inhalation of fugitive dust, direct contact and dust. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels.
Asbestos in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present at the site and may contain asbestos. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Ground gases from biodegradable matter in the Made Ground, Alluvium or off-site source	Construction workers.	Entry into confined spaces.	Explosion or asphyxiation in confined spaces. Workers in trenches, sewers etc. Workers in houses prior to sale.	Low likelihood	Moderate	Adverse. Temporary timing but could be permanent effects.	Minor significance. Concentrations of ground gases are possibly present in excess of workplace exposure limits. Risk is low during temporary construction conditions if appropriate Health and Safety assessments are made and followed with regards to ground gases.
Ground gases as above.	Off-site population.	Build-up of gases to greater than Lower Explosive Limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Concentrations of ground gases are possibly present in excess of workplace exposure limits. Proposed earthworks, are unlikely to cause migration of ground gases.
Spillage of fuel etc. brought to site by contractors.	Groundwater. Surface water.	Direct infiltration. Surface run-off. Base flow from contaminated	Contamination of Controlled Waters.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Contractors will use mobile temporary fuel tanks, but likelihood of spills will be reduced if codes of practice are followed. Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26) include requirements such as the bunded storage of any chemicals or fuel kept on site, the introduction of petrol interceptors to

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		groundwater.					filter run off from areas of hardstanding created for construction plant. Nearest water course is the canal on site.
Silt particles from exposed soil during site preparation works.	Surface water.	Surface run-off. Fugitive dust.	Physical effects from silt in the water courses.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Environmental protection during construction will be achieved by following industry standard codes of practice such those explained in the Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26).
Unexploded bombs.	End users of the site and nearby off-site population.	Contact.	Explosion.	Negligible	Negligible	Adverse. Temporary	Negligible significance. The site is assessed as having a low risk of UXO.
Adverse geotechnical ground conditions.	Existing Canal.	Adverse ground movements.	Damage to structures.	Low likelihood	Minor	Adverse. Permanent.	Minor significance. The ground conditions are likely to comprise Made Ground and Alluvial clay in places, which will require improvement to allow construction. Piling will be required for the bridge structures. Works to be done in accordance with an appropriate Geotechnical Design Reports and Specifications and the design will not result in additional loads being placed on the canal.
Adverse geotechnical	New structures	Adverse ground	Damage to	Low likelihood	Minor	Adverse.	Minor significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
ground conditions.	etc.	movements.	structures.			Permanent.	The ground conditions are likely to comprise Made Ground and Alluvial clay in places, which will require improvement to allow construction. Cut to fill works are likely to be required to allow construction. This will ensure adverse ground movements are minimised. Appropriate ground improvement to be designed to reduce total and differential settlements. Piling will be required for the bridge structures. Works to be done in accordance with an appropriate Geotechnical Design Reports and Specifications.

Table 13.19: Other Minor Highway Works - Potential Significant Effects from Ground and Hazardous Substances (During Construction)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the Made Ground soil arisings by heavy metals, metalloids and PAH.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Moderate.	Adverse. Temporary	Minor significance. Made Ground may be present and may contain elevated metals and PAH. The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing lorries.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Heavy metals, metalloids and PAH in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata. There will be either no change to infiltration (e.g. signage, line marking or signal timing), or a reduction in infiltration (if lane widening, thus reducing leaching potential. No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Groundwater.	Artificial Pathway due to Construction.	Toxic etc., effects from mobile contaminants or dissolved substances	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata. No significant foundations are proposed. No infiltration drainage will be placed in brownfield land.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Heavy metals¸ metalloids and PAH in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. There will be either no change to infiltration (e.g. signage, line marking or signal timing), or a reduction in infiltration (if lane widening, thus reducing leaching potential. No infiltration drainage will be placed in brownfield land.
Heavy metals and PAH in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete etc. from PAHs and metals.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Pervasive contamination potentially exists where concentrations exceed tolerable limits. It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Heavy metals and PAH in soils as above.	Landscape planting on site.	Root uptake.	Inhibition of plant growth.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present. However, the concentrations of metals and PAH are not significantly elevated.
Contamination of the soil and Made Ground by	Site workers.	Ingestion of soil, inhalation of fugitive	Toxic etc. effects.	Low likelihood	Moderate	Adverse. Temporary	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Petroleum Hydrocarbons.		dust, direct contact.					The main activities will be remediation, site re-profiling, compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site or passing	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
			lorries.				There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small due to embedded mitigation measures detailed above.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Medium likelihood	Minor.	Adverse. Temporary.	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata. There will be either no change to infiltration (e.g. signage, line marking or signal timing), or a reduction in infiltration (if lane widening, thus reducing leaching potential. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Groundwater.	Artificial Pathway due to	Toxic etc., effects from mobile contaminants	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		Construction.	or dissolved substances				The Aquifers on site are either Secondary Aquifers, or Unproductive Strata. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. Unlikely to be significant discharge of untreated water as contractors will follow accepted site practices. There will be either no change to infiltration (e.g. signage, line marking or signal timing), or a reduction in infiltration (if lane widening, thus reducing leaching potential. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete etc. from PAHs and metals.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Contamination of the soil and Made Ground by asbestos.	Site workers.	Ingestion of soil, inhalation of fugitive dust, direct	Toxic etc. effects.	Low likelihood	Medium	Adverse. Temporary.	Minor significance. Made Ground may be present at the site and may contain asbestos. The main activities will be remediation, site re-profiling,

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		contact.					compaction of fill and construction on the new fill. Workers may be exposed directly to contaminants, especially if unforeseen pockets of contamination are encountered. However, embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the Control of Asbestos Regulations, 2012 (Ref 13.27) and the CEMP), will reduce the possibility of ingestion of soil, inhalation of fugitive dust, direct contact. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.
Asbestos in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from contaminated dust or water	Low likelihood	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present at the site and may contain asbestos.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
			leaving the site, including during earthworks or on lorries removing soil.				There is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. The chance of contact is extremely small and direct exposure will be restricted due to embedded mitigation (as part of the Health and Safety at Work etc. Act 1974 (Ref 13.30), the Control of Asbestos Regulations, 2012 (Ref 13.27) and the CEMP), will reduce the possibility of inhalation of fugitive dust, direct contact and dust. These embedded mitigation measures would include: • Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. • Damping down of excavated soils to prevent the generation of dust. Dust Monitoring to confirm low dust levels.
Asbestos in soils as above.	Off-site population.	Direct contact.	Toxic effects from contact in the event of road traffic accidents involving lorries carrying soil.	Unlikely	Negligible	Adverse. Temporary.	Negligible significance. Made Ground may be present at the site and may contain asbestos. There is unlikely to be substantial removal of soil off-site as this will be reused on site wherever possible. Chance of contact is extremely small.
Ground gases from biodegradable matter in the Made	Construction workers.	Entry into confined	Explosion or asphyxiation in confined	Low likelihood	Moderate	Adverse.	Minor significance. Concentrations of ground gases are possibly present in

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Ground, or off-site source		spaces.	spaces. Workers in trenches, sewers etc. Workers in houses prior to sale.			Temporary timing but could be permanent effects.	excess of workplace exposure limits. Risk is low during temporary construction conditions if appropriate Health and Safety assessments are made and followed with regards to ground gases.
Ground gases as above.	Off-site population.	Build-up of gases to greater than Lower Explosive Limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Low likelihood	Minor.	Adverse. Temporary.	Negligible significance. Concentrations of ground gases are possibly present in excess of workplace exposure limits. Proposed earthworks, are unlikely to cause migration of ground gases.
Spillage of fuel etc. brought to site by contractors.	Groundwater. Surface water.	Direct infiltration. Surface run-off. Base flow from contaminated groundwater.	Contamination of Controlled Waters.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Contractors will use mobile temporary fuel tanks, but likelihood of spills will be reduced if codes of practice are followed. Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26) include requirements such as the bunded storage of any chemicals or fuel kept on site, the introduction of petrol interceptors to filter run off from areas of hardstanding created for construction plant. Nearest water course is the canal on site.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Silt particles from exposed soil during site preparation works.	Surface water.	Surface run-off. Fugitive dust.	Physical effects from silt in the water courses.	Low likelihood	Minor.	Adverse. Temporary.	Minor significance. Environmental protection during construction will be achieved by following industry standard codes of practice such those explained in the Environment Agency Pollution Prevention Guidelines PPG5 (Ref 13.25) and PPG6 (Ref 13.26).
Adverse geotechnical ground conditions.	New structures etc.	Adverse ground movements.	Damage to structures.	Low likelihood	Minor	Adverse. Permanent.	Minor significance. The ground conditions are likely to comprise Made Ground. Cut to fill works are likely to be required to allow construction. This will ensure adverse ground movements are minimised. Works to be done in accordance with an appropriate Geotechnical Design Reports and Specifications.

13.179 With regards to construction of the Main SRFI Site, once the effects of embedded mitigation are taken into account, the significant effects of 'moderate' or greater significance for the Construction Phase can be summarised as:

- Effects of asbestos present within existing buildings present on site.

13.180 With regards to construction of the J15a, there are no significant effects of 'moderate' or greater significance for the Construction Phase.

13.181 With regards to construction of the other minor highway works, there are no significant effects of 'moderate' or greater significance for the Construction Phase.

Assessment of Operational Phase Effects

13.182 The baseline study has been used to assess any effects as a result of the Proposed Development after construction (Operational Phase). These are given in **Table 13.20** for the Main SRFI Site and **Table 13.21** for the J15a works and **Table 13.22** for other minor highway works.

13.183 The tables list all effects, including those which have been assessed to be negligible or of minor significance. This is to demonstrate that they have been considered and discounted in terms of the ES, although certain actions will be embedded in the design of the Proposed Development and these are mentioned in the tables. Effects deemed to be of moderate significance or above are considered further and relevant to the EIA process and are summarised below.

13.184 Note that the term "toxic etc." is used as shorthand notation to include all likely harmful effects such as toxic, carcinogenic, mutagenic etc.; and the word "artificial" is used to describe the introduction of a substance by site user/construction worker activities.

Table 13.20: Main SRFI - Potential Significant Effects from Ground and Hazardous Substances (Operational Phase)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the soil and Made Ground by heavy metals, metalloids and PAH from the landfill in the northwest corner of the site.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low Likelihood	Moderate	Adverse. Permanent.	Minor significance. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. No development is planned for this section of the site apart from landscaping and attenuation basins. Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from Site.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Heavy metals and PAH in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely	Minor	Beneficial. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. The development will reduce infiltration, thus improving the groundwater. . The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, no significant metals or PAH groundwater contamination has been noted in the vicinity of Lodge Farm. There are no elevated concentrations of PAH or metal in Milton Malsor Brook.
Heavy metals and PAH in soils as above.	Surface water.	Surface run-off. Fugitive dust. Base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. There are no surface water abstractions within 1000m of the site. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated and are not be a result of the Development. Water monitoring has proven that PAH and metals are at low

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. The development will reduce infiltration, thus improving the groundwater. There are no elevated concentrations of PAH or metal in Milton Malsor Brook. The development will reduce infiltration, thus improving the groundwater and no infiltration drainage will be placed in brownfield land.
Heavy metals and PAH in soils as above.	Groundwater.	Direct infiltration.	Toxic etc., effects from mobile contaminants or dissolved substances	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated and are not be a result of the Development. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. The development will reduce infiltration, thus improving the groundwater. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							at Lodge Farm, no significant metals or PAH groundwater contamination has been noted in the vicinity of Lodge Farm. The development will reduce infiltration, thus improving the groundwater and no infiltration drainage will be placed in brownfield land.
Heavy metals and PAH in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete etc. from PAHs and metals.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Pervasive contamination potentially exists where concentrations exceed tolerable limits. It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Heavy metals and PAH in soils as above.	Landscape planting on site.	Root uptake.	Inhibition of plant growth.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated.
Contamination of the soil and Made Ground by heavy metals, metalloids and PAH from the Made Ground	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Moderate	Adverse. Permanent	Minor significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated apart from at Lodge Farm. Significantly elevated concentrations of contaminates will be

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
located at farmyards, the former petrol filling station and used as gate fill at field entrances across the site.							excavated and disposed or more likely remediated on site (by materials management). Surface soils are likely to be covered by hardstanding or a growing medium, limiting Ingestion of soil, inhalation of fugitive dust and direct contact.
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from Site.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. The concentrations of metals and PAH are not significantly elevated with regards to offsite migration. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Heavy metals and PAH in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely	Minor	Beneficial. Permanent.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. The concentrations of metals and PAH are not significantly elevated apart from at Lodge Farm. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							potential contaminants will attenuate as the groundwater moves away from the source. The development will reduce infiltration, thus improving the groundwater. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, no significant metals or PAH groundwater contamination has been noted vicinity of Lodge Farm. There are no elevated concentrations of PAH or metal in Milton Malsor Brook.
Heavy metals and PAH in soils as above.	Surface water.	Surface run-off. Fugitive dust. Base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. There are no surface water abstractions within 1000m of the site. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. The concentrations of metals and PAH are not significantly elevated apart from at Lodge Farm and are not be a result of the Development. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							moves away from the source. The development will reduce infiltration, thus improving the groundwater. There are no elevated concentrations of PAH or metal in Milton Malsor Brook. The development will reduce infiltration, thus improving the groundwater and no infiltration drainage will be placed in brownfield land.
Heavy metals and PAH in soils as above.	Groundwater.	Direct infiltration.	Toxic etc., effects from mobile contaminants or dissolved substances	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. The concentrations of metals and PAH are not significantly elevated apart from at Lodge Farm and are not be a result of the Development. Water monitoring has proven that PAH and metals are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. The development will reduce infiltration, thus improving the groundwater. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, no significant metals or PAH groundwater

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							contamination has been noted vicinity of Lodge Farm. The development will reduce infiltration, thus improving the groundwater and no infiltration drainage will be placed in brownfield land.
Heavy metals and PAH in soils as above.	Construction materials.	Direct contact.	Impact to plastics, services, bitumen's and buried concrete etc. from PAHs and metals.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Contamination is present where concentrations exceed tolerable limits. It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Heavy metals and PAH in soils as above.	Landscape planting on site.	Root uptake.	Inhibition of plant growth.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at a number of isolated locations across the site and does contain metals and PAH above the detection limits of the analytical apparatus. However, the concentrations of metals and PAH are not significantly elevated when compared to plant life GACs.
Contamination of the soil and Made Ground by Petroleum Hydrocarbons from the landfill in the northwest	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
corner of the site.							
Petroleum Hydrocarbons in soils as above.	Site Users	Inhalation of vapours.	Toxic etc. effects.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations and carbon banding of Petroleum Hydrocarbons are such that significant vapours will not be present.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated and are not as a result of the Development. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. Water monitoring has proven that Petroleum Hydrocarbons are at low concentrations in the landfill. In addition, the concentration of potential contaminants will attenuate as the groundwater moves away from the source. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site. Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, the landfill site is downgradient of Lodge farm. There are no elevated concentrations of Petroleum Hydrocarbons in Milton Malsor Brook. The development will reduce infiltration, thus improving the groundwater and no infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely	Minor	Beneficial. Permanent.	Negligible significance. Made Ground is present at the landfill and does contain TPH above the detection limits of the analytical apparatus. However, the concentrations of TPH are not significantly elevated and are not as result of the Development. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. Water monitoring has proven that Petroleum Hydrocarbons are at low concentrations in the landfill. In addition, the

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							concentration of potential contaminants will attenuate as the groundwater moves away from the source. There are no elevated concentrations of Petroleum Hydrocarbons in Milton Malsor Brook.
Petroleum Hydrocarbons in soils as above.	Surface water.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former landfill. There are no surface water abstractions within 1000m of the site. Made Ground is present at the landfill and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations of Petroleum Hydrocarbons are not significantly elevated. Petroleum Hydrocarbons are present in perched groundwater within the Made Ground. However, whilst this is occasionally elevated, concentrations will attenuate as the groundwater moves away from the site. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. There are no elevated concentrations of Petroleum

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Hydrocarbons in Milton Malsor Brook or Wootton Brook. The development will reduce infiltration, thus improving the groundwater and no infiltration drainage will be placed in brownfield land.
Contamination of the soil and Made Ground by Petroleum Hydrocarbons associated with the former filling station on the central western boundary of the site,	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor (proven) Moderate (potential)	Adverse. Permanent	Minor significance. The soils in the vicinity of historical tanks at the former filling station contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, assessment has indicated generally a low risk. However, there is the potential for elevated concentrations of Petroleum Hydrocarbons in close proximity to former tanks. Significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on site (by materials management). Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Site Users	Inhalation of vapours.	Toxic etc. effects.	Low likelihood	Minor	Adverse. Permanent	Negligible significance. The soils in the vicinity of historical tanks at the former filling station do not contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Whilst there is the potential for elevated concentrations of Petroleum Hydrocarbons in close proximity to former tanks, these are unlikely to contain significant volatile components and vapour risk is low.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Whilst petroleum hydrocarbons may be present when tanks are removed, there is unlikely to be substantial removal of soil off site as this will be reused on site wherever possible. Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Unlikely	Negligible	Beneficial. Permanent.	Negligible significance. The soils in the vicinity of historical tanks at the former filling station do not contain significant elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Whilst, there is the potential for elevated concentrations of Petroleum Hydrocarbons in very close proximity to former tanks, this is likely to be restricted due to the significant clay content of the soils in this section of the site and will attenuate as the groundwater moves away from the site. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. No infiltration drainage will be placed in brownfield land. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, the former petrol filling station site is downgradient of Lodge Farm.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former filling station. However, this is a significant distance removed from the former filling station. There are no surface water abstractions within 1000m of the site. The soils in the vicinity of historical tanks at the former filling station do not contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Whilst, there is the potential for elevated concentrations of Petroleum Hydrocarbons in very close proximity to former tanks, this is likely to be restricted due to the significant clay content of the soils in this section of the site and will attenuate as the groundwater moves away from the site. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. No infiltration drainage will be placed in brownfield land. There are no elevated concentrations of Petroleum

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Hydrocarbons in Milton Malsor Brook or Wootton Brook.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and flows to the east and downgradient of the former filling station. However, this is a significant distance removed from the former filling station. There are no surface water abstractions within 1000m of the site. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system.
Contamination of the soil and Made Ground by Petroleum Hydrocarbons located at farmyards (either in Made Ground or associated	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Moderate	Adverse. Permanent	Minor significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons. Significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on site (by materials management). However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
with storage tanks).							
Petroleum Hydrocarbons in soils as above.	Site Users	Inhalation of vapours.	Toxic etc. effects.	Low Likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However, the concentrations and carbon banding of Petroleum Hydrocarbons are such that significant vapours will not be present.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no licenced groundwater abstractions within 1000m of the site.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							Whilst groundwater may be abstracted from a borehole noted at Lodge Farm, no TPH has been noted in groundwater near Lodge Farm. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. No infiltration drainage will be placed in brownfield land. There are no elevated concentrations of Petroleum Hydrocarbons in Milton Malsor Brook or Wootton Brook.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Milton Malsor Brook flows south to north through the western part of the site and is downgradient of the farms. Wootton Brook is located to the north of the farms. However, these are a significant distance removed from the farms. There are no surface water abstractions within 1000m of the site. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. However Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. The development will reduce infiltration, thus improving the

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an improvement in water quality. There are no elevated concentrations of Petroleum Hydrocarbons in Milton Malsor Brook or Wootton Brook. Surface soils are likely to be covered by hardstanding or a growing medium. All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Made Ground is present at the farmyards and does contain elevated Petroleum Hydrocarbons above the detection limits of the analytical apparatus. Petroleum Hydrocarbons are not present in perched groundwater within the general Made Ground. Surface soils are likely to be covered by hardstanding or a growing medium. The development will reduce infiltration, thus improving the groundwater. In addition, source reduction (betterment) via treatment of any hydrocarbons that exceed the tolerable limits will be undertaken during the construction phase. This will lead to an

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							improvement in water quality. All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete etc. from petroleum hydrocarbons.	Low likelihood	Medium	Adverse. Permanent	Minor significance. Pervasive contamination potentially exists where concentrations exceed tolerable limits. It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Contamination of the soil and Made Ground by asbestos.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Permanent	Minor significance. Made Ground is present at the site and may contain asbestos. Asbestos is potentially present and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. Main risk is to future maintenance workers who are excavating at the site, rather than the occupiers. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils. Cover of growing medium to be installed at former landfill in northeast, former sandpit (now filled) at Rathvilly farm

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Asbestos in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Asbestos is potentially present and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium. Any fugitive dust from the surface is low risk. Cover of growing medium to be installed at former landfill in northeast, former sandpit (now filled) at Rathvilly farm
Asbestos in soils as above.	Surrounding ecosystem.	Fugitive dust.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely.	Negligible.	Adverse. Temporary.	Negligible significance. Asbestos is potentially present and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium. Cover of growing medium to be installed at former landfill in northeast, former sandpit (now filled) at Rathvilly farm Any fugitive dust from the surface is low risk.
Asbestos in soils as above.	Future Maintenance Workers	Direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Made Ground is present at the site and may contain asbestos. Asbestos is potentially present and future maintenance workers may come into contact if excavation is undertaken. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Ground gases from the landfill.	Site Users	Build-up of gases to the Lower	Explosion or asphyxiation in confined	Low likelihood	Minor	Adverse. Permanent	Negligible significance. Ground gases are present. However, they are low risk due to the low concentrations and low flow rates.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		Explosive limit. Entry into confined spaces.	spaces.				
Ground gases as above.	Off-site population.	Build-up of gases to greater than Lower Explosive Limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Low likelihood	Minor	Adverse. Permanent	Negligible significance. Concentrations of ground gases have been monitored at low concentrations. Gas flow rates are low.
Ground gas (radon).	Site users.	Entry into confined spaces.	Carcinogenic effects.	Medium likelihood	Medium	Adverse. Permanent.	Moderate significance. Based on geological study, basic protection measures required.
Adverse geotechnical ground conditions.	New structures etc.	Adverse ground movements.	Damage to structures.	Unlikely	Medium	Adverse. Permanent.	Negligible significance. The ground conditions at the operations stage, will have been improved to allow construction within tolerable limits of settlement.

Table 13.21: J15a - Potential Significant Effects from Ground and Hazardous Substances (Operational Phase)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the Made Ground soil and demolition arisings by heavy metals, metalloids and PAH.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor	Beneficial. Permanent.	Minor significance. Made Ground may be present and may contain elevated metals and PAH. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. No buildings proposed for the J15a works and exposure will be very limited as site users drive through the site.
Heavy metals, metalloids and PAH in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. The Grand Union Canal is located on site and a tributary of Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). This will lead to an improvement in water quality. All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The concentrations of metals and PAH are not anticipated to be significantly elevated with regards to offsite migration. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Heavy metals, metalloids and PAH in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Negligible	Beneficial. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no groundwater abstractions within 1000m of the site. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). No infiltration drainage will be placed in brownfield land.
Heavy metals, metalloids and PAH in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Adverse. Permanent.	Negligible significance. The Grand Union Canal is located on site and a tributary of Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
		contaminated groundwater.					Made Ground may be present and may contain elevated metals and PAH. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system. No infiltration drainage will be placed in brownfield land.
Contamination of the soil and Made Ground by Petroleum Hydrocarbons.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor	Adverse. Permanent	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. No buildings proposed for the J15a works and exposure will be very limited as site users drive through the site.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated petroleum hydrocarbons. The concentrations of petroleum hydrocarbons are not anticipated to be significantly elevated with regards to offsite

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							migration. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated petroleum hydrocarbons. The concentrations of petroleum hydrocarbons are not anticipated to be significantly elevated with regards to offsite migration. If present, in significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system. No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in	Construction	Direct contact.	Impact to services,	Low	Medium	Adverse.	Minor significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
soils as above.	materials.		plastics, bitumen's and buried concrete etc. from petroleum hydrocarbons.	likelihood		Permanent	Made Ground may be present and may contain elevated petroleum hydrocarbons. The concentrations of petroleum hydrocarbons are not anticipated to be significantly elevated with regards to offsite migration. If present, in significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). It is possible for services to come into contact with contamination. However, embedded mitigation undertaken during design works will ensure all services are placed in clean soils.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The Aquifers on site are either Secondary Aquifers, or Unproductive Strata and there are no groundwater abstractions within 1000m of the site. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in	Surface water and possible	Leaching through	Toxic etc., effects from	Low likelihood	Minor	Beneficial.	Negligible significance. The Grand Union Canal is located on site and a tributary of

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
soils as above.	abstractors or ecosystems.	unsaturated zone, surface run-off, base flow from contaminated groundwater.	mobile contaminants or dissolved substances.			Permanent.	Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system. No infiltration drainage will be placed in brownfield land.
Contamination of the soil and Made Ground by asbestos.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Medium	Beneficial. Permanent.	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. If present, significantly elevated concentrations of contaminates will be excavated and disposed. Asbestos is potentially present and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. No buildings proposed for the J15a works and exposure will be very limited as site users drive through the site. Main risk is to future maintenance workers who are excavating at the site, rather than the occupiers.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Asbestos in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Beneficial. Permanent.	Negligible significance. Made Ground may be present at the site and may contain asbestos and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium. Any fugitive dust from the surface is low risk.
Asbestos in soils as above.	Surrounding ecosystem.	Fugitive dust.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely.	Negligible.	Beneficial. Permanent.	Negligible significance. Made Ground may be present at the site and may contain asbestos and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium. Any fugitive dust from the surface is low risk.
Asbestos in soils as above.	Future Maintenance Workers	Direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Made Ground may be present at the site and may contain asbestos. Asbestos is potentially present and future maintenance workers may come into contact if excavation is undertaken. Main risk is to future maintenance workers who are excavating at the site, rather than the occupiers. However, embedded mitigation undertaken during design works will ensure all services are placed in installed in over-excavated trenches, backfilled with clean stone.
Ground gases	Site Users	Build-up of	Explosion or	Unlikely	Negligible	Adverse.	Negligible significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
from the Made Ground, Alluvium or off-site source.		gases to the Lower Explosive Limit. Entry into confined spaces.	asphyxiation in confined spaces.			Permanent	Ground gases may be present. However, they there are no buildings proposed for the J15a development.
Ground gases as above.	Off-site population.	Build-up of gases to greater than Lower Explosive Limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Unlikely	Negligible	Adverse. Permanent	Negligible significance. Ground gases may be present. However, they there are no buildings proposed for the J15a development.
Ground gas (radon).	Site users.	Entry into confined spaces.	Carcinogenic effects.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. There are no buildings proposed for the J15a development.
Adverse geotechnical ground conditions.	New structures etc.	Adverse ground movements.	Damage to structures.	Unlikely	Medium	Adverse. Permanent.	Negligible significance. The ground conditions at the operations stage, will have been improved to allow construction within tolerable limits of settlement.

Table 13.22: Other Minor Highway Works - Potential Significant Effects from Ground and Hazardous Substances (Operational Phase)

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Contamination of the Made Ground soil and demolition arisings by heavy metals, metalloids and PAH.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Minor	Beneficial. Permanent.	Minor significance. Made Ground may be present and may contain elevated metals and PAH. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. No buildings proposed for the minor highway works and exposure will be very limited as site users drive through the site.
Heavy metals, metalloids and PAH in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water leaving the site.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. The Grand Union Canal is located on site and a tributary of Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). This will lead to an improvement in water quality. All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
Heavy metals, metalloids and PAH in soils as above.	Off-site population.	Inhalation of fugitive dust, direct contact	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. The concentrations of metals and PAH are not anticipated to be significantly elevated with regards to offsite migration. However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Heavy metals, metalloids and PAH in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Negligible	Beneficial. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). No infiltration drainage will be placed in brownfield land.
Heavy metals¸ metalloids and PAH in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management).
Contamination	Site Users	Ingestion of	Toxic etc. effects.	Low	Minor	Adverse.	Minor significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
of the soil and Made Ground by Petroleum Hydrocarbons.		soil, inhalation of fugitive dust, direct contact.		likelihood		Permanent	Made Ground may be present and may contain elevated Petroleum Hydrocarbons. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). Surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface. No buildings proposed for the minor highway works and exposure will be very limited as site users drive through the site.
Petroleum Hydrocarbons in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated petroleum hydrocarbons. The concentrations of petroleum hydrocarbons are not anticipated to be significantly elevated with regards to offsite migration. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Surrounding ecosystem.	Fugitive dust or water.	Toxic etc. effects from contaminated dust or water	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. Made Ground may be present and may contain elevated petroleum hydrocarbons. The concentrations of petroleum hydrocarbons are not

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
			leaving the site.				anticipated to be significantly elevated with regards to offsite migration. If present, in significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). However, surface soils are likely to be covered by hardstanding or a growing medium, limiting fugitive dust from the surface.
Petroleum Hydrocarbons in soils as above.	Construction materials.	Direct contact.	Impact to services, plastics, bitumen's and buried concrete etc. from petroleum hydrocarbons.	Low likelihood	Medium	Adverse. Permanent	Minor significance. Made Ground may be present and may contain elevated petroleum hydrocarbons. The concentrations of petroleum hydrocarbons are not anticipated to be significantly elevated with regards to offsite migration. If present, in significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). Embedded mitigation undertaken during design works will ensure all services are placed in installed in over-excavated trenches, backfilled with clean stone.
Petroleum Hydrocarbons in soils as above.	Groundwater and possible abstractors.	Leaching through unsaturated zone.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. Made Ground may be present and may contain elevated metals and PAH. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							the SRFI Main site (by materials management). No infiltration drainage will be placed in brownfield land.
Petroleum Hydrocarbons in soils as above.	Surface water and possible abstractors or ecosystems.	Leaching through unsaturated zone, surface run-off, base flow from contaminated groundwater.	Toxic etc., effects from mobile contaminants or dissolved substances.	Low likelihood	Minor	Beneficial. Permanent.	Negligible significance. The Grand Union Canal is located on site and a tributary of Wootton Brook is located just off site to the north. There are no surface water abstractions within 1000m of the site. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. If present, significantly elevated concentrations of contaminates will be excavated and disposed or more likely remediated on the SRFI Main site (by materials management). All surface water is to be attenuated prior to discharge. Interceptors will be installed in the drainage system. No infiltration drainage will be placed in brownfield land.
Contamination of the soil and Made Ground by asbestos.	Site Users	Ingestion of soil, inhalation of fugitive dust, direct contact.	Toxic etc. effects.	Low likelihood	Medium	Beneficial. Permanent.	Minor significance. Made Ground may be present and may contain elevated Petroleum Hydrocarbons. If present, significantly elevated concentrations of contaminates will be excavated and disposed. Asbestos is potentially present and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium,

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							limiting fugitive dust from the surface. No buildings proposed for the minor highway works and exposure will be very limited as site users drive through the site. Main risk is to future maintenance workers who are excavating at the site, rather than the occupiers.
Asbestos in soils as above.	Off-site population.	Inhalation of fugitive dust.	Toxic etc. effects from dust from site.	Low likelihood	Negligible	Beneficial. Permanent.	Negligible significance. Made Ground may be present at the site and may contain asbestos and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium. Any fugitive dust from the surface is low risk.
Asbestos in soils as above.	Surrounding ecosystem.	Fugitive dust.	Toxic etc. effects from contaminated dust or water leaving the site.	Unlikely.	Negligible.	Beneficial. Permanent.	Negligible significance. Made Ground may be present at the site and may contain asbestos and site users may come into contact if excavation is undertaken. However, surface soils are likely to be covered by hardstanding or a growing medium. Any fugitive dust from the surface is low risk.
Asbestos in soils as above.	Future Maintenance Workers	Direct contact.	Toxic etc. effects.	Low likelihood	Medium	Adverse. Permanent.	Minor significance. Made Ground may be present at the site and may contain asbestos. Asbestos is potentially present and future maintenance workers may come into contact if excavation is undertaken. However, embedded mitigation undertaken during design works will

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
							ensure all services are placed in installed in over-excavated trenches, backfilled with clean stone.
Ground gases from the Made Ground, Alluvium or off-site source.	Site Users	Build-up of gases to the Lower Explosive Limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Unlikely	Negligible	Adverse. Permanent	Negligible significance. Ground gases may be present. However, they there are no buildings proposed for the minor highway works.
Ground gases as above.	Off-site population.	Build-up of gases to greater than Lower Explosive limit. Entry into confined spaces.	Explosion or asphyxiation in confined spaces.	Unlikely	Negligible	Adverse. Permanent	Negligible significance. Ground gases may be present. However, they there are no buildings proposed for the minor highway works.
Ground gas (radon).	Site users.	Entry into confined spaces.	Carcinogenic effects.	Unlikely	Negligible	Adverse. Permanent.	Negligible significance. There are no buildings proposed for the minor highway works.
Adverse	New structures	Adverse	Damage to	Unlikely	Medium	Adverse.	Negligible significance.

Source	Receptor(s)	Pathway(s)	Effect	Likelihood of Pollutant Linkage	Magnitude	Effect Type	Impact Significance and Justification
geotechnical ground conditions.	etc.	ground movements.	structures.			Permanent.	The ground conditions at the operations stage, will have been improved to allow construction within tolerable limits of settlement.

13.185 With regards to operation of the Main SRFI Site, once the effects of embedded mitigation are taken into account, the significant effects of 'moderate' or greater significance for the Operational Phase can be summarised as:

- Effects of radon on site users.

13.186 With regards to operation of the J15a, and the other minor highway works, there are no significant effects of 'moderate' or greater significance for the Operational Phase.

Assessment of Decommissioning Phase Effects

13.187 Decommissioning phase effects are the effects resulting from the activities associated with the removal of the Proposed Development if it is removed once it is no longer required.

13.188 It is not known when there will no longer be a need for the Proposed Development and many elements of the development are unlikely to be decommissioned at all. The design life of the warehousing buildings will be in the order of 60+ years (approximately), and the rail infrastructure and civil engineering works will be significantly longer than this. Once the warehouses reach their design life, it is entirely feasible that they will be re-provided in a modern form. Should that occur it would be subject to its own assessment of effects at the relevant time.

13.189 Predicting the baseline so far into the future to enable a meaningful assessment of the sensitivity of the environment, and the significance of effects from the decommissioning of the Proposed Development is extremely difficult.

13.190 When and if the development is decommissioned, the appropriate environmental assessments will be undertaken to identify any significant environmental effects and propose suitable mitigation methods. Notwithstanding this, professional judgement suggests that it is likely that the effects will be similar to, or less than, those experienced during the construction phase.

Cumulative Effects

Cumulative Assessment: Intra-Project Effects

13.191 Intra-project cumulative effects are those that might arise between the different environmental topics being assessed in the EIA.

13.192 The following Chapters have been identified as topics which may share linkages with issues of geology, hydrogeology and ground conditions.

- Interaction with flora and fauna and soil conditions or contamination (**Chapter 16:** Biodiversity).

- Interaction between hydrology and hydrogeology and contamination of surface waters (**Chapter 14:** Hydrology, Drainage and Flood Risk). Potential intra-relationship effects between these disciplines are considered possible only if significant sources of in-ground contamination or sediment run off are

encountered, or produced, respectively, during demolition and construction phases.

- Interaction of ground conditions with archaeology (**Chapter 11**: Archaeology).

- Generation of dust and contamination (**Chapter 9**: Air Quality). Potential intra-relationship effects between these disciplines are considered possible only if significant sources of fugitive dust and odours or volatile contamination is encountered and mobilised to air during demolition and construction.

- Generation of noise and vibration (**Chapter 18**: Noise and Vibration). Potential intra-relationship effects between these disciplines are considered possible only if significant vibration is caused by demolition and construction.

Cumulative Assessment: Inter-project cumulative effects

13.193 Inter-project cumulative effects are those that might arise as a result of the Proposed Development interacting with other developments projects in the vicinity.

13.194 In general, potential cumulative effects to geology, hydrogeology and ground conditions from a contamination perspective are considered possible only where the footprint of proposed development interacts with the footprint of other developments that have the potential to impact upon ground conditions. This is in consideration and in recognition that other major developments will be required to be undertaken in accordance with statutory guidance and best practice relating to construction and land contamination.

13.195 The long-list of projects provided as **Appendix 7.1** has been reviewed. This list includes projects located within the wider surrounding area and was undertaken to assess potential cumulative effects. With regards to the projects identified in **Appendix 7.1**, it is considered that Northampton Gateway is the only project which has the potential to have inter-project cumulative effects.

13.196 The assessment with regards to geology, hydrogeology and ground conditions are highly site specific, with assessments generally limited to the site only. However, potential cumulative effects with regards to inter-project cumulative effects when considering the Northampton Gateway project are:

- Ground stability, with the Northampton Gateway site being located immediately adjacent to the Rail Central Main SRFI site on the southern side of the Northampton Loop Rail Line.

- Potential for surface water discharge and runoff during construction.

13.197 However, it is considered that no significant cumulative effects will in practice occur as:

- The existing Northampton Loop Rail Line, effectively acts as a barrier to interaction between the two developments.

- Based on a review of the ground conditions at the sites, and on the assumption that all works will be undertaken in accordance with suitable geotechnical designs and Specifications, to the satisfaction of Network Rail and Building Control, ground stability will not be a significant concern.

- All works should be undertaken in line with Environmental best practice including PPG5 (Ref 13.25), which would reduce and restrict surface water discharge and run off.

Mitigation Measures

Introduction

13.198 Mitigation measures will be put in place during the design and the construction phases of the Proposed Development. Where likely significant environmental effects of 'moderate' or greater significance have been identified in the sections above, mitigation measures are proposed. These are summarised in **Table 13.23** during construction in order of significance of the likely significant environmental effect. There is no need for mitigation measures where effects are assessed to be 'minor' or 'negligible'. Nevertheless, best practice measures are also proposed to further reduce the significance of other adverse effects (non-significant) where appropriate.

13.199 The majority of the potential significant effects will be mitigated by remediation to industry standard methods in agreement with the regulatory authorities.

During Construction

13.200 Protection of workers during the construction phase will be undertaken by the contractors. The measures required are standard best practice and include compliance with a number of regulations including, but not limited to, the Construction (Design and Management) Regulations 2015 (Ref 13.28), the Control of Asbestos at Work Regulations 2012 (Ref 13.27), the Asbestos (Licensing) Regulations 1998 (Ref 13.29)and the Health and Safety at Work etc. Act 1974 (13.30).

13.201 Environmental protection during construction will be achieved by the following of industry standard codes of practice such those explained in the EA Pollution Prevention Guideline PPG5 (Ref 13.25) and PPG6 (Ref 13.26). This will include requirements such as the bunded storage of any chemicals or fuel kept on site and the introduction of petrol interceptors to filter run off from areas of hardstanding created for construction plant.

13.202 Handling and clearance of waste will be carried out under UK legislation, enacted to comply with the EU Waste Framework Directive and will be subject to approval from the EA. Preventing contamination of surface water during the construction phase will be of paramount importance.

13.203 Re-use of soils will be undertaken in accordance with an approved Materials Management Plan [MMP] in accordance with the CL:AIRE 'Development Industry Code of Practice -

Definition of Waste'. This will demonstrate how the re-use of soils meet the required criteria of a MMP:

- protection of human health and protection of the environment;
- suitability for use, without further treatment;
- certainty of use; and
- quantity of material.

13.204 An Environmental Permit will be required to undertake the remediation at the site. As part of the submission of the Environmental Permit application, the remediation contractor will need to have agreed all appropriate licences, appropriate monitoring protocols and emergency procedures. No remediation works are to begin without an approved Environmental Permit in place. In addition, the Environmental Permit will need to include all required and relevant monitoring as detailed the in the Construction Environmental Management Plan (CEMP) (**see Appendix 13.4**) and Materials Management Plan (**See Appendix 13.5**), Remediation Method Statement (**Appendix 13.8**) and Pollution Prevention Method Statement (PPMS) (See **Appendix 13.9**).

13.205 All works will be undertaken in accordance with suitable geotechnical design reports and specifications.

13.206 It should be noted that whilst some of the impacts are not present on all parts of the site, where impacts are present at the various locations (refer to **Tables 13.17** to **13.22**) the impact and the mitigation measures described below apply across the entire site (Main SRFI, J15a and other minor highway works).

During Operation

13.207 Protection of site users during operation will be undertaken by works during construction. Works during Operations will comprise standard maintenance only and no ongoing monitoring is required.

13.208 Mitigation measures (including embedded) are detailed in **Table 13.23**.

Table 13.23: Mitigation Measures

Potential effect Construction	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
Asbestos in existing buildings impacting site workers during demolition	All asbestos in buildings to be removed works to be undertaken by appropriately trained contractors who would be required	Implementation of a Demolition Specification which will include the requirement of the contractor to hold the appropriate licences and	The Health and Safety at Work etc. Act 1974 (Ref 13.30).

Potential effect	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
	to obtain appropriate licences. • Demolition asbestos surveys to be undertaken prior to demolition. • All asbestos in buildings to be removed prior to demolition by appropriately trained contractors who would be required to obtain appropriate licences in accordance with the Control of Asbestos Regulations, 2012 (Ref 13.27). • Damping down to be undertaken throughout the works to reduce the generation of dust. • Dust Monitoring to confirm low dust levels. • Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. • Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.	have completed the appropriate notifications, including: ASB NNLW1 – Notification of non-licensed asbestos work if the work is deemed not be requiring a licence. ASB 5 Control of Asbestos Regulations 2012 (CAR) regulation 9 - Notification of asbestos work.	The Control of Asbestos Regulations, 2012 (Ref 13.27).
Effects of soil contamination on workers. Metals and PAHs in Made Ground. Asbestos in Made Ground. Petroleum hydrocarbons in Made Ground.	Vigilance during construction work to report unexpected pockets of contamination such as patches of oil not identified during the ground investigation. Vigilance during construction work to report any Asbestos Containing Material. Adopt Appropriate mitigation measures which shall be undertaken throughout the works including: Damping down and cleaning	Implementation of Construction Environmental Management Plan (CEMP). Implementation of Pollution Prevention Method Statement (PPMS). Implementation of the Remediation Method Statement (RMS), which states: The requirements with regards to unexpected contamination. The requirements with regards to compliance with legislation and	The Health and Safety at Work etc. Act 1974 (Ref 13.30).

Potential effect	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
	roadways to be undertaken throughout the works to reduce the generation of dust. Damping down of excavated soils to prevent the generation of dust. Dust Monitoring to confirm low dust levels. Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them. Installation of services in clean corridors (if placed within potentially contaminated Made Ground.	standards and the requirement of the contractor to undertake appropriate Health and Safety Risk Assessments.	
Formaldehyde Foam which is indicated to be present in decommissioned underground tanks at the former petrol filling station	Vigilance during construction work to report the presence of foam. Adopt Appropriate mitigation measures which shall be undertaken throughout the works including: Damping down to reduce the generation of dust. Implementation of standard hygiene precautions, such as, no eating or smoking without washing hands, designated mess areas. Appropriate risk assessment and provision of appropriate PPE (gloves and Respiratory Protective Equipment (RPE) where job specific tasks require them.	Implementation of the Remediation Method Statement (RMS), which states: The requirements with regards to unexpected contamination. The requirements with regards to compliance with legislation and standards and the requirement of the contractor to undertake appropriate Health and Safety Risk Assessments.	The Health and Safety at Work etc. Act 1974 (Ref 13.30).
Effects of ground gases on workers.	Adopt approved health and safety measures, including Health and Safety Risk Assessments and monitoring of ground gases during entry into confined spaces.	Implementation of the Remediation Method Statement (RMS), which states the requirements with regards to compliance with legislation and standards and the requirement of	

Potential effect	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
		the contractor to undertake appropriate Health and Safety Risk Assessments.	
Effects of soil contamination and contaminated groundwater on groundwater, surrounding ecosystem and surface waters. Metals and PAHs in Made Ground. Petroleum hydrocarbons in Made Ground.	Vigilance during construction work to report unexpected pockets of contamination such as patches of oil not identified during the ground investigation. As part of the CEMP, the contractors will need to have agreed all appropriate licences, appropriate monitoring protocols and emergency procedures. Treatment of water in accordance with PPG5 and discharge either to surface water as part of the Environmental Permit or to sewer under licence.	Implementation of CEMP. Implementation of PPMS. Implementation of the RMS, which indicates: The requirements with regards to unexpected contamination. The requirements with regards to compliance with legislation and standards. That appropriate Environmental permit to be in place before works commence. Surface water discharge licence to be in place if required.	
Dust emissions impacting off-site residential and commercial / industrial site users and members of the public.	Adopt Appropriate mitigation measures, which shall be undertaken throughout the works including: Damping down and cleaning roadways to be undertaken throughout the works to reduce the generation of dust. Damping down of excavated soils to prevent the generation of dust. Dust Monitoring to confirm low dust levels.	Implementation of CEMP. Implementation of PPMS.	
Adverse geotechnical ground conditions.	Further investigation to further define existing conditions. Appropriate ground improvement to be designed to reduce total and differential settlements. Appropriate excavation and placement of Fill during the earthworks.	Implementation of construction is accordance with appropriate Geotechnical Design reports and Earthworks Specification. Implementation of construction in accordance the MMP.	
Silt particles from exposed soil and run-off to the ditch	Implementation of mitigation measures to reduce silt particles within surfaces waters, such as:	Implementation of CEMP. Implementation of PPMS. Implementation of the RMS, which	

Potential effect	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
	Installation of settlement lagoons, silt interceptors and oil interceptors as appropriate. If necessary existing drainage routes will be blocked so as to prevent a preferential pathway. Direction of surface water run-off from stockpiles through a surface water drainage system to provide attenuation, monitoring and, if necessary, treatment. Implementation of a visual inspection on a regular basis, of measures implemented to prevent pollution.	indicates: That appropriate Environmental permit to be in place before works commence. Surface water discharge licence to be in place if required.	
Effects of spills of substances brought to site such as fuel for contractors' plant).	Mitigation to comprise the: Regular maintenance of vehicles and plant and inspection for fuel, oil and hydraulic fluid leaks. Provision of a proprietary oil spill kit in all vehicles with additional kits positioned at appropriate locations around the site. Storage of diesel fuel will be within a bunded area or self-bunded tank. Drainage within the refuelling area to be directed to an oil interceptor to contain any accidental spillage. Storage of small containers in a secure fixed container (COSHH Store) located in the compound. Biodegradable oils will be used on plant operating in or within 10m of any watercourse on site. Mobile refuelling will be avoided wherever possible and shall not be carried out within 10m of a watercourse	Implementation of CEMP.	
Operation			
Effects of soil contamination on site	Mitigation to comprise: The materials management of the	Implementation of construction	

Potential effect	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
users. Metals and PAHs in Made Ground. Petroleum hydrocarbons in Made Ground. Asbestos in Made Ground.	impacted soils during construction to ensure they are placed at depth (for example at the base of the proposed noise bunds) Installation of services in clean corridors (if placed within potentially contaminated Made Ground. No soakaways being placed in Made Ground. Installation of a subsoil and topsoil growing medium where potentially contaminated Made Ground is present at the surface.	in accordance MMP. Implementation of Construction in accordance with the RMS. Design of drainage in accordance with BRE364, which states "The soakaway should not connect a contamination source to a groundwater target".	
Effects of soil contamination on future maintenance workers. Asbestos in Made Ground.	Mitigation to comprise: The materials management of the impacted soils during construction to ensure they are placed at depth (for example at the base of the proposed noise bunds) Installation of services during construction in clean corridors (if placed within potentially contaminated Made Ground.	Implementation of construction in accordance MMP. Implementation of Construction in accordance with the RMS.	
Effects of radon on site users.	Mitigation to comprise construction of appropriate floor slabs and installation of an appropriate radon membrane during construction.	Implementation of Construction in accordance with the RMS.	
Effects of soil contamination on services, plastics, bitumen's and buried concrete etc. due to PAHs, and petroleum hydrocarbons in Made Ground.	Mitigation to comprise the installation of hydrocarbon resistant plastics (in ground) and barrier type pipework during construction. Concrete to be designed according to BRE SD 1 Design Sulphate classification and Aggressive Chemical Environment for Concrete.	Implementation of Construction in accordance with the RMS.	
Decommissioning			
Similar to construction.			

Potential effect	Proposed Mitigation	Means of Implementation	Mechanism for Securing mitigation and DCO reference (where applicable)
Cumulative			
Nil.			

Residual Effects

13.209 There are no residual effects caused by the development remaining after implementation of mitigation measures detailed above, either during construction or after completion (including through operation and decommissioning).

13.210 Following the implementation of mitigation measures detailed above, either during construction or after completion, all potential impacts are reduced to negligible.

13.211 Post Construction, following mitigation, **Table 13.24** summarises the mitigation measures and residual risk magnitude for those linkages which were originally a Moderate significance or greater. It should be noted that whilst some of the impacts are not present on all parts of the site, where impacts are present at the various locations (refer to **Tables 13.17** to **13.22**) the impact and the mitigation measures described below in **Table 13.24** apply across the entire site (Main SRFI, J15a and other minor highway works).

Table 13.24: Summary of Residual Effects

Description of Impact	Significance of Effect	Possible Mitigation Measures	Residual Effect
Construction			
Asbestos in existing buildings impacting site workers during demolition (Main SRFI Site only)	Major significance.	All asbestos in buildings to be removed works to be undertaken by appropriately trained contractors who would be required to obtain appropriate licences.	Negligible significance.
Operation			
Effects of radon on site users.	Moderate significance.	Mitigation to comprise construction of appropriate floor slabs and installation of an appropriate radon membrane.	Negligible significance.
Decommissioning			
Similar to construction.			
Cumulative			
Nil.			

Monitoring

13.212 Monitoring will be required during construction to confirm that the works have been undertaken in accordance with the:

- Construction Environmental Management Plan (CEMP).
- Pollution Prevention Method Statement (PPMS).
- Remediation Method Statement (RMS).
- Geotechnical Design Reports and the Earthworks Specifications.

13.213 No post-construction monitoring is required.

Limitations and Assumptions

13.214 This chapter has been written based on a Desk Study and a preliminary Site Investigation Report for the Main SRFI Site; a Desk Study for J15a and a data review for the other minor highway works. It is assumed that further site investigation works will be undertake at all locations to allow detailed design to be undertaken and the finalisation of management plans and method statements.

13.215 It should be noted that the site area as indicated in the Ground Conditions Desk Study Report, M1 Junction 15a Improvements (**Appendix 13.3**) was correct at the time of the desk study, but has since changed(refer to **paragraph 13.11**). As such, several features identified as a potential contaminant source in the desk study have been removed from this Chapter due to the site boundary changes noted above. The previously identified features, now removed as a potential contaminant source are: Shepherds Lodge, and derelict structures and a number of stockpiles of material land to the north of the M1 and east of the A43). Where relevant this has been noted within this Chapter.

13.216 At this stage detailed design has not been undertaken. Preliminary outline design has been completed to allow "proof of concept" and to highlight potential design issues. Further design works are required.

13.217 Site investigation at the Main SRFI Site has been undertaken on parts of the site where access has been possible. Some parts of the site have not been investigated to date. However, the un-investigated areas comprise open fields, with no significant sources of contamination. Whilst further investigation is required to allow geotechnical design. It is considered that no additional works are required in these areas to assess geo-environmental risk.

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Ref 13.2. DCLG. March 2012. National Planning Policy Framework. DCLG, London.

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Ref 13.4. Environmental Protection Act 1990. Part 2A.

Ref 13.5. ENVIRONMENT AGENCY. August 2013. Groundwater protection: Principles and practice (GP3). Version 1.1. The Environment Agency, Bristol.

Ref. 13.6. Water Resources Act 1991.

Ref 13.7. The Water Act 2003 and 2014.

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Ref 13.9. Waste Framework Directive (2006/12/EC) and daughter directive 2006/118/EC as amended by 2013/39/EU.

Ref 13.10. The Water Supply (Water Quality) Regulations (2016).

Ref 13.11. Groundwater (England & Wales) Regulations (2009).

Ref 13.12. The Private Water Supplies (England) Regulations (2016).

Ref 13.13. West Northamptonshire Joint Core Planning Unit. Adopted December 2014. West Northamptonshire Joint Core Strategy Local Plan (Part 1).

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Ref 13.27 Control of Asbestos Regulations 2012.

Ref 13.28 Construction (Design and Management) Regulations 2015.

Ref 13.29 The Asbestos (Licensing) Regulations 1998.

Ref 13.30 The Health and Safety at Work etc. Act 1974.

Ref 13.31 Northampton Development Plan. Northampton Borough Council (1997). https://www.northampton.gov.uk/info/200205/planning_for_the_future/1746/

Appendices

Appendix 13.1: Hydrock Consultants Limited. April 2015, Updated February 2018. 'Milton Malsor Northamptonshire - Desk Study Report', Ref R/151171/001 Issue 8

Appendix 13.2: Hydrock Consultants Limited. April 2015, Updated February 2018. 'Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main SRFI Site', Ref R/151171/002 Issue 4.

Appendix 13.3: Hydrock Consultants Limited. July 2017, Updated February 2018. 'Rail Central, Milton Malsor. Ground Conditions Desk Study Report, M1 Junction 15A Improvements', Ref R/151171/003 Issue 2.

Appendix 13.4: Hydrock Consultants Limited. February 2018. Rail Central SRFI Northamptonshire. Construction Environmental Management Plan', Ref. RCL-HYD-XX_VAL-RP-GE-5001-S2-P4.

Appendix 13.5: Hydrock Consultants Limited. February 2018. 'Rail Central SRFI Northamptonshire. Materials Management Plan', Ref. RCL-HYD-XX_REM-RP-GE-3001-S2-P4.

Appendix 13.6: Tim O'Hare Associates LLP. July 2017.'Rail Central Development, Milton Malsor, Northamptonshire. Soil Resource Survey.

Appendix 13.7 – Hydrock Consultants Limited. September 2017, Updated February 2018. 'Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main Strategic Rail Freight Interchange - Conceptual Geotechnical Design', Ref R/151171/005 Issue 2.

Appendix 13.8 – Hydrock Consultants Limited. September 2017, Updated February 2018. 'Rail Central. Milton Malsor, Northamptonshire. Ground Investigation Report - Main Strategic Rail Freight Interchange - Remediation Method Statement', Ref R/151171/006 Issue 2.

Appendix 13.9 Hydrock Consultants Limited. February 2018. 'Rail Central SRFI Northamptonshire. Pollution Prevention Method Statement, Ref. Hydrock Ref. RCL-HYD-XX_REM-RP-GE-3003-S2-P4.