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Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume I

Chapter 11 – Geology and Soils

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11. Geology and Soils

11.1 Introduction

11.1.1 This chapter of the Environmental Statement (ES) presents the likely significant geology and soils effects as a result of the Housing Infrastructure Fund (HIF1) Scheme, during construction and operation, on receptors within the study area. This chapter should be read in conjunction with Chapters 1 to 5 of this ES.

11.1.2 Using the methodology outlined in Section 11.4 of this chapter, likely significant effects (adverse and beneficial) have been identified and are described in Section 11.10. A summary of these likely significant effects is provided in Section 11.12 but must be read in conjunction with the whole chapter.

Competent expertise

11.1.3 This chapter of the ES has been prepared by competent experts with relevant and appropriate experience. The technical lead for this geology and soils chapter has 24 years of relevant experience and has professional qualifications as summarised in Appendix 1.1.

11.2 Legislative and policy framework

11.2.1 The following sub-sections provide specific details of the legislation and policies that are of most relevance to the geology and soils assessment, namely where these have informed the identification of receptors and resources and their sensitivity; the assessment methodology; the potential for significant environmental effects; and required mitigation.

Legislation

The Environmental Quality Standards Directive (2008/105/EC)

11.2.2 The Environmental Quality Standards Directive (2008/105/EC) (Ref 11.1) sets out environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of the Water Framework Directive 2000/60/EC (WFD) (Ref 11.2), with the aim of achieving good surface water chemical status and in accordance with the provisions and objectives of Article 4 of that Directive.

The Groundwater Directive (2006/118/EC) (replacing 1980/68/EC)

11.2.3 The Groundwater Directive (2006/118/EC) (replacing 1980/68/EC) (Ref 11.3) sets out measures for the protection of groundwater against pollution by certain dangerous substances.

The Dangerous Substances Directive (67/548/EEC)

11.2.4 The Dangerous Substances Directive (67/548/EEC) (Ref 11.4) sets out the measures on pollution caused by certain dangerous substances discharged into the aquatic environment.

The Environmental Protection Act 1990 and Part 2A (the Contaminated Land Regime)

- 11.2.5 Part 2A of the Environmental Protection Act 1990 (Ref 11.5) provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment. Enforcing authorities are required to identify and deal with such land.

The Environment Act 1995 (as amended)

- 11.2.6 The Environment Act 1995 (Ref 11.6) makes provision with respect to contaminated land and abandoned mines.

The Water Act 2014

- 11.2.7 The Water Act 2014 (Ref 11.7) provides measures with regards to holding and issuing licences for water abstractions. The four broad aims of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation.

The Water Resources Act 1991 (as amended)

- 11.2.8 The Water Resources Act 1991 (as amended) (Ref 11.8) gives the Environment Agency (EA) powers and duties to prevent or remedy the pollution of controlled waters. Previously under the Act and now under the Environmental Permitting (England and Wales) Regulations 2010 (as amended 2012) it is a criminal offence for a person to cause or knowingly permit pollution of controlled waters.

The Water Environment (Water Framework Directive) Regulations 2017

- 11.2.9 The Water Environment (Water Framework Directive) Regulations 2017 (Ref 11.9) sets out the measures for establishing a framework for community action in the field of water policy. These Regulations revoke and replace the 2003 Regulations.

The Private Water Supplies (England) (Amendment) Regulations 2018

- 11.2.10 The Private Water Supplies (England) (Amendment) Regulations 2018 (Ref 11.10) apply to private water supplies intended for human consumption. The Regulations set out the requirements and imposes a duty on each local authority to carry out a risk assessment of every private water supply in its area. These Regulations place a duty on local authorities to monitor private water supplies and to ensure that each sample taken is analysed. It also requires the local authority to make and keep records for every private water supply in its area. These Regulations also require supplies to be sampled before being brought back into use if decommissioned or if supplies are new.

The Environmental Permitting (England and Wales) Regulations 2016

- 11.2.11 The Environmental Permitting (England and Wales) Regulations 2016 (Ref 11.11) set out the measures for those carrying out activities that may cause imminent threats of, or actual 'environmental damage', which require a permit. These Regulations also outline the authorities responsible for enforcing the Regulations.

The Environmental Damage (Prevention and Remediation) (England) Regulations, 2015

- 11.2.12 The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref 11.12) describe the legal framework for the prevention of environmental damage and requirements for remediation of damage when it occurs. It sets out the

UK Government views on how they should be applied and how particular terms should be interpreted.

The Contaminated Land (England) (Amendment) Regulations, 2012

11.2.13 The Contaminated Land (England) (Amendment) Regulations, 2012 (Ref 11.13) set out the processes of risk assessment and identification/ evaluation of remediation options.

The Land Drainage Act 1991 (as amended)

11.2.14 The Land Drainage Act 1991 (as amended) (Ref 11.14) requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream, for example a new housing development.

The Waste (England and Wales) Regulations

11.2.15 The Waste (England and Wales) Regulations 2011 (Ref 11.15) set out the measures required for the prevention of, production and management of waste.

National planning policy

National Planning Policy Framework

11.2.16 The National Planning Policy Framework (NPPF) (Ref 11.17) contains policies relevant to the geology and soils assessment. For example: paragraph 174 relates to contributing to and enhancing the local environment (including economic and other benefits of the Best and Most Versatile agricultural land); and paragraphs 183 – 184 relate to ground conditions and pollution.

Planning Policy Guidance

11.2.17 The relevant Planning Policy Guidance (PPG) for the geology and soils assessment is: Land Affected by Contamination (Ref 11.18) and Land Stability (Ministry of Housing, Communities and Local Government, 2014) Updated 2019 (Ref 11.18a).

Local planning policy

- The South Oxfordshire District Council (SODC) Local Plan 2034 (Ref 11.19); and
- The Vale of White Horse District Council (VoWHDC) Local Plan 2031 (Ref 11.21).

11.2.18 The saved policies of the Local Plan relating to environmental protection are relevant to the geology and soils assessment, in particular:

- Surface water protection (page 170);
- Groundwater protection (page 206);
- Contaminated land (page 187 and 205);
- Hazardous substances (page 186); and
- Minerals and waste (page 204).

SODC Core Strategy, 2012

11.2.19 The following policies of the SODC Core Strategy (Ref 11.20) are relevant to the geology and soils assessment:

- The environment; in particular, the sub-section on water (page 99); and
- Green infrastructure and biodiversity (page 108).

VoWHDC Local Plan 2031

11.2.20 The policies of the VoWHDC Local Plan 2031 (Ref 11.21) that are relevant to the geology and soils assessment include:

- Core Policy 16: Didcot A Power Station, which outlines the Council’s support for redevelopment of the Didcot A site (Part 1, page 84);
- Core policy 46, which sets out the measures for conservation and improvement of biodiversity, including sites of special scientific interest (SSSI) and locally important geological sites (Part 1, page 143); and
- Development Policy 27, which sets out the measures required for land affected by contamination (Part 2 – Detailed Policies and Additional Sites, page 106).

Oxfordshire County Council (OCC) Connecting Oxfordshire: Local Transport Plan 4 (LTP 4): Strategic Environmental Assessment

11.2.21 The policies of the OCC Connecting Oxfordshire: LTP4 (Ref 11.22) that are relevant to the geology and soils assessment include:

- 4.7 Water, particularly 4.7.1 Water Framework Directive and 4.7.2 Surface Water Quality (page 28-30);
- 4.8 Geology and Soils (page 31);
- 6.3.8 Water, SEA Objective 9 (page 54);
- 6.3.9 Geology and Soil, SEA Objective 11 & 12 (page 55);
- 7.7 Water (page 61); and
- 7.8 Geology and Soil (page 62).

11.3 Consultation with relevant stakeholders

11.3.1 An EIA Scoping Opinion Request was submitted by OCC (as the promoter) to OCC in its capacity as the Local Planning Authority (LPA) in April 2020, which sought the opinion of the LPA regarding the approach for the assessment of environmental effects resulting from the construction and operation of the Scheme. In accordance with the EIA Regulations, the LPA consulted statutory stakeholders and non-statutory stakeholders where they considered it applicable. The consultation responses detailed in Table 11.1 were received in relation to geology and soils.

11.3.2 Consultation has been carried out through emails to Oxfordshire Geology Trust, Thames Valley Environmental Records Centre (TVERC), and Natural England, requesting any information they may have on sensitive geological sites that may have not been made public. The response from Natural England was that they had no further information other than what was available on the 'MAGIC' website (Ref 11.23). No responses have been received from TVERC or Oxfordshire Geology Trust.

11.3.3 A consultation meeting was conducted on the 5th October 2020 between AECOM, OCC and the EA to discuss pertinent information relating to the Scheme. During the meeting the EA confirmed the location of the landfills potentially affecting the Scheme, which were previously identified by AECOM using the Envirocheck reports (Ref 11.39, 11.40, 11.41 and 11.42). The EA stated that there were no other landfill operations in the vicinity of the Scheme. It was confirmed by the EA, and supported by the LPA,

that they are working on the assumption that the areas around the former Didcot A Power Station will be remediated satisfactorily prior to the construction of the Scheme.

Table 11.1: Scoping Opinion and responses

Scoping Opinion	Where addressed within the ES
Clifton Hampden Parish Council	
Paragraph 10.4.19 notes that there is no agricultural land classification for the northern areas of the Didcot to Culham River Crossing or for any part of the Clifton Hampden Bypass section. The EIA should include a detailed soil survey for these sections of the scheme and include an assessment of the schemes impact on Best and Most Versatile Agricultural Land.	See Section 11.7.
Culham Parish Council	
The range of developments included within the scope of the cumulative impact assessment should be agreed, in advance, with relevant consultees including Culham Parish Council. The quantitative assessment should include consideration of issues such as flood risk, landscape and visual impacts, permanent loss of agricultural land , light pollution, air quality impacts, noise and vibration, nature conservation impacts, fragmentation of agricultural land holdings, water quality and traffic impacts.	See Section 11.10.
Natural England	
The EIA will need to consider any impacts upon local wildlife and geological sites. Local Sites are identified by the local wildlife trust, geo-conservation group or a local forum established for the purposes of identifying and selecting local sites. They are of county importance for wildlife or geodiversity. The Environmental Statement should therefore include an assessment of the likely impacts on the wildlife and geodiversity interests of such sites. The assessment should include proposals for mitigation of any impacts and if appropriate, compensation measures. Contact the local wildlife trust, geo-conservation group or local sites body in this area for further information.	See Section 11.3.
Natural England does not hold local information on local sites, local landscape character and local or national biodiversity priority habitats and species. We recommend that you seek further information from the appropriate bodies (which may include the local records centre, the local wildlife trust, local geo-conservation group or other recording society and a local landscape characterisation document).	See Section 11.3.
Impacts from the development should be considered in light of the Government's policy for the protection of the Best and Most Versatile (BMV) agricultural land as set out in paragraph 170 of the NPPF. We also recommend that soils should be considered in the context of the sustainable use of land and the ecosystem services they provide as a natural resource, as also highlighted in paragraph 170 of the NPPF. As identified in the NPPF new sites or extensions to new sites for peat extraction should not be granted permission by Local Planning Authorities or proposed in development.	See Section 11.9.
OCC Environment Strategy Manager (Nick Mottram)	
Local Plan Policy: Oxfordshire County Council “acknowledged” the climate emergency at a meeting of Council in October 2019. The County Council has published its declaration Climate Action for a Thriving Oxfordshire (2020) setting out its commitment to be a zero-carbon organization by 2030, and fully playing its part in creating a zero carbon Oxfordshire. Whilst not an area in which OCC can offer specific expertise, I note the following: the assessment of climate	See Section 11.9.

Scoping Opinion	Where addressed within the ES
<p>change includes the impacts due to loss of carbon sink through initial land clearance (Table 15.5). This will require an assessment of all existing and future soil carbon resources. The assessment should also consider the wider natural capital and ecosystem service functions of the soil resource as indicated in section 170 of the NPPF (2019). This should be linked back to the Geology and Soils section and in particular the proposals for soil survey in 11.8.3. In order to adequately assess soil functions and impacts it may be necessary to include all soils not just those in the Grade 3 category.</p>	
<p>Environment Agency</p>	
<p>As referred to in chapter 1, the majority of the proposals lie over Gault Clay bedrock which is unproductive strata. The main impact on groundwater will be on superficial secondary aquifers such as river gravels and lower greensand. Overall, the sensitivity of groundwater quality is moderate in this area.</p> <p>The report indicates that development may be located near to areas of potential contamination such as railways and landfill which could pose a risk to water quality. The proposal to carry out ground investigation as mentioned in section 11.8.1 should satisfy our requirements to characterise the site and assess the risk to groundwater to see if any remedial works are required.</p>	<p>See Section 11.5.3.</p>
<p>Please ensure that you continue to discuss key areas of environmental impact with us during preparation of the EIA. Further engagement will provide you with the opportunity to discuss and gain our views on potential impacts and options for mitigation and enhancement prior to a planning application being submitted.</p>	<p>See Section 11.3.</p>

11.4 Assessment methodology

11.4.1 This geology and soils assessment has been undertaken in accordance with the following guidance:

- Design Manual for Roads and Bridges (DMRB) LA 101: Introduction to environmental assessment (Ref 11.24);
- DMRB LA 104: Environmental assessment and monitoring (Ref 11.25);
- DMRB LA 109: Geology and soils (Ref 11.26);
- DMRB LA 113: Road drainage and the water environment (Ref 11.26A)
- DMRB LA 120: Environmental management plans (Ref 11.27);
- British Standards (BS) 10175+A2:2017 – Investigation of Potentially Contaminated Sites – Code of Practice (Ref 11.28);
- BS 5930:2015+A1:2020 – Code of practice for ground investigations (Ref 11.29);
- BS 3882:2015 – Specification for Topsoil and Requirements for Use (Ref 11.30);
- BS 1997-2:2007 – Eurocode 7: Geotechnical design Ground investigation and testing (Ref 11.31);
- BS 8576:2013 – Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs) (Ref 11.32);
- C552 Contaminated Land Risk Assessment. A Guide to Good Practice (Ref 11.33);
- C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings (Ref 11.34);

- The Definition of Waste: Development Industry Code of Practice, V2 (Ref 11.16);
- CAR-SOIL™ Control of Asbestos Regulations 2012. Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance (Ref 11.35);
- Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (Ref 11.5);
- Waste Classification, Guidance on the classification and assessment of waste (1st Edition v1.1). Technical Guidance WM3 (Ref 11.36);
- Land contamination risk management (LCRM). How to assess and manage the risks from land contamination (Ref 11.37); and
- TR P5-065/TR: Technical Aspects of Site Investigation (Volumes 1 & 2) (Ref 11.38).

11.4.2 With regards to impacts upon agricultural soils, the assessment methodology has taken into account the consultation procedures in the Town and Country Planning (Development Management Procedure) Order 2010 (Ref 11.38a) in which Natural England has to consider proposals which individually or cumulatively involve the loss of more than 20 hectares (ha) of Best and Most Versatile land (defined as agricultural soils with ALC grades 1, 2 and 3a).

Baseline conditions

11.4.3 The baseline for the geology and soils assessment involved reference to the following data sources, consultation with statutory bodies and other organisations, and fieldwork surveys:

- Information available in 'Envirocheck' Reports (Refs 11.39 – 11.42);
- Data from British Geological Survey (BGS) Solid and Drift Geology Sheets (Refs 11.43 – 11.45);
- BGS borehole logs, where appropriate (Ref 11.46);
- Preliminary Sources Study Reports (PSSR) prepared by AECOM, 2020 (Refs 11.47 – 11.50);
- Agricultural land classification (ALC) survey, Reading Agricultural Consultants, 2020 (Ref 11.51) and publicly available data (magic.defra.gov.uk) (Ref 11.23);
- Information on controlled waters as detailed in Chapter 14: Road Drainage and the Water Environment;
- Information provided by FCC Environment UK Limited;
- Consultation with Natural England;
- Consultation with the EA;
- Consultation with TVERC;
- Consultation with Oxfordshire Geology Trust; and
- Consultation with OCC.

11.4.4 Third party information on sites located within the study area, including the former Didcot A Power Station and Sutton Courtenay Landfill, as well as ALC surveys have been reviewed and reported as applicable.

Evaluation of receptor importance or sensitivity

11.4.5 The importance or sensitivity of potential receptors and soil or geological resources to ground condition impacts has been described qualitatively according to the categories itemised in DMRB LA109 (Ref 11.26) and LA113 (Ref 11.26A) as shown in Table 11.2.

Table 11.2: Descriptive scale for importance or sensitivity of geology and soils receptors

Importance	Criteria	Geology	Soil Resources	Receptors susceptible to land contamination impacts
Very High	Very high importance and rarity, international scale and very limited potential for substitution	<ul style="list-style-type: none"> Very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, SSSI's and GCR where citations indicate features of international importance). Geology meeting international designation criteria which is not designated as such. 	<ul style="list-style-type: none"> Soils directly supporting an Environment Agency designated site (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar); and / or ALC Grade 1 & 2 or Land Capability for Agriculture (LCA) Grade 1 & 2 	<ul style="list-style-type: none"> Human health: very high sensitivity land use such as residential or allotments Surface Water: use sensitivity criteria in Road drainage and water environment LA113, (Nationally significant surface water of high importance: e.g. watercourse having a WFD classification shown in a RBMP¹ and Q95 ≥ 1.0 m³/s; site protected / designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water) / species protected by EC legislation LA 108; and Groundwater: use sensitivity criteria in Road drainage and water environment LA113, (Nationally significant groundwater of high importance: e.g. Principal Aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108; groundwater locally supporting a GWDTE²; Source Protection Zone (SPZ) 1.)
High	High importance and rarity, national scale, and limited potential for substitution	<ul style="list-style-type: none"> Rare and of national importance with little potential for replacement (e.g. geological SSSI, ASSI, National Nature Reserves (NNR)). Geology meeting national designation citation criteria which is not designated as such. 	<ul style="list-style-type: none"> Soils supporting a UK designated site (e.g. SSSI); and / or ALC grade 3a, or LCA grade 3.1. 	<ul style="list-style-type: none"> Human health: high sensitivity land use such as public open space Surface water: use sensitivity criteria in Road drainage and water environment LA113 (Locally significant surface water of high importance: e.g. watercourse having a WFD classification shown in a RBMP and Q95 < 1.0 m³/s; species protected under EC or UK legislation LA 108); and Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (Locally significant groundwater of high importance: e.g. Principal Aquifer providing a locally important resource or

¹ River Basin Management Plan

² Groundwater Dependent Terrestrial Ecosystem

Importance	Criteria	Geology	Soil Resources	Receptors susceptible to land contamination impacts
				supporting a river ecosystem; groundwater supporting a GWDTE; SPZ2).
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution	<ul style="list-style-type: none"> Features of regional importance with limited potential for replacement (e.g. RIGS). Geology meeting regional designation criteria which is not designated as such. 	<ul style="list-style-type: none"> Soils supporting non-statutory designated sites (e.g. Local Nature Reserves (LNR), LGS's, Sites of Nature Conservation Importance (SNCI's)); and / or ALC grade 3b or LCA grade 3.2 	<ul style="list-style-type: none"> Human health: medium sensitivity land use such as commercial or industrial Surface water: use sensitivity criteria in Road drainage and water environment LA113 (Surface water of moderate quality and rarity: e.g. watercourses not having a WFD classification shown in a RBMP and Q95 >0.001 m³/s); and Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (Groundwater of moderate quality and rarity: e.g. aquifer providing water for agricultural or industrial use with limited connection to surface water; SPZ3).
Low	Low or medium importance and rarity, local scale	<ul style="list-style-type: none"> Features of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites). 	<ul style="list-style-type: none"> ALC grade 4 & 5 or LCA grade 4.1 to 7; and / or Soils supporting non-designated notable or priority habitats. 	<ul style="list-style-type: none"> Human health: low sensitivity land use such as highways and rail; Surface water: use sensitivity criteria in Road drainage and water environment LA113 (Surface water of lower quality: e.g. watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001 m³/s); and Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (Groundwater of lower quality: e.g. unproductive strata).
Very Low	Very low importance and rarity, local scale	<ul style="list-style-type: none"> No geological exposures, little / no local interest 	<ul style="list-style-type: none"> Previously developed land formerly in 'hard uses' with little potential to return to agriculture 	<ul style="list-style-type: none"> Human health: undeveloped surplus land / no sensitive land use proposed Surface water: N/A; Groundwater: N/A.

11.4.6 Note that soils not categorised as Best and Most Versatile or prime land can be allocated in a higher sensitivity category where particular agricultural practices contribute to the quality and character of the environment or local economy (e.g. in upland areas where lower quality agricultural land is integral to agricultural practices).

Identification and assessment of potential impacts

11.4.7 The magnitude of the geology and soils impact of the Scheme has been determined using the four-point scale with DMRB LA109 (Ref 11.26) and LA113 (Ref 11.26A) as shown in Table 11.3.

Table 11.3: Criteria for assessing the magnitude of impact upon features/ attributes – geology and soils

Magnitude		Criteria	Geology	Soil resources	Receptors susceptible to land contamination impacts
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.	Loss of geological feature / designation and/or quality and integrity, severe damage to key characteristics, features or elements.	Physical removal or permanent sealing of soil resource or agricultural land.	<ul style="list-style-type: none"> Human Health: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels (Ref 11.13a)) SP1010 with potential for significant harm to human health. Contamination restricts future use of land. Surface water: use sensitivity criteria in road drainage and water environment LA113 (i.e. failure of both acute-soluble and chronic-sediment related pollutants in Highways England Water Risk Assessment Tool (HEWRAT) and compliance failure with EQS values; risk of pollution from a spillage $\geq 2\%$ annually; reduction in water body WFD classification). Groundwater: use sensitivity criteria in road drainage and water environment LA113 (i.e. extensive change to an aquifer; potential high risk of pollution to groundwater from routine runoff; reduction in water body WFD classification).
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.	Large scale or major improvement of geological feature / designation; extensive restoration; major improvement to quality of geological feature.	Large scale or major improvement of soil resource or agricultural land quality; extensive restoration; major improvement of soil quality.	<ul style="list-style-type: none"> Human health: large scale or major improvement of contaminated land condition; extensive restoration; major improvement of soil quality in relation to contamination. Surface water: use sensitivity criteria in road drainage and water environment LA113 (i.e. removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse; improvement in water body WFD classification). Groundwater: Groundwater: use sensitivity criteria in road drainage and water environment LA113 (i.e. removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse; improvement in water body WFD classification).
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of / damage	Partial loss of geological feature / designation, potentially	Permanent loss / reduction of one or more soil function(s) and restriction to	<ul style="list-style-type: none"> Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category

Magnitude		Criteria	Geology	Soil resources	Receptors susceptible to land contamination impacts
		to key characteristics, features or elements.	adversely affecting the integrity; partial loss of / damage to key characteristics, features or elements.	current or approved future use (e.g. through degradation, compaction, erosion of soil resource).	<p>4 screening levels) SP1010. Significant contamination can be present. Control / remediation measures are required to reduce risks to human health / make land suitable for intended use.</p> <ul style="list-style-type: none"> • Surface water: use sensitivity criteria in road drainage and water environment LA113 (i.e. failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values; risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually; contribution to reduction in water body WFD classification). • Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (i.e. partial change to aquifer; potential medium risk of pollution to groundwater from routine runoff; reduction in water body WFD classification).
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.	Benefit to, or addition of, key characteristics, features or elements of geological feature / designation; improvement to quality of geological feature.	Benefit to, or addition of, key characteristics, features or elements of soil resource or agricultural land quality; improvement of soil quality.	<ul style="list-style-type: none"> • Human health: benefit to human receptors; improvement of contaminated land condition. • Surface water: use sensitivity criteria in Road drainage and water environment LA113 (i.e. HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition; reduction in existing spillage by 50% of more (when existing spillage risk $> 1\%$ annually); contribution to improvement in water body WFD classification). • Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (i.e. reduction in existing spillage by 50% of more (when existing spillage risk $> 1\%$ annually); contribution to improvement in water body WFD classification).
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.	Minor measurable change in geological feature / designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key	Temporary loss / reduction of one of more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource).	<ul style="list-style-type: none"> • Human health: contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels) SP1010. Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health. • Surface water: use sensitivity criteria in Road drainage and

Magnitude		Criteria	Geology	Soil resources	Receptors susceptible to land contamination impacts
			characteristics, features or elements.		<p>water environment LA113 (i.e. failure of either acute soluble or chronic sediment related pollutants in HEWRAT; risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually).</p> <ul style="list-style-type: none"> • Groundwater: use sensitivity criteria in Road drainage and water environment LA113 i.e. potential low risks of pollution from routine runoff; risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually; minor effects on an aquifer).
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements of geological feature / designation; some beneficial impact on geological feature or a reduced risk of negative impact occurring.	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements of soil resource or agricultural land quality; some beneficial impact on attribute or a reduced risk of negative impact occurring.	<ul style="list-style-type: none"> • Human health: minor benefit to human receptors; some beneficial impact on contaminated land condition or a reduced risk of negative impact occurring. • Surface water: use sensitivity criteria in Road drainage and water environment LA113 (i.e. HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a “fail” condition; reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually)). • Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (i.e. reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually)).
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.	Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature / designation. Overall integrity of resource not affected.	No discernible loss / reduction of soil function(s) that restrict current or approved future use.	<ul style="list-style-type: none"> • Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels) SP1010. No requirement for control measures to reduce risks to human health / make land suitable for intended use. • Surface water: use sensitivity criteria in Road drainage and water environment LA113 (i.e. no risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants); risk of pollution from spillages $< 0.5\%$). • Groundwater: use sensitivity criteria in Road drainage and water environment LA113 (i.e. No measurable impact upon aquifer and/or groundwater receptors and risk of pollution from spillages $< 0.5\%$).

Magnitude		Criteria	Geology	Soil resources	Receptors susceptible to land contamination impacts
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.	Very minor benefit to or positive addition of one or more characteristics, features or elements of geological feature / designation.	Very minor benefit to or positive addition of one or more characteristics, features or elements of soil resource or agricultural land quality.	Very minor benefit to receptors susceptible to land contamination hazards or positive addition of one or more characteristics, features or elements to improve the condition of contaminated land.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.				

Identification of significant effects

11.4.8 For each of the potential impacts identified, an assessment has been made of the likely level of significance of the resulting effects. The effect significance categories are described in Table 11.4.

Table 11.4: Significance categories

Significance category	Typical description
Very large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

11.4.9 The assessment of effect significance was made by taking into account both the importance or sensitivity of the receptor (refer to Table 11.2) and the magnitude of the predicted impact (refer to Table 11.3), using the matrix as presented in Table 11.5, in conjunction with professional judgement of the site-specific factors that may be of relevance.

Table 11.5: Criteria for assessing the significance of effects upon geology and soils

		Magnitude of impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Environmental value (sensitivity)	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

11.4.10 Potential geology and soil effects can be either beneficial or adverse. Effects predicted to be slight or neutral are not considered to be significant, whereas effects assessed as moderate or large are considered to be significant.

11.4.11 When assessing the potential significance of geology and soil environment effects, impact avoidance measures embedded in the Scheme design have been considered

as have standard environmental management activities (refer to Section 11.9). Where potentially significant effects have been predicted, further mitigation and management actions have been defined and the significance of effects with the additional mitigation in place have also been assessed.

11.5 Assessment assumptions and limitations

- 11.5.1 The assessment has been based on the Scheme description detailed within ES Chapter 2: The Scheme, taking account of the lateral and vertical limits of deviation to establish a realistic worst-case assessment scenario.
- 11.5.2 The assessment takes into account the potential for the Scheme to impact existing geological and soil resources and agricultural land, and the impact on potential contaminative land uses through the development of the Scheme.
- 11.5.3 Geology and soils mitigation measures embedded in the design of the Scheme are described in Section 11.10.
- 11.5.4 A ground investigation was undertaken between March and July 2021 to support the geotechnical design for the Scheme. The results of the ground investigation did not identify any potential contamination issues with regards to soils. However, the results from three rounds of groundwater monitoring undertaken so far have identified potential risks to controlled water receptors from metals and inorganic contaminants. Groundwater monitoring is still ongoing and further assessment of data from the remaining monitoring rounds and a Detailed Quantitative Risk Assessment (DQRA) will be required to quantify potential risks to identified receptors. A full interpretation of the ground investigation results and recommendations to the Scheme is available in the Ground Investigation Report (AECOM, 2021) (Ref 11.55) which is submitted with the planning application for the Scheme.
- 11.5.5 Data from the ground investigation will be used to prepare a remediation strategy, provide input to the Construction Environmental Management Plan (CEMP) and CEMP components such as the Soil Management Plan (SMP), Materials Management Plan (MMP), and if required, the Asbestos Management Plan (AMP) and any further plans needed to inform the strategies for mitigation. Refer to Section 11.9 for further details.
- 11.5.6 An agricultural land survey was undertaken in 2020 to determine the area of land which is within the ALC 3a and 3b sub grades to allow an assessment of the impact of the Scheme on agricultural soils and determine mitigation measures. An additional ALC survey was undertaken in March 2021, covering the proposed flood compensation area north of the River Thames.

11.6 Study area

- 11.6.1 In general, the receptors and sources related to the geology and soils assessment have been identified within 250 m to 1 km of the Site boundary, or within the Site boundary. Table 11.6 summarises the search area for baseline information and the study area for the geology and soils impact assessment for each resource or receptor.

Table 11.6: Summary of Study Areas

Receptor/ Resource	Study Area	Rationale
Geology and Soils	Within 250 m of the Site boundary	This is appropriate to assess the local soil and geological setting in accordance with the methodology set out in DMRB LA 109 and the location and nature of onsite and offsite potential receptors.

Receptor/ Resource	Study Area	Rationale
Agricultural Land	Within the Site boundary	For the agricultural soil assessment, the study area comprises the agricultural soils (and their ALC), potentially directly affected by the Scheme i.e. only land underlain by the footprint of the Scheme route and the associated temporary land take that will be restored post construction.
Contaminated Land	Within 250 m of the Site boundary	This is appropriate to assess any influence that potential contaminated land might have on the Scheme.
Soil Chemical Quality	Within the Site boundary	Soil chemical quality, where available, is based on information from within the Site boundary only.
Hydrology: Groundwater Abstractions and Discharge Consents	Within 1 km of the Site boundary	The study area extends far enough from the Scheme to be able to consider contamination migration risks through groundwater.
Hydrology: Surface Water	Within 1 km of the Site boundary	The study area for surface water receptors may be extended further as required downstream, depending on the risk of impact. Moreover, the key surface water features in relation to geology and soils effects are usually on Site or within 250 m of the Site boundary.
Sites Designated for Biodiversity Interests	Within 250 m of the Site boundary	This is considered an appropriate study area for the assessment of potential land contamination affecting ecological receptors. The study area may be further for Sites of Special Scientific Interest (SSSI) if the site is located within the Impact Risk Zone of a SSSI.

11.6.2 The study areas are indicated on Figure 11.1: Geological Sequence and Study Area.

11.7 Baseline conditions

Published Geology

- 11.7.1 BGS mapping (Ref 11.43, 11.44 and 11.45) identifies the geology across the Scheme as described in the following sections.
- 11.7.2 Made ground is expected to be present throughout the study area, in particular along the routes of the A4130 and A415 Abingdon Road, through the area of the former Didcot A Power Station and in areas of infilled ground, such as landfill sites. Made ground may be limited or absent in the areas of the Site located on agricultural land to the south of the existing A4130 and between Didcot and Clifton Hampden.
- 11.7.3 The superficial geology beneath the A4130 Widening section is comprised of Head, described as ‘poorly sorted and poorly stratified, angular rock debris and/ or clayey hillwash and soil creep’. Superficial deposits of Alluvium (clay, silt, sand and gravel) are also located within the study area to the north of the A4130.
- 11.7.4 The superficial geology underlying the southern portion of the Didcot Science Bridge is comprised of Head. The central region of this area is underlain by superficial deposits of Alluvium and the northern region is underlain by superficial deposits of

the Wolvercote Sand and Gravel Member, described as '*predominantly cold phase sands and gravels*'.

- 11.7.5 There are areas of worked ground underlying the Didcot to Culham River Crossing on the BGS mapping, to the south-west of Appleford. Additional areas of worked ground are also shown within the study area and immediately west of the Scheme, to the west and north-west of Appleford. The features are described as voids. No other deposits of artificial ground are shown on the BGS mapping within the study area.
- 11.7.6 The superficial geology beneath the southern-most area of the Didcot to Culham River Crossing comprises Wolvercote Sand and Gravel Member. The central area of this section is underlain by deposits of the Northmoor Sand and Gravel Member.
- 11.7.7 The northern-most area of the Didcot to Culham River Crossing is underlain by Alluvium, following the course of the River Thames and tributaries. Deposits of the Summertown-Radley Sand and Gravel Member underlie the Scheme to the north of the River Thames. These deposits are described as '*predominantly cold phase sands and gravel*'. Local deposits of Head also outcrop to the north of the River Thames, at the western extent of the Scheme.
- 11.7.8 Superficial deposits are absent along most of the Clifton Hampden Bypass. An area in the south of this section is underlain by superficial geology comprising deposits of the Summertown-Radley Sand and Gravel Member. An area in the north of this section is underlain by superficial deposits of the Wolvercote Sand and Gravel Member.
- 11.7.9 The bedrock geology beneath most of the Scheme is Gault Formation, which is described as '*pale to dark grey or blue-grey clay or mudstone, glauconitic in part, with a sandy base*'. The Upper Greensand Formation is located at the south-western corner of the Scheme, sub-cropping below Head deposits. The Upper Greensand Formation also outcrops at the south-eastern corner of the A4130 Widening section and to the south of the study area.
- 11.7.10 The Lower Greensand Group underlies the Site to the north of the River Thames, between Culham and the north-eastern edge of the study area, to the north of Clifton Hampden. This is described as '*mainly sands and sandstones with silts and clays in some intervals*'. Areas of Gault Formation are also locally present north of the River Thames.

Hydrogeology and Hydrology

- 11.7.11 Information to support the findings of the hydrogeology and hydrology across the site is taken from MAGIC website (Ref 11.23) and the four Envirocheck Reports from Landmark (Ref 11.39, 11.40, 11.41, 11.42),
- 11.7.12 The hydrogeology of the Site is described as follows:
- The superficial Head is designated as a secondary undifferentiated aquifer;
 - The Alluvium, Wolvercote Sand and Gravel Member and Summertown-Radley Sand and Gravel Member are designated secondary A aquifers;
 - The bedrock Gault Formation is designated as unproductive strata;
 - The Lower Greensand Group bedrock is designated as a secondary A aquifer; and
 - The Upper Greensand Formation, which is largely outside the hydrology study area, is a Principal Aquifer.

11.7.13 The groundwater vulnerability is described as follows:

- Secondary superficial aquifer with high vulnerability in the A4130 Widening section, related to the Head deposits;
- Secondary superficial aquifer with high vulnerability in the Didcot Science Bridge section, related to the Alluvium and Wolvercote Sand and Gravel Member. Locally, the groundwater vulnerability is described as secondary bedrock aquifer with low vulnerability, related to the Gault Formation;
- Secondary superficial aquifer with high vulnerability across majority of the Didcot to Culham River Crossing section, related to the Northmoor Sand and Gravel Member and Alluvium. Locally, the groundwater vulnerability is described as Secondary bedrock aquifer with high vulnerability, related to the Lower Greensand Group;
- Secondary superficial aquifer with high vulnerability, related to the superficial sand and gravel deposits, and Secondary bedrock aquifer with medium vulnerability, related to the Lower Greensand Group, in the Clifton Hampden Bypass section; and
- Principal Aquifer with high vulnerability at the south-western extent of the A4130 Widening section, and to the south and south-east of the Scheme, related to the Upper Greensand Formation.

11.7.14 The hydrology of the Site and surrounding area is described as follows:

- The most significant surface water feature within the Site is the River Thames. The Didcot to Culham River Crossing crosses the River Thames which flows through the Site from west to east;
- Moor Ditch, which is a tributary of the River Thames, is located north of the A4130, flowing eastwards. Tributaries of Moor Ditch, including Ladygrove Ditch, flow through the Scheme in this area, as well as other local ditches/ drains and ponds;
- The Site crosses a drain within the former Didcot A Power Station land;
- The Site crosses ponds and a possible tributary of Moor Ditch in the area of Appleford Crossing;
- A fish pond is located adjacent to the Site, to the west to Appleford;
- A number of artificial water features associated with areas of worked ground and landfill are located within the Site and study area, to the west and north-west of Appleford;
- A ditch flows alongside the Site on the western side of the study area. The ditch is at the edge of Sutton Courtenay landfill site;
- The Site crosses two unnamed tributaries of the River Thames and several ditches along the Clifton Hampden Bypass section of the Scheme;
- Cow Brook appears to rise at SU 49496 90376 from road drainage infrastructure adjacent to the A34 and flows north to cross the A4130 at SU 50062 91359, and on to its confluence with Moor Ditch at SU 50559 91770, adjacent to Didcot Power Station; and
- Meadow Brook appears to rise in the centre of Harwell at SU 49233 89003. It then flows generally north, crossing the A34 and continues into the Site to the south of the A4130, and west of the Valley Park development. The Meadow Brook then flows along a more easterly course and crosses the A4130 at SU 50694 91192. Based on ordnance survey mapping, the watercourse appears to be culverted beneath the former Didcot A Power Station site and meets Moor Ditch within this site at an undetermined location.

11.7.15 The details of surface water and groundwater abstractions on Site and in the surrounding area have been provided by the EA. There is one relevant water activity license within the Scheme boundary located within the area of the Didcot to Culham River Crossing - this is summarised in Table 11.7.

Table 11.7: Water Activity Permits within the Scheme boundary (source: Environment Agency data request)

Consent Number	License Holder Name	NGR	Discharge Type	Receiving Watercourse	Discharge Maximum (m3/d)
EPRRP3991E G	Sutton Courtenay Pit	SU5235092620 (E452350/N192620)	Mineral/ Gravel Extraction/ Quarrying	Westward Ditch	5500

11.7.16 There are a further 10 water activity permits located within the study area (up to 1 km of the Site boundary) but are not located within the Site.

11.7.17 There are no private water abstractions listed within the Site. However, there are four listed within the study area up to 1 km from the Site boundary.

11.7.18 There are no abstraction licenses listed within the Site as confirmed by the EA.

11.7.19 A total of eight abstraction licenses are listed within the study area up to 1 km of the Site boundary.

11.7.20 For additional information on the hydrology and hydrogeology of the Site, refer to Chapter 14: Road Drainage and the Water Environment.

Current and Historical Land Uses

11.7.21 Current and historical land use information, including historical mapping and regulatory data, have been reviewed to identify potential sources of contamination within the study area.

11.7.22 The key land use information for the A4130 Widening section of the Scheme is summarised as follows:

- Historical maps indicate that the main land use on this part of the Site has been agricultural;
- The existing A4130 road was constructed in the early 1980s;
- To the south of the road, the Site overlies an area of land that was historically used as a sewage works, including filter beds, until at least 1980. This area is located at the south-western extent of the Scheme, with Milton Interchange located immediately to the west of this area;
- A long-established railway forms the northern boundary of the A4130 Widening section of the Scheme;
- The former Didcot A Power Station, which consisted of a closed combined coal and oil power plant, is located directly to the north of the railway. The power station site has been in the process of being demolished in recent years, with the remaining three cooling towers demolished in 2019. The demolition process is due to be completed in quarter three of 2021;
- The Didcot B Power Station an active natural gas power plant is situated north west of the Site;

- An area of land in the south-eastern part of the Site and a large area further to the south is currently awaiting planning permission to be developed for the Valley Park mixed use scheme, including housing. The development is taking place on the western outskirts of Didcot;
- Additional land uses within this part of the study area that may impact the Scheme include an existing petrol filling station on the southern side of the A4130, directly south-west of the Site and an industrial estate including a cement handling facility, dry cleaners, freight depot and organic chemicals manufacturer on the northern side of the A4130;
- Information provided by OCC indicates that Harwell Pipeline, which discharged treated water to the River Thames, historically ran underneath the A4130 near Milton Interchange in the south-western area of the Site. The pipeline was removed by Magnox Limited after operations ceased in 2013 as the pipeline is no longer required. Magnox has removed the pipeline and allowed permitted authorisation and access rights over the land to be extinguished. It is understood that validation testing of soils did not identify any significant evidence of contamination. However, the potential presence of residual contamination within the soil and or surface and groundwater cannot be ruled out, particularly in the area around the proposed Backhill roundabout;
- Areas of potentially infilled land related to water features (e.g. ponds, marshes, rivers or streams) are located within the Scheme boundary and have the potential to contain deleterious materials, such as organic matter. This includes former marshland and a linear pond feature on the land now occupied by the existing A4130, to the south of the railway line; and
- Several licences for Registered Radioactive Substances are held by laboratories located on Milton Park, north of the A4130. However, the potential for contamination related to radioactive substances migrating into the area of the Site is considered to be very low.

11.7.23 The key land use information for the Didcot Science Bridge section of the Scheme is summarised as follows:

- At the southern extent of the Didcot Science Bridge, the Site crosses a long-established railway line;
- The Site passes through the former Didcot A Power Station, which was a combined coal and oil power plant. A railway loop was also located within the power station area. The former Didcot A Power Station area is currently undergoing remediation and construction work for wider redevelopment activities. Potential areas of contamination were observed during a site walkover carried out by AECOM in December 2019, as part of the PSSR (Ref 11.50). These included historic railways, evidence of an underground coal store, deep pits across the Site, an oily sheen in standing water within a well and a fenced off area believed to contain an underground diesel tank (diesel odours were also noted in this area). Existing boreholes and air quality monitoring points were also observed, as well as numerous ditches, channels and culverts and a deep well;
- A decommissioned nuclear storage facility existed on the site of the former Didcot A Power Station;
- Didcot B Power Station is an active natural gas power plant that supplies the National Grid. The power station is located adjacent to the northern boundary of the Didcot Science Bridge and is operated by RWE;
- The land immediately to the east and south-east of the Site is occupied by industrial estates within the town of Didcot. A petrol filling station is located within 250 m of the Site, at a Tesco distribution centre. The Didcot Sewage Treatment

works is also located in this area, at the edge of the Site boundary. The sewage works is operated by Thames Water. Other commercial activities within the Site boundary include road haulage services, air conditioning and refrigeration contractors, builders' merchants, recycling services and printers;

- There are three control of major accident hazards (COMAH) sites, two notification of installations handling hazardous substances (NIHHS) and two planning hazardous substance enforcements sites within the Site boundary;
- A prosecution relating to controlled waters was recorded within the hydrology study area, east of the Site, in 2004. This was due to an untreated chemical (siloxane) being allowed to enter surface water drains and, subsequently, nearby watercourses; and
- Areas of potentially infilled land related to water (e.g. ponds, marshes, rivers or streams) and non-water (e.g. pit or quarry) are located within the north-eastern area of the Didcot Science Bridge; and areas of potentially infilled land related to water are located within the southern area. These all have the potential to contain deleterious material, such as organic matter.

11.7.24 The key land use information for the Didcot to Culham River Crossing section of the Scheme is summarised as follows:

- Historical maps indicate that the principal land uses of the Site have been related to agriculture, quarrying and landfilling;
- A pallets and wood recycling business is located within the southern area of the Site, between the Collett roundabout and Appleford level crossing;
- A motor garage is located within the study area for most receptors, to the east of the Site, at the southern extent of Appleford;
- ARC Limited, Sutton Courtenay 6 Acre Site is located within the Site. The historic landfill lies to the west of the Site in an area between the former Didcot A Power Station and Appleford. The first input date was January 1986 and the last input date was December 1987. Deposited waste included inert, commercial and household waste, and liquid sludge;
- Hanson Asphalt, Sutton Courtenay Quarry is located within the study area for most receptors, immediately west of the Site and north of the former Didcot A Power Station. A recycling facility and an energy from landfill gas facility are also located in this area. The Site crosses Appleford rail sidings, which leads into the Hanson Asphalt site. Observations made during the 2019 walkover survey include two existing monitoring wells and tanks for unknown uses at Appleford Sidings. It is understood that two additional tracks are to be constructed for Hanson within the sidings area;
- A railway line runs along the eastern boundary of the Site extending northward to the River Thames. Both Appleford Railway Station and Culham Railway Station are located within the Site boundary. Appleford Station lies to the east of the Site in the central area of Didcot Culham River Crossing section, whereas Culham Station lies at the north-eastern Site boundary;
- The village of Appleford is located to the east of the Site and south of the River Thames. As it is located within 250 m of the Site boundary, it is within the study area for most receptors;
- This section of the Scheme crosses areas of infilled land west and south-west of Appleford that are related to the presence of the following historic landfill sites in this area:

- ARC Limited, Sutton Courtenay 90 Acre Site. First input date January 1977, last input date December 1983. Deposited waste included inert, commercial and household waste, and liquid sludge.
- ARC Limited, Radcot Farm. First input unknown, last input date December 1976. Deposited waste included inert, commercial and household waste, and liquid sludge.
- The Site crosses the Sutton Courtenay Landfill licenced waste management facility between Appleford Sidings and the former Didcot A Power Station. The landfill category is >10 tonnes per day with a capacity of >25,000 tonnes, excluding inert waste;
- The PSSR (Ref 11.49) indicates that the southern part of the restored landfill area is an active gas field. Scattered gas venting and piping were observed during the Site walkover survey in December 2019, as well as a noticeable unspecified odour. Evidence of previous ground investigation work was observed in the northern part of the restored landfill; and
- The Site crosses a series of former gravel pits (worked ground) at Bridge Farm Quarry, to the south of the River Thames, with areas of restored wetland.

11.7.25 The key land use information for the Clifton Hampden Bypass section of the Scheme is summarised as follows:

- The A415 Abingdon Road runs east-west through the southern-most part of the Site;
- An electrical substation and water mains were observed on Abingdon Road, within the south-western part of the Site, during the 2019 walkover survey. The substation appeared to be of modern construction;
- This section of the Scheme crosses a long-established railway line at the western extent of the Site. Abingdon Road crosses the railway on a bridge. This is immediately south of Culham Railway Station;
- Active businesses located within this part of the study area include a waste disposal services business and commercial vehicle servicing and repairs to the north of the Site, in Culham;
- There are also inactive businesses listed within the study area in Culham, including distribution services, road haulage services and car breakdown and recovery services;
- A small former gravel pit is shown on historical mapping within the geology and soils study area, to the south-west of the Clifton Hampden Bypass. This area is also shown as a BGS recorded mineral site and potentially infilled ground (non-water);
- As Culham Science Centre (CSC) is within 250 m of the Site boundary it lies partly within the study area, and is used by businesses including laboratories and scientific apparatus and equipment manufacturers. There are licences for the disposal of registered radioactive waste held by facilities located at CSC, which is used for nuclear and atomic research. However, the facilities are subject to strict control measures and it is considered highly unlikely that the radioactive materials will have any impact on the Site area;
- The PSSR by AECOM (January 2020) reports that the CSC was previously used as a World War II airfield. A ground condition report by Arup (2012) is referenced in the PSSR (Ref 11.49). This report indicates that associated airfield buildings and support facilities were constructed within the site, around the southern side of Thame Lane and the existing sewage works. Bulk storage of aviation fuel and

kerosene in the south-eastern part of the airfield was also reported, which has the potential to have impacted the Site area. The airfield is not shown on the available historical mapping or aerial photographs, which is not unusual in the case of World War II military sites;

- During the 2019 site walkover, a fireworks business was observed operating at the southern end of Thame Lane, with a small site office and shipping containers. Speaking with the business operator on site, AECOM was informed that the containers contained explosives. At the northern end of Thame Lane two more shipping containers were located and were believed to have similar contents. In addition, it is understood that the field has previously been used to test fireworks;
- A large above ground fuel storage tank was observed during the 2019 site walkover at the entrance to Thame Lane;
- A sewage works, including two tanks and filter beds, are located to the north of Thame Lane. The sewage works is located at the eastern end of CSC and is within the Site boundary. An unspecified strong odour was noted during the 2019 site walkover;
- A second sewage treatment works is visible from an aerial view, off Thame Lane south of the sewage works described above;
- The northern end of Thame Lane, within the geology and soils study area, was found to be blocked with brick rubble and earth fill during the site walkover carried out in 2019;
- Several dilapidated caravans were observed within the northern part of Thame Lane. Discarded gas bottles, insulation material, oil cans, propane bottles and car tyres were present in this area, as well as evidence of rubbish burning;
- The Site boundary partially surrounds land occupied by a sewage works to the south-east of Thame Lane;
- Historical mapping shows a disused camp to the south of CSC in the 1970s. Seven possible building structures and a tank are also shown on the mapping. This area is currently agricultural land, located between the sewage works to the south-east of Thame Lane, the sewage works at CSC and the village of Clifton Hampden. This could potentially be related to the historical airfield on the site of CSC;
- An active petrol filling station, along with a motor garage and a blacksmith's forge, are located at the edge of the geology and soils study area, in Clifton Hampden; and
- The northern-most section of the Site largely runs through agricultural land to the north of Clifton Hampden, before joining the B4015 Oxford Road at the north-eastern edge of the Site.

Previous Site Investigations

11.7.26 Where available, information on previous surveys and investigations within the study areas that may be relevant to the geology and soils assessment has been reviewed.

11.7.27 Several documents have been provided by OCC in relation to the former Didcot A Power Station, the current and historic landfills, Sutton Courtenay Quarry, Appleford rail sidings and the Valley Park mixed use development. Additional information on the registered and historic landfills has also been obtained from the EA (see figure 11.3).

11.7.28 Information considered relevant to the geology and soils assessment has been summarised in Table 11.8 to Table 11.12.

Table 11.8: Former Didcot A Power Station

Document title	Source	Summary of information
<p>Land at Didcot A Environmental Statement. Chapter Ten (Geotechnical Issues and Land Contamination)</p>	<p>BWB Consulting Ltd. May 2015. EMS. 2500</p>	<ul style="list-style-type: none"> • Assessment of the environmental effects of the proposed development: residential properties and 'green spaces'. • Third party ground investigation and assessment has encountered localised contamination comprising petroleum hydrocarbons and polycyclic aromatic hydrocarbons in soil and metals in groundwater. Significant hydrocarbon contamination in the north of the site has been mostly remediated and the remainder of the site has been assessed as having a low to moderate risk to human health and low risk to controlled water receptors. • An unexploded ordnance (UXO) risk assessment by BAE systems in 2014 considered there is a low likelihood that UXO remains at the site. • Potential sources of ground gases have been identified on-site including Made Ground and Alluvium deposits, infilled features including swimming pool and ground workings (a pond and cuttings) and contamination. • Remaining infrastructure associated with the use of the site as Didcot A power station includes an internal railway line, basements, an underground conveyor system and stairwells, a reinforced concrete slab and deep foundations associated with the former cooling towers (the towers have been demolished and crushed for reuse as engineering fill), buildings, settlement lagoons, a coal bund and Pulverised Fuel Ash (PFA) bunds and stockpiles (intended for on-site reuse).
<p>Clowes Developments Former Didcot A Power Station Didcot Phase 2 Geo-Environmental Assessment</p>	<p>BWB Consulting Ltd. April 2019. DID-BWB-ZZ-XX-RP-YE-0002_GI_P3</p>	<ul style="list-style-type: none"> • Groundwater has been recorded within all boreholes except one located in the south-east of the site, between ground level and 10.88 m below ground level (bgl). • Marginally elevated carbon dioxide and methane concentrations have been recorded during the monitoring period and as such, the site is given a classification of CS2 Low Risk (Ref 11.54). • Soil chemical analysis identified generally low concentrations of heavy metals and petroleum hydrocarbons present within the Made Ground, with exceedances of lead, Total Petroleum Hydrocarbons (TPH) and several Polynuclear Aromatic Hydrocarbons (PAHs) also recorded. Asbestos fibres and asbestos containing materials were identified within seven locations across the site. • Soil leachability analysis identified marginal exceedances of several heavy metals and elevated sulphate and cyanide. In the absence of any on-site source and localised nature were not considered to pose a significant risk to controlled waters. • Groundwater chemical analysis reported marginal exceedances of several heavy metals, PAHs, cyanide, aromatic hydrocarbon. However, concentrations were not considered a significant risk to controlled waters. • Additional groundwater samples obtained from BH205 and DS223 reported elevated concentrations of Trichloroethylene (TCE) and vinyl chloride. These exceedances were considered to be a hot spot and not

Document title	Source	Summary of information
		representative of site wide conditions. These concentrations were considered to pose a risk to controlled waters and as such further work and remediation is likely to be required for the site.
Clowes Developments Ltd Former Didcot A Power Station – Southern Area Didcot. Phase 2 Geo-Environmental Assessment	BWB Consulting Ltd. July 2019. DID-BWB-ZZ-XX-RP-YE-0007_Ph2-S2-P3	<ul style="list-style-type: none"> This report focuses on approximately 14 hectares along the southern boundary of the former Didcot A Power Station. Ground gas monitoring identified marginally elevated concentrations of carbon dioxide (7.8% v/v) and methane (3.0% v/v) at the site. Soil chemical analysis identified exceedances of total TPH, benzo(a)pyrene, dibenzo(a,h)anthracene and cis-1,2-dichloroethene within Made Ground soils at the site. All exceedances were noted to be marginal in nature and unlikely to pose a significant risk to human health. Chrysotile asbestos was encountered at one location in the centre of the site. Soil leachability analysis reported a number of marginal exceedances for several heavy metals, including barium and copper. In the absence of a significant on-site source and the localised nature of the impact, these elevated concentrations are not considered to pose a significant risk to human health or controlled waters. Groundwater chemical analysis reported exceedances of several heavy metals, sulphate and selected PAHs. The results of waste classification indicated that soils at the site are likely to be classified as non-hazardous.
Surrender notice with introductory note. Didcot A Power Station Permit number EPR/YP3030LR	The Environmental Permitting (England & Wales) Regulations 2010	<ul style="list-style-type: none"> This section refers to a notice of surrender of the environmental permit Amendment of the conditions of the permit, specifically Burning any fuel in an appliance with a rated thermal input of 50 MW or more and the associated activities of surface water drainage and process effluent, and waste handling and storage. Specifies the point source emissions to water as Moor Ditch NGR SU 515 915. Monitoring is to happen weekly and reporting of monitoring data is to happen quarterly.

Table 11.9: Registered and historical landfills

Document title	Source	Summary of information
Sutton Courtenay Landfill Site, As-built cell base & outline phasing plan	Waste Recycling Group, 22/09/2005. Drawing no. 427B045, Plan 12	<ul style="list-style-type: none"> The plan shows contour data for the base of the landfill cells that were active in 2005, to the west and south-west of Appleford. Final (restored) contour levels are shown over the historic landfill areas. Based on the plan, the site is likely to cross the eastern edge of the landfill containment cells at the Sutton Courtenay Landfill licenced waste management facility, between Appleford Sidings and the former Didcot A Power Station. The contours indicate that the base of the cells are up to 12 m below the surrounding ground level within the site area, increasing in depth from west to east. The site surrounds a former gravel pit (worked ground) and crosses through the eastern edge of the Radcot Farm historic landfill.

Document title	Source	Summary of information
		<ul style="list-style-type: none"> The contours on the plan indicate that the landfill is raised by up to approximately 4 m above the surrounding ground level at the highest point. Immediately to the north of Appleford Sidings, the site crosses through the central area of the Sutton Courtenay 90 Acre historic landfill site from the southern to northern extents of the landfill. The contours indicate that the landfill is raised up to approximately 10 m above the surrounding ground level, in the central area of the landfill.
Sutton Courtenay Landfill Site. Waste update Plan W2 2020	FCC Environment, 10/08/2020. Drawing no. 427W508	<ul style="list-style-type: none"> The plan covers the same footprint as Drawing no. 427B045, Plan 12. The plan depicts the latest available (2020) ground contour levels on top of approved top of waste pre-settlement contours, as-built cell footprint and ownership boundaries. Leachate monitoring, groundwater and landfill gas monitoring and extraction points are also plotted. In comparison to the 2005 Drawing no. 427B045, Plan 12 the contour plots are much higher. Particularly in cells 9A to 14. The approved top of waste pre-settlement contours are over cells 13 and 14 and extend north. At its highest points it is approximately 40 m higher than the 2005 plot.
Sutton Courtenay Landfill Site. Environmental Monitoring Plan. Plan 4A	FCC Environment, 27/10/2020. Drawing no. 427M323	<ul style="list-style-type: none"> The plan covers the same footprint of the previous landfill plans. Shows leachate, groundwater and gas monitoring and collection points.
Sutton Courtenay Landfill Site. Detailed Restoration Master Plan. Plan 7	FCC Environment, 06/04/2011. Drawing no. 427R220F	<ul style="list-style-type: none"> The plan covers the same footprint as the previous landfill plans. Master plan of the final agricultural restoration for the landfill area. This includes the final restoration seeding and planting specification and typical annual maintenance programme. The plan also shows post settlement contours depicting contours in the phase 4 area (where cells 13/14 are in landfill plans). The contour lines show these areas at levels approximately 10-15 m lower than in drawing no. 427W508.
OCC Roundabout Design in Relation to Site	FCC Environment, 07/09/20. Drawing No. 2488-01-SK01	<ul style="list-style-type: none"> The plan covers the same footprint as the previous landfill plans. The drawing shows the construct limits of the proposed link road and Middle roundabout on top of the landfill cells. In the plan, the site crosses the eastern edge of the landfill containment cells at the Sutton Courtenay Landfill licenced waste management facility, between Appleford Sidings and the former Didcot A Power Station.

Table 11.10: Sutton Courtenay Quarry and Appleford Sidings

Document title	Source	Summary of information
Sutton Courtenay Landfill Site. Annual Monitoring Review 2020. PPC Permit BV7001IK	FCC Environment, 25/02/21	<ul style="list-style-type: none"> The report is for quantitative monitoring of the Sutton Courtenay Landfill site during 2020. The report concludes that leachate level and quality data are compliant. Groundwater and surface water quality show some breaches which are being investigated.
90 Acre Landfill. Gas monitoring results 2018 – 2019 (spreadsheet)	FCC Environment 25/02/21	<ul style="list-style-type: none"> This area is not covered by an Environmental Permit. Perimeter gas and leachate level monitoring is carried out once a year. Due to Covid pandemic no gas monitoring was carried out in 2020. The gas monitoring results for 2018 – 2019 recorded a maximum methane reading of 8.7% v/v at one location, SW11 A5. A maximum carbon dioxide concentration of 8.8% v/v was recorded at location SW11 A26. A minimum oxygen reading within the same location SW11 26 was recorded at 10.8% v/v.
90 Acre Landfill. Gas monitoring results 2020 (spreadsheet)	FCC Environment 26/02/21	<ul style="list-style-type: none"> This area is not covered by an Environmental Permit. Perimeter gas and leachate level monitoring is carried out once a year. The results for the 2020 leachate levels monitoring showed a minimum recorded depth of 3.15 m and a maximum recorded depth of 9.95 m. Two sample points (SUTC90LC18 and SUTC90LS1) were noted as being 'overgrown' and thereby unable to sample from.

Table 11.11: Valley Park development

Document title	Source	Summary of information
Valley Park, Didcot. Non-Technical Summary	RPS, Valley Park Didcot, December 2014	<ul style="list-style-type: none"> Non-technical summary of the Environmental Statement. The summary document provides an overview of the assessment findings. The report considers the Valley Park site to the west of Didcot, covering approximately 178.1 hectares and includes the area where the Didcot Science Bridge will be constructed. The majority of the site has been subject to an Agricultural Land Classification (ALC) assessment undertaken by the former Land Use Planning Unit of the Ministry of Agriculture Fisheries and Food (MAFF). Site assessment found the area in which the Didcot Science Bridge is to be constructed to be of grade 3b (Moderate). The wider site area contains a significant area of very good (ALC Grade 2) and good (ALC Grade 3a) agricultural land.
Phase II Detailed Strategic Geo-Environmental Assessment – Proposed Residential Development	Geo Environmental Group, January 2018. GEG-17-512/PII	<ul style="list-style-type: none"> Detailed Strategic Phase II Geo-Environmental Assessment for the proposed residential areas, local centre and balancing ponds on the Valley Park Site.

Table 11.12: Culham Science Centre

Document title	Source	Summary of information
Culham Science Centre – Phase 1. Ground Condition and Contamination Review	ARUP, 3 December 2012. 53526-00. Issue 2	<ul style="list-style-type: none"> • Report providing detail of the ground conditions of the Phase 1 development plot. • Also considers any issues associated with any potential contamination of the plot. • Summarises a desk top study review carried out on behalf of the United Kingdom Energy Authority (UKAEA) for the Culham Science Centre. • Assessment within the report was based on results from a contamination ground investigation carried out on the East Culham (JET) site in 2004. • Neither the previous desk studies undertaken by various parties at the instruction of the UKAEA nor the ground investigation have indicated any significant residual chemical or radiological contamination of the soils or groundwater at the site. • Based on the information reviewed as part of the ground condition/ contamination desk study, it was concluded that the proposed development of the Phase 1 site area has not been subject to any known contaminative land use during the wider site's former use as a WW2 airfield or the more recent/ current research facility use.

Ground Investigation

11.7.29 A phase 2 ground investigation (March to July 2021) has been undertaken to support the construction of the Scheme. The ground investigation included chemical testing for a range of potential contaminants in soil, soil leachate and groundwater. Groundwater and ground gas monitoring is also being carried out following installation of the monitoring wells.

11.7.30 Upon completion of the ground investigation and receipt of the chemical analysis results, environmental risk assessments have been undertaken for human health, controlled waters and ground gas risks based. The findings of the risk assessments are presented in the Ground Investigation Report (AECOM, 2021) (Ref 11.55), and will be used during the Scheme detailed design stage to further define requirements for remediation to break potential contaminant linkages in advance of Scheme construction.

Conceptual Site Model

11.7.31 A conceptual site model has been developed for the Scheme and is included in Appendix 11.1. The conceptual site model has been developed in accordance with the risk-based framework adopted in the recently issued Environment Agency guidance entitled 'Land Contamination: Risk Management' (LCRM) (Ref 11.37). The key sources, pathways and receptors identified in the conceptual site model are detailed in the following sections.

Potential sources

11.7.32 Based on the current and historical land uses identified in paragraphs 11.7.21 to 11.7.24, the most significant potential sources of contamination at the Site are:

- The former Didcot A Power Station;
- The active Didcot B Power Station;

- Historic landfill sites;
- The registered FCC landfill site; and
- Sutton Courtenay Quarry, including asphalt plant and railway sidings.

11.7.33 Other potentially significant sources of contamination include:

- Existing railway lines;
- The historical pipeline near to the Milton Interchange;
- Existing roads within the Site;
- Sewage works (current and historical);
- The historical World War II airfield at Culham, including possible fuel storage areas;
- Local petrol filling stations;
- Other local industries, including a fireworks company and waste sites; and
- Dilapidated caravans, earth/ rubble bunds, rubbish burning and abandoned waste on Thame Lane.

11.7.34 There is also potential for made ground to be present across the Site; which could contain Asbestos Containing Materials (ACM) or other potential contaminants. Made ground could also be a potential source of ground gas.

Potential pathways and receptors

11.7.35 The following principal pathways for contaminant migration have been identified for the Site:

- Dermal contact/ ingestion/ inhalation with/ of soils, dusts or liquids;
- Migration of contamination via made ground and permeable natural strata;
- Migration of contamination via groundwater;
- Migration of ground or landfill gases and vapours via made ground and permeable natural strata;
- Inhalation of ground or landfill gases in confined spaces;
- Plant uptake of bio-available contamination in soils;
- Migration of contamination via existing buried infrastructure and services; and
- Physical contact with construction materials.

11.7.36 The following principal receptors for contaminant migration have been identified for the Site:

- Humans – current site users;
- Humans – construction and maintenance workers;
- Humans – adjacent site users;
- Humans – future users of the highways scheme;
- Groundwater;
- Surface water;
- Flora and fauna within landscaping and open space areas; and
- Infrastructure and services.

Soils and agricultural land

11.7.37 The soil quality within the Site is described as follows:

- An area of slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils, with moderate fertility is in the western part of the A4130 Widening section of the Scheme, south of Milton Park. The remaining agricultural areas located within the A4130 Widening section of the Scheme are underlain by freely draining, lime-rich, loamy soils of moderate fertility;
- The southern area of the Didcot Science Bridge section of the Scheme is underlain by loamy and clayey floodplain soils with naturally high groundwater, of moderate fertility. The northern area is underlain by freely draining, slightly acid but base-rich soils of high fertility (Ref 11.56);
- The Didcot to Culham River Crossing section of the Scheme is underlain by freely draining, slightly acid but base-rich soils of high fertility, except in the area of the River Thames, which is underlain by loamy and clayey floodplain soils with naturally high groundwater, of moderate fertility; and
- The southwestern area of the Clifton Hampden Bypass section of the Scheme is underlain by freely draining slightly acid but base-rich soils of high fertility, while the north-eastern area is underlain by freely draining, slightly acidic sandy soils of low fertility.

11.7.38 Pre-existing agricultural land classification information was obtained from the MAGIC website (Ref 11.23) for areas within the study area where available and are indicated on Figure 11.2, and as described as:

- The agricultural land south of the A4130 is generally classified Grade 3b, with areas of Grade 3a classification at the western and eastern extents;
- The Scheme crosses Grade 3a and Grade 3b agricultural land at the southern extent of the Didcot Science Bridge and passes through Grade 3a agricultural land in the northern area; and
- The Didcot to Culham River Crossing section of the Scheme passes through Grade 3a and Grade 3b agricultural land at the southern extent and passes through a small area (approximately 5.5 ha) of Grade 2 agricultural land south of Appleford. The historical workings to the west of Appleford are classified Grade 4, with small areas of Grade 2 (approximately 6 ha) and Grade 3a (approximately 3.5 ha) land to the north.

11.7.39 A soil and ALC survey was carried out by Reading Agricultural Consultants (RAC) in May 2020 (Ref 11.51). The survey was carried out within the areas of the Didcot to Culham River Crossing and Clifton Hampden Bypass sections of the Scheme. These were areas that did not have any published/ available ALC data.

11.7.40 Further agricultural assessment was undertaken in March 2021 for the area north of the River Thames, which is to be used for flood compensation. The results of the survey are presented in Appendix 11.2. The results presented within the AECOM/ OCC ALC and Soil Resources (Ref 11.50) report state that most of this part of the Site is classified as Best and Most Versatile (BMV) land in Grades 2 and 3a.

11.7.41 In the northern section of the Scheme, within the Clifton Hampden Bypass section and the northern portion of the Didcot to Culham River Crossing section, the land comprises a mixture of Grade 2, Grade 3a and Grade 3b land. In the centre of the Didcot to Culham River Crossing section, immediately north of Appleford Sidings, the land has been assessed as Grade 4. Within the Didcot Science Bridge section south west of Hill Farm, the land is considered Grade 3a and Grade 3b. The land south of

the A4130 Widening section is largely considered Grade 3b with some areas of Grade 3a.

11.7.42 Table 11.13 sets out the results of agricultural land classification calculations undertaken by Reading Agricultural Consultants, with the distribution shown in Figure 11.2. Refer to Appendix 11.2 for the results of the soils survey and further details of the agricultural land quality within the survey area. The survey area and subsequent area over which the calculation relates to is larger than the Scheme boundary.

Table 11.13: Agricultural Land Classification

Grade	Description	Area (ha)	% of agricultural land
2	Very good quality	96.5	31
3a	Good quality	103.5	34
3b	Moderate quality	73	24
4	Poor quality	31	10
Land not surveyed		3	1
Total Agricultural		307	100
Other Land		376	-

Designated Sites

11.7.43 The 'MAGIC' website and the TVERC were consulted to identify any potential sites of special scientific interest or local geological sites. The Oxfordshire Geology Trust and Natural England were also contacted (see Section 11.3) for information on local geological sites. A response from Natural England has been received stating that no further information was held by them other than what was already in the public domain. No response has been received from Oxfordshire Geology Trust.

11.7.44 No SSSI or Local Geological Sites have been identified within the study area. However, the majority of the site is located within the SSSI Impact Risk Zones for Little Wittenham SSSI, which is located approximately 4 km east of the Site. The Culham Brake SSSI is located approximately 1 km to the north-west of the Site - the A4130 is located within 150 m of the SSSI Impact Risk Zone outer boundary for Culham Brake SSSI. It is noted that these SSSIs do not have any designations relating to geology.

11.7.45 The Site is not located within a groundwater Source Protection Zone (SPZ), but is within a Drinking Water Safeguard Zone (Surface Water). The Clifton Hampden Bypass section and the northern areas of the Didcot to Culham River Crossing section are also within a drinking water protected area for surface water. The Site is located within a Nitrate Vulnerable Zone.

Construction Year Baseline (2023)

11.7.46 The potential for the baseline ground conditions to change in the lead up to Scheme construction is limited to the extent to which any new development necessitates remediation or mitigation measures to control potential contamination releases, or new sources of contamination. Any new development in the vicinity of the Scheme on potentially contaminated land will need to be suitable for its intended use as set out in the NPPF (Ref 11.17). To meet this requirement new development sites may require remediation to be undertaken. This will mean that some areas described as having potentially contaminative current or historical land use, may no longer be of significance at the time of construction of the Scheme.

- 11.7.47 The potential for the baseline conditions to change will also depend on whether any land has been classified as contaminated land, by the Local Authority under Part 2A of the Environmental Protection Act 1990. Several mechanisms drive these determinations. Therefore, they are difficult to predict. Where Part 2A determinations are made, the potential baseline change will occur where remediation works are subsequently undertaken.
- 11.7.48 The purpose of the ground investigation undertaken from March to July 2021, was to identify any contaminated land areas which may need remediation prior to Scheme construction. It was confirmed during consultation with the EA (refer to Section 11.3.3), that the areas around the former Didcot A Power Station will be satisfactorily remediated and validated prior to the construction of the Scheme.
- 11.7.49 There is the potential for additional contamination sources to occur through existing land uses, for example fuel or chemical spills along roads and railways, incidents at landfills, wastewater treatment works and at CSC. However, it is anticipated that any such incidents will be appropriately managed and remediated.
- 11.7.50 Should planning approval be granted at the former Didcot A Powers Station and development commences prior to 2023, it is likely that remediation as part of the development will improve any potential soil contamination status at the Site.
- 11.7.51 Based on the above, the land quality assessment does not consider any significant future changes to baseline ground conditions by 2023.

Opening Year Baseline (2025)

- 11.7.52 The potential for the geology and soils baseline to have changed by the time the Scheme is operational is limited to the extent to which any new development, between 2021 and 2025, necessitates remediation or mitigation measures to control potential contamination. The Scheme is due to be built by 2025. However, it is not envisaged that the Scheme will materially alter the baseline conditions in 2025 for land quality.

11.8 Potential Impacts

Construction

- 11.8.1 In relation to potentially contaminative land uses, the following adverse impacts could potentially arise as a result of construction of the Scheme:
- Mobilising existing contamination in soil and groundwater as a result of ground disturbance and de-watering during construction;
 - Increasing the potential for contaminants in unsaturated soils to leach to groundwater in open excavations during construction;
 - Increasing the potential for contaminated surface run-off to migrate to surface water and groundwater receptors as a result of leaching from uncovered stockpiles;
 - Introducing new sources of contamination, such as fuels, chemicals and oils used during construction activities; increasing the potential of construction workforces (from handling, storage and exposure) to possibly unknown contaminants/ waste as a result of working through known historical landfills; and
 - Creating preferential pathways for the migration of soil contamination and gases, for example along new below ground service routes, service ducts and as a result of dewatering.

11.8.2 Construction of the Scheme has the potential to result in the following adverse impacts on existing geology and soils resources:

- Degradation of soil resources, including damage to soil structure, reduced biological function, mixing of soil types, resulting from the compaction of soil due to heavy construction vehicle movement, changes in topography, handling and storage of soils, or ground stability impacts;
- The temporary and permanent loss of Best and Most Versatile agricultural soils through land-take; and
- The generation of waste soils that cannot be reused elsewhere on the Scheme, requiring off-site disposal as waste.

11.8.3 Construction has the potential to result in beneficial impacts through the following:

- Creation of new geological features or attributes, for example through fresh exposure of a geological sequence in a road cutting;
- Removal or treatment of contaminated soil, with the effect that existing adverse effects on receptors are removed; and
- A reduction in soil erosion through improved drainage and landscaping.

Operation

11.8.4 During operation of the Scheme, road users and the road infrastructure will be introduced as new receptors. Any contamination deemed by risk assessment to have posed a significant risk to the Scheme, will have been removed or remediated during the construction phase. Previous risk assessment and any subsequent mitigation measures will have already been undertaken to satisfactorily close out any residual risks identified as part of the construction phase.

11.8.5 Following the opening of the Scheme, soils adjacent to the road may be affected by spray or airborne contaminants generated during routine maintenance and operation of the road or released during road accidents/ emergency situations.

11.9 Design, mitigation and enhancement measures

Embedded mitigation

11.9.1 Embedded mitigation is defined within the DMRB LA104 (Ref 11.25) as “*design measures which are integrated into a project for the purpose of minimising environmental effects*”. The Scheme has been designed, as far as possible, to avoid and minimise impacts and effects on the geology and soils environment through the process of design-development (refer to Chapter 3: Assessment of Alternatives) considering good design principles. The following section reports the essential mitigation required in addition to embedded mitigation to reduce and offset likely significant adverse environmental effects.

Essential mitigation

Construction

11.9.2 Construction of the Scheme will be subject to measures and procedures as defined within the Outline Environmental Management Plan (OEMP) (Appendix 4.2) that have been developed for the Scheme. The OEMP includes a range of measures to enable compliance with relevant standards and legislation and best practice guidance when working with or around contaminated materials. The measures detailed within the

OEMP will be developed into a CEMP and implemented by the selected construction contractor.

- 11.9.3 Before Scheme construction, an earthworks strategy, which may include a Remediation Strategy for isolated areas of the Scheme, will be required. The strategy will set out how the earthworks/ excavation stage of the Scheme will be undertaken. Where necessary, the strategy will consider what materials, if any, can be reused and what materials are surplus and require either disposal or onward management to ensure appropriate re-use. The strategy will also define whether any treatment may be required, prior to reuse or disposal as well as establishing risk-based compliance criteria for soils to be screened against. The strategy will cover site clearance and the works required to prepare the site for development. A remediation strategy will be prepared where significant contamination is encountered during ground investigation.
- 11.9.4 A MMP will be prepared alongside the earthworks strategy and remediation strategy in line with the CL:AIRE CoP (Ref 11.16) during the detailed design stage. The MMP will form part of the CEMP and detail the procedures and measures that will be taken to classify, track, store, dispose of and possibly re-use all excavated materials that are expected to be encountered during the development works.
- 11.9.5 The disposal of soil waste, contaminated or otherwise to landfill sites will be best mitigated by minimisation of the overall quantities of waste generated during construction and by ensuring that excavated material consigned to landfill cannot, as an alternative, be put to use either on Site or on other sites (see Chapter 12: Materials Assets and Waste).

Human health receptors

- 11.9.6 The potential impacts on human health receptors including off-site receptors will be addressed through the adoption of the following measures, which will be included in the CEMP:
- Damping of ground with water to minimise dust;
 - Sheeting of lorries transporting spoil off site and the use of dust suppression equipment on plant;
 - Groundwater level controls (as required);
 - Adequate fuel/ chemical storage facilities e.g. bunded tanks, hard standing and associated emergency response spillage control procedures;
 - Well maintained plant and associated emergency response/ spillage control procedures; and
 - Any temporary onsite storage of contaminated material will be stored on sheeting and covered to minimise the potential for leachate and run off from the stockpile being generated.
- 11.9.7 The historical land use of the study area does not include activities that will result in asbestos contamination. The materials and remediation strategy and safe work plan will include provisions for asbestos containing material should it be encountered during the earthworks. The Scheme is largely to be constructed offline on agricultural land. However, the remediation strategy and/ or earthworks specification will detail works to reduce the gassing potential of made ground within the areas constructed over historical landfills.

Controlled waters

- 11.9.8 The mitigation measures detailed in Chapter 14: Road Drainage and the Water Environment will ensure that surface water run-off from the construction site (site preparation, earthworks and construction activities) does not have a detrimental effect on any receiving waterbodies or underlying Principal and Secondary Aquifers. Surface water run-off will be controlled using appropriate drainage measures to minimise infiltration of the surface waters into the ground. This will minimise the potential for contaminants to migrate into controlled waters during construction.
- 11.9.9 If piled foundation solutions are required for the Scheme, then piling risk assessments will need to be undertaken in accordance with EA guidance. Construction involving piling or penetrative ground improvement will require a location-specific risk assessment to establish the means of mitigating the risks of causing new pollutant linkages or worsening existing ones with respect to risks to controlled waters at the construction stage. This will be undertaken during the detailed design of the Scheme.

Soil resources

- 11.9.10 Potential impacts specific to contamination impacting on soil resources will be mitigated through the following measures:
- Works will be in compliance with BS 3882:2015 'British Standard Specification for Topsoil and Requirements for Use' (2015) (Ref 11.30) and the Defra Construction Code of Practice for the sustainable use of soils on construction sites (Ref 11.51);
 - The source of topsoil and subsoil will be investigated carefully with respect to its suitability for the intended use;
 - A Soil Resource Plan (part of the Soil Management Plan within the CEMP) will need to be prepared by the contractor prior to the start of construction. The Soil Resource Plan will detail the areas and type of topsoil/subsoil to be stripped, stripping method, haul routes and the management of the soil stockpiles;
 - Topsoil will be handled only in the appropriate conditions of weather and soil moisture, and with suitable machinery in line with the Defra Construction Code of Practice (Ref 11.52);
 - The stockpiling of soils will be avoided whenever possible. Where stockpiling is unavoidable, heaps will be tipped loosely and the surface firmed and shaped to shed water. Where soils are to be stockpiled for more than six months the surface will be seeded with a grass/ clover seed mix;
 - Where possible, topsoil will be re-used on site as applicable;
 - The movement of traffic will be confined to designated haul routes to reduce the amount of heavy machinery going over soil materials which could cause compaction of soil materials. Such routes will exclude areas of proposed landscaping; and
 - Following the completion of construction activities, agricultural land taken on a temporary basis will be restored and returned to the landowner for unrestricted agricultural use in the same agricultural condition that currently exists (refer to paragraph 11.7.37).

Agricultural Soils

- 11.9.11 The footprint of the Scheme has been designed through optioneering to reduce the loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives. There are no universally applicable measures available to mitigate the direct loss of agricultural land.

- 11.9.12 The primary measures to mitigate the impacts on soil resources will be set out in a SMP (part of the CEMP), to be prepared at the detailed design stage. The SMP will include a Soil Resource Plan and Soil Handling Strategy which will confirm the different soil types (based on the soil surveys already undertaken as much as possible); the most appropriate re-use for the different types of soils; and the proposed methods for handling, storing and replacing soils on-site.
- 11.9.13 The aim of a Soil Resource Plan will be to re-use as much of the surplus soil resources on-site in the detailed design of the Scheme. Any surplus soils will be used in a sustainable manner (i.e. as close to the Scheme as possible and to an after-use appropriate to the soils quality) in accordance with Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Ref 11.52).
- 11.9.14 The quality of soils retained on-site or exported off-site (if required) will be maintained by following good practice guidance on soil handling and storage, particularly to avoid compaction and biodegradation of soils that are to be retained on site in storage. In this respect, topsoil must be stockpiled separately to subsoil.
- 11.9.15 With the adoption of appropriate mitigation for the handling and restoration of soils, as part of a CEMP, most soils will be able to continue their various ecosystem functions on or off site, principally as a medium for producing food and biomass; for storing and cycling water and carbon; and for supporting habitats, biodiversity and landscape planting.

Operation

- 11.9.16 The mitigation measures detailed in Chapter 14: Road Drainage and the Water Environment (refer to Section 14.9) will prevent the pollution of controlled waters during the Scheme operational phase.
- 11.9.17 Any spillages on the Scheme following road accidents will be routinely managed by OCC who will be responsible for the maintenance of the Scheme once operational (refer to Chapter 14: Road Drainage and the Water Environment, Section 14.9).

Enhancements

- 11.9.18 No enhancements in relation to geology and soils are considered necessary.

11.10 Assessment of likely significant effects

Construction Phase Environmental Effects

Impacts on human health receptors

Exposure to contaminants

- 11.10.1 Human health receptors potentially affected by the Scheme during construction include people living close to the Scheme in residential areas and those using commercial/ industrial properties in the vicinity of the Scheme. Exposure to contaminants could occur through various pathways including dermal contact, ingestion, inhalation and migration through groundwater. The sensitivity of these receptors ranges from low to very high, the highest rating concerns residents living close to the Scheme who will experience potential exposure over a longer period (refer to the conceptual site model in Appendix 11.1). The magnitude of impact is dependent on the contaminant concentrations identified within the Site. The areas of the Site with the greatest contamination potential are the areas that underlie the A4130 Widening, Didcot Science Bridge and the Didcot to Culham River Crossing

where the historic sewage works including filter beds, the former Didcot A Power Station, Sutton Courtenay Landfill, and the Railway Sidings are located, respectively.

- 11.10.2 One of the purposes of the ground investigation (AECOM, 2021) was to identify and confirm any significant contaminant exceedances that warranted additional control measures to reduce the risk so that the overall risk (sensitivity) to human health is low. With standard mitigation measures in place, as outlined in an OEMP, the magnitude of impact on construction workers is considered to be minor adverse due to the close contact with soils. The effects on human health receptors will be neutral which is not significant.
- 11.10.3 In the potential scenario where the chemical screening results reveal a high level of contaminants hazardous to human health, a series of assessments will be undertaken to identify the source, categorise the material, and set a course of remediation. These assessments include a HazWaste (Ref 11.35a) assessment and Control of Asbestos Regulation (CAR Soil) assessment (Ref 11.35) (dependent on the contaminants found) followed by a remediation options appraisal, involving consultation with OCC and other relevant bodies, and development of a remediation strategy. These report conclusions will work in conjunction with the SMP, MMP, and CEMP.

Exposure to Ground Gas

- 11.10.4 The risks from accumulation of ground gases will likely occur during the construction and maintenance phases of the Scheme. As the Didcot to Culham River Crossing section of the Scheme is to be constructed over Sutton Courtenay landfill, there is the potential for gas to migrate out of the landfill and towards potential receptors. The sensitivity of this receptor is very high as it will largely affect construction workers, maintenance workers and nearby residents. The magnitude of the impact after mitigation described in section 11.9.2 is considered negligible, and therefore, the effect is slight adverse which is not significant.
- 11.10.5 Following receipt of gas monitoring results, a gas risk assessment will be conducted in accordance with guidelines within CIRIA C665 (Ref 11.34). Gas Screening Values (GSVs) will be calculated to assess the significance of gas generation at the Site. In the instance of high GSVs a ground gas monitoring programme will be set out to undertake additional ground gas monitoring during and post-works within the former landfill to monitor the levels of generated landfill gas. Appropriate mitigation measures will be implemented where risks are identified following assessment of the gas monitoring data.
- 11.10.6 Risks relating to the accumulation of ground gas across the Site would only present during the construction and maintenance phases of the works where temporary confined/ enclosed spaces are likely to be present.
- 11.10.7 During construction, access to confined spaces and excavations should be restricted. Where work in confined spaces is unavoidable, a site specific and task specific risk assessment should be undertaken prior to the commencement of the works. Monitoring of confined spaces for potential ground gas accumulation should be carried out and the works should be undertaken by suitably trained personnel with the use of specialist personal protective equipment where necessary. Maintenance workers that are required to undertake excavations during the operational life of the Scheme will be provided with sufficient information on the nature of each sub area at the Site, upon which to base site and task specific risk assessments. Such work will also include measures as detailed in the CEMP to minimise the effects of the work on human health.

Impacts on Surface Water and Groundwater

- 11.10.8 The sensitive water receptors include groundwater abstractions which can be polluted or rendered inactive during dewatering activities, groundwater aquifers which can be polluted and then act as a pathway to laterally migrate contamination through the aquifer to underlying aquifers, and surface water features which can be polluted and migrate contaminants to other water courses. The sensitivity of these receptors ranges from low to very high. The highest rating is related to a small area of the Didcot Science Bridge section of the Scheme which crosses the Upper Greensand Formation principal bedrock aquifer. The necessity of remedial works will be dependent on the risks posed by concentrations of potential contaminants in groundwater recorded within the Scheme boundary during the ground investigation to identified receptors. As mitigation, construction works will be carried out in accordance with the CEMP, a Water Management Plan, and in line with ES Chapter 14: Road Drainage and the Water Environment. Therefore, the magnitude of impact will be minor adverse, resulting in a slight adverse to neutral effect which is not significant. Mitigation measures are detailed further in ES Chapter 14: Road Drainage and the Water Environment, Section 14.9.
- 11.10.9 The results from three out of twelve rounds of groundwater monitoring undertaken from the 2021 ground investigation, have identified potential risks to controlled water receptors from metals and inorganic contaminants. Groundwater monitoring is still ongoing and further assessment of data from the remaining monitoring rounds and a Detailed Quantitative Risk Assessment (DQRA) will be required to quantify potential risks to identified receptors. The DQRA for Controlled Waters Risk Assessment is used to derive Remedial Targets for contaminants of concern in the groundwater at the Site followed by a remediation options appraisal. If remediation is deemed necessary, consultation with the EA, OCC and other relevant bodies will be undertaken and a remediation strategy will be produced. The report conclusions will work in conjunction with the SMP, MMP and CEMP.

Impacts on Soil Resources

- 11.10.10 The construction of the Scheme will necessitate a loss of soil resources. A review of publicly available information from 'MAGIC' (Ref 11.23) and a site assessment conducted in 2020 found the Didcot Science Bridge section of the Scheme to be of over Grade 3b (Moderate) soils. Land south of the A4130 has been classified as Grade 3b with areas of Grade 3a at the western and eastern extents of the Site. Sections of the Didcot to Culham River Crossing contain very good (ALC Grade 2) and good (ALC Grade 3a) agricultural land (refer to paragraph 11.7.38). Therefore, loss of BMV land cannot be avoided. A further agricultural assessment was undertaken in March 2021 for the area north of the River Thames which is to be used for flood compensation. The sensitivity of this receptor is from medium to very high due to ALC Grades 2, 3a, and 3b being present across the Scheme. The magnitude of impact is major to moderate adverse due to the permanent loss of the agricultural soil function of the land and restriction of its future use. The resultant effect is very large to large adverse for ALC Grade 2 and Grade 3a, which is significant. The resultant effect for ALC Grade 3b is moderate and is therefore, significant.
- 11.10.11 As shown in Table 11.14 this will result in the permanent loss of approximately 39.4 ha of BMV soils from agricultural use, and the temporary loss of approximately 19.1 ha of BMV soils within the Scheme. The Scheme will result in approximately 15.8 ha permanent loss and approximately 3.9 ha temporary loss of Grade 2 (very high value); approximately 23.6 ha permanent loss and approximately 15.2 ha temporary loss of Grade 3a (high value); and approximately 16.6 ha permanent loss and approximately 0.74 ha temporary loss of Grade 3b (medium value) agricultural land to facilitate the Scheme.

Table 11.14: Impact on agricultural soils within the Scheme boundary

Agricultural Land Classification*	Total area permanently impacted by the scheme (ha)	Total area temporarily impacted by the scheme (ha)	% of ALC within the Scheme boundary permanently impacted
Grade 1	0	0	0
Grade 2	15.8	3.9	10.1
Grade 3a	23.6	15.2	15.2
Total BMV	39.4	19.1	25.3
Grade 3b	16.6	0.74	10.7
Grade 4	6	19.5	3.8
*The categories 'other' and 'non-agricultural' are not shown as they do not constitute agricultural land			

11.10.12 The loss of topsoil and subsoil during construction is deemed of medium sensitivity and the magnitude of impact is moderate adverse. The resultant effect is moderate adverse and is therefore, significant.

11.10.13 As mitigation, construction works will be carried out in accordance with the CEMP, SMP, including advice within Defra's Code of Practice for Sustainable Use and Management of Soils on Construction Sites (2009) (Ref 11.52) and environmental good practice on site. The footprint of the Scheme has been designed through optioneering to reduce the loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives.

Operational Phase Environmental Effects

Impacts on human health receptors

11.10.14 The main human receptors affected by the Scheme during the operation phase include maintenance workers, future users of the road, people living close to the Scheme in residential areas and those using public open spaces and commercial/ industrial properties in close proximity to the Scheme. Exposure to contaminants could occur through various pathways including through dermal contact, ingestion, inhalation and migration through groundwater. The sensitivity of these receptors ranges from low to very high, the highest rating relates to residents living in the vicinity who will experience prolonged exposure. The magnitude of impact after mitigation will be negligible and the effect slight adverse, which is not significant.

11.10.15 As mitigation, maintenance workers are required to adopt safe working practices under relevant health and safety legislation. No additional mitigation measures are required as operation of the Scheme is not anticipated to cause significant effect on offsite receptors with regards to geology and soils, and the potential exposures to future users of the Scheme will be negligible and transient in nature and, therefore, unlikely to interact with the underlying ground conditions and hydrogeology. As a result, the effect is neutral, which is not significant.

Impacts on Surface Water and Groundwater

11.10.16 The sensitive water receptors include; groundwater abstractions which can be polluted, groundwater aquifers and surface water features which could experience a reduction in groundwater quality due to an uncontrolled release of pollutants, and surface water features which can be polluted and migrate contaminants to other water courses. The sensitivity of these receptors ranges from low to high. The highest

rating is related to a small area of the Didcot Science Bridge which crosses the Upper Greensand Formation principal bedrock aquifer. The magnitude of the impact will be reduced to low based on the remediation measures that will be carried out if necessary (as detailed in paragraph 11.9.8).

- 11.10.17 Further mitigation measures are detailed in ES Chapter 14: Road Drainage and the Water Environment (refer to Section 14.9). The sensitivity of future users of the Scheme in relation to potential contamination from exposure to surface water and groundwater will be negligible and transient in nature; it is unlikely that future users will interact with the underlying ground conditions and hydrogeology. As a result, the magnitude of impact is negligible and the effect is neutral, which is not significant.

Impacts on Soil Resources

- 11.10.18 The sensitivity of agricultural soils, and topsoil and subsoil, during the operational phase is considered very low and the magnitude of impact is negligible. Therefore, the effect is neutral, which is not significant. No additional mitigation measures are required.

11.11 Monitoring

- 11.11.1 The Scheme will have significant adverse effects upon agricultural land within the Scheme boundary, primarily due to the proportion of temporary and permanent land take required to construct the Scheme. Where agricultural land taken on a temporary basis is restored and returned to the landowner for continued agricultural use, post-construction monitoring will be required to determine whether pre-existing agricultural soil capability had been reinstated. Such monitoring requirements will be detailed in a SMP, the requirement for which is detailed in the OEMP.
- 11.11.2 The specification for the ground investigation (Ref 11.53), outlines the gas and groundwater monitoring schedule. At the time of writing (September 2021), there have been three monitoring rounds. However, results from the third monitoring round are currently outstanding. A further nine monitoring rounds are to be undertaken at monthly intervals for a period of 12 months. The final factual report is to be issued to AECOM on completion of all monitoring and laboratory testing. The monitoring results will be used to provide a pre-construction baseline of information (during the detailed design stage).

11.12 Summary

- 11.12.1 Table 11.15 provides a summary of likely geology and soils significant effects of the Scheme during construction and operation.

Table 11.15: Summary of likely soils and geology significant effects during construction and operation

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
CONSTRUCTION					
Impacts on human health receptors (Contamination)					
Not applicable.					
Impact on surface water and groundwater (Contamination)					
Groundwater aquifers (Unproductive, Undifferentiated, Secondary A and Principal)	Low to very high	Reduction in groundwater/ quality due to uncontrolled release of pollutants. Lateral migration of contamination through aquifer. Leaching of contaminants to underlying aquifers. Migration of contaminated water through preferential pathways (such as piling) to groundwater in underlying aquifers.	Data from the ground investigation will be used to inform the design strategies within the CEMP, and WMP. Construction works will be carried out in accordance with the CEMP, WMP, location specific Piling Risk Assessments and environmental good practice on site.	Negligible adverse	Slight adverse to Neutral
Impacts on soil					
Permanent loss of soil resources BMV	Very high	Loss of Grade 2, agricultural land (approximately 15.8ha)	Data from the ground investigation will be used to inform the design strategies within the CEMP, and SMP. Construction works will be carried out in accordance with the CEMP, SMP, including advice within Defra's Code of Practice for Sustainable Use and Management of Soils on Construction Sites (2009) and environmental good practice on site. Footprint of the Scheme designed through optioneering to reduce loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives.	Moderate adverse	Large adverse

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
Temporary loss of soil resources BMV	Very high	Loss of Grade 2, agricultural land (approximately 3.9ha)	Data from the ground investigation will be used to inform the design strategies within the CEMP, and SMP. Construction works will be carried out in accordance with the CEMP, Soil Management Plan, including advice within Defra's Code of Practice for Sustainable Use and Management of Soils on Construction Sites (2009) and environmental good practice on site. Footprint of the Scheme designed through optioneering to reduce loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives.	Moderate adverse	Large adverse
Permanent loss of soil resources BMV agricultural land.	High	Loss of Grade 3a agricultural land (approximately 23.6ha),	Data from the ground investigation will be used to inform the design strategies within the CEMP, and SMP. Construction works will be carried out in accordance with the CEMP, Soil Management Plan, including advice within Defra's Code of Practice for Sustainable Use and Management of Soils on Construction Sites (2009) and environmental good practice on site. Footprint of the Scheme designed through optioneering to reduce loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives.	Major adverse	Large adverse
Temporary loss of soil resources BMV agricultural land.	High	Loss of Grade 3a agricultural land (approximately 15.2ha)	Data from the ground investigation will be used to inform the design strategies within the CEMP, and SMP. Construction works will be carried out in accordance with the CEMP, Soil Management Plan, including advice within Defra's Code of Practice for Sustainable Use and Management	Moderate adverse	Large adverse

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
			of Soils on Construction Sites (2009) and environmental good practice on site. Footprint of scheme designed through optioneering to reduce loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives.		
Permanent loss of soil resources BMV agricultural land.	Medium	Loss of Grade 3b agricultural land (approximately 16.6ha).	Data from the ground investigation will be used to inform the design strategies within the CEMP, and SMP. Construction works will be carried out in accordance with the CEMP, Soil Management Plan, including advice within Defra's Code of Practice for Sustainable Use and Management of Soils on Construction Sites (2009) and environmental good practice on site. Footprint of the Scheme designed through optioneering to reduce loss of BMV agricultural land where possible, see Chapter 3: Assessment of Alternatives3.	Moderate adverse	Moderate adverse
OPERATION					
Impacts on human health receptors (Contamination)					
Not applicable.					
Impact on surface water and groundwater (Contamination)					
Not applicable.					
Impacts on geology and soils resources					
Not applicable.					

11.13 References

- Ref 11.1 The Environmental Quality Standards Directive (2008/105/EC).
- Ref 11.2 Water Framework Directive (2000/60/EC).
- Ref 11.3 Groundwater Directive (2006/118/EC) (replacing 1980/68/EC).
- Ref 11.4 Dangerous Substances Directive (67/548/EEC).
- Ref 11.5 Environmental Protection Act, 1990: Part 2A Contaminated Land Statutory Guidance.
- Ref 11.6 The Environment Act, 1995.
- Ref 11.7 The Water Act, 2014.
- Ref 11.8 The Water Resources Act, 1991.
- Ref 11.9 The Water Environment (Water Framework Directive) Regulations, 2017.
- Ref 11.10 The Private Water Supplies (England) (Amendment) Regulations, 2018.
- Ref 11.11 The Environmental Permitting (England and Wales) Regulations, 2016.
- Ref 11.12 The Environmental Damage (Prevention and Remediation) (England) Regulations, 2015.
- Ref 11.13 The Contaminated Land (England) (Amendment) Regulations, 2012.
- Ref 11.13a Defra (2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Contamination - Policy Companion Document, December 2014.
- Ref 11.14 The Land Drainage Act, 1991.
- Ref 11.15 The Waste (England and Wales) Regulations, 2011.
- Ref 11.16 CL:AIRE The Definition of Waste: Development Industry Code of Practice (CoP) Version 2, 2011.
- Ref 11.17 Ministry of Housing, Communities & Local Government, National Planning Policy Framework, 2021.
- Ref 11.18 Ministry of Housing, Communities & Local Government, Land affected by contamination, 2019.
- Ref 11.18a Ministry of Housing, Communities & Local Government, Land Stability, 2019.
- Ref 11.19 South Oxfordshire Local Plan (South Oxfordshire District Council, 2011).
- Ref 11.20 South Oxfordshire Core Strategy (South Oxfordshire District Council, 2012).
- Ref 11.21 Vale of White Horse Local Plan 2031 (Vale of White Horse District Council, 2016).
- Ref 11.22 Connecting Oxfordshire: Local Transport Plan 2015-2031 (Oxfordshire County Council, 2015) / Local Transport Plan 4 (LTP 4): Strategic Environmental Assessment.
- Ref 11.23 MAGIC website: <http://magic.defra.gov.uk/>
- Ref 11.24 Highways England, DMRB LA 101: Introduction to environmental assessment, 2019.
- Ref 11.25 Highways England, DMRB LA 104: Environmental assessment and monitoring, 2020.
- Ref 11.26 Highways England, DMRB LA 109: Geology and soils, 2019.

- Ref 11.26A Highways England, DMRB LA 113: Road Drainage and the water environment, 2019.
- Ref 11.27 Highways England, DMRB LA 120: Environmental management plans, 2020.
- Ref 11.28 BS 10175+A2:2017 – Investigation of Potentially Contaminated Sites – Code of Practice, 2017.
- Ref 11.29 BS 5930:2015+A1:2020 – Code of practice for ground investigations, 2020.
- Ref 11.30 BS 3882:2015 British Standard Specification for Topsoil and Requirements for Use', 2015.
- Ref 11.31 BS 1997-2:2007 – Eurocode 7: Geotechnical design Ground investigation and testing, 2015.
- Ref 11.32 BS 8576:2013 – Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs), 2013.
- Ref 11.33 CIRIA, C552, Contaminated Land Risk Assessment. A Guide to Good Practice, 2001.
- Ref 11.34 CIRIA, C665, 'Assessing Risks Posed by Hazardous Ground Gases to Buildings', 2007.
- Ref 11.35 CAR-SOIL™ Control of Asbestos Regulations 2012. Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance, 2012.
- Ref 11.35a Environment Agency, Waste Classification – Guidance on the classification and assessment of waste (1st Edition v1.1) Technical Guidance WM3, 2018
- Ref 11.36 Waste Classification, Guidance on the Classification and Assessment of Waste (1st Edition v1.1). Technical Guidance WM3, 2015.
- Ref 11.37 Land contamination risk management (LCRM). How to assess and manage the risks from land contamination, 2020.
- Ref 11.38 TR P5-065/TR: Technical Aspects of Site Investigation (Volumes 1 & 2), 2000.
- Ref 11.38a Town and Country Planning (Development Management Procedure) Order 2010
- Ref 11.39 Landmark Information Group (A4130 Widening Envirocheck Report), Reference: 220280369_1_1, 2019.
- Ref 11.40 Landmark Information Group (Clifton Hampden Bypass Envirocheck Report), Reference: 220288066_1_1, 2019.
- Ref 11.41 Landmark Information Group (Culham to Didcot River Crossing Envirocheck Report), Reference: 220387044_1_1, 2019
- Ref 11.42 Landmark Information Group (Didcot Science Bridge Envirocheck Report), Reference: 220389844_1_1, 2019.
- Ref 11.43 Geological Survey of England and Wales 1:63,360/1:50,000 geological map series. Sheet 253, Abingdon, Drift, 1971.
- Ref 11.44 Geological Survey of England and Wales 1:63,360/1:50,000 geological map series. Sheet 253, Abingdon, Solid, 1971.
- Ref 11.45 Geological Survey of England and Wales 1:63,360/1:50,000 geological map series. Sheet 254, Henley on Thames, Solid and Drift, 1980.
- Ref 11.46 BGS borehole logs, BGS GeoRecords Plus interactive map <http://mapapps.bgs.ac.uk/GeoRecords/GeoRecords.html>
- Ref 11.47 AECOM (2020) Preliminary Sources Study Report, A4130 Widening, WID-ACM-EGT-SW_ZZ_ZZ_ZZ-RP-CE-0001.

- Ref 11.48 AECOM (2020) Preliminary Sources Study Report, Clifton Hampden Bypass, CHB-ACM-EGT-SW_ZZ_ZZ_ZZ-RP-CE-0001.
- Ref 11.49 AECOM (2020) Preliminary Sources Study Report, River Crossing, RIV-ACM-EGT-SW_ZZ_ZZ_ZZ-RP-CE-0001.
- Ref 11.50 AECOM (2020) Preliminary Sources Study Report, Didcot Science Bridge, DSB-ACM-EGT-SW_ZZ_ZZ_ZZ-RP-CE-0001.
- Ref 11.51 Reading Agricultural Consultants, AECOM/ Oxfordshire County Council Agricultural Land Classification and Soil Resources at Didcot Garden Town Housing Infrastructure Fund (HIF) Scheme, 2020.
- Ref 11.52 Department for Environment, Food & Rural Affairs, 'Code of Practice for the sustainable use of soils on construction sites', 2011.
- Ref 11.53 AECOM (2020), Specification for Ground Investigation, DSB-ACM-VGT-SW_ZZ_ZZ_ZZ-SP-CE-0003.
- Ref 11.54 CIRIA C665: Assessing risks posed by hazardous ground gases to buildings, 2007, Table 8.5.
- Ref 11.55 AECOM (2021) Ground Investigation Report (GIR) PD-ACM-HGT-SW_ZZ_ZZ_ZZ-RP-CE-0002.
- Ref 11.56 Cranfield Soil and Agrifood Institute, Soilscales. [Soilscales soil types viewer - National Soil Resources Institute. Cranfield University \(landis.org.uk\)](#) accessed 23.06.2021.

