M20 Junction 10a

TR010006

Environmental Statement

Chapter 9 Geology and Soils

APFP Regulation 5(2)(q)

Revision A

Planning Act 2008

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Volume 6.1

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Content

9 Geology and Soils

9.1 Introduction

9.1.1 The soils and geology of an area play an important part in determining the environmental character, including influencing the landform and vegetation present, as well as the types of horticultural and agricultural practices that the area can support.

9.1.2 The development of the Main and Alternative Schemes have the potential to impact on local geology and soils, and constraints could also be imposed on the construction of the Main and Alternative Schemes as a result of the existing ground conditions. This chapter describes the assessment of geology and soils, including contaminated land, mineral resources and unstable land which may impact, or be impacted by the Main and Alternative Schemes, both for the construction phase and the subsequent operational phase. This chapter provides an overview of the baseline, geological and soil conditions in the area, the potential presence of land and groundwater conditions, Sites of Special Scientific Interest (SSSIs) and assessment of potential impacts of the Main and Alternative Schemes relating to geology and soils and contaminated land.

9.1.3 Impacts on geology and soils may be Adverse or Beneficial; the assessment methodology used in this chapter has been designed to identify both and subsequently seek appropriate mitigation measures to avoid or reduce significant adverse impacts.

9.1.4 Impacts on agricultural soils are also discussed in Chapter 13 Community and Private Assets, Volume 6.1. Impacts on groundwater are also discussed in Chapter 14 Road Drainage and Water Environment, Volume 6.1.

9.1.5 Geological and geomorphological features considered to be of national importance are designated SSSIs. Other sites of geological importance may be designated as Regionally Important Geological Sites (RIGS). RIGS are any geological or geomorphological sites, excluding SSSIs that have an educational, research, historic or aesthetic importance.

9.1.6 Mineral resources are natural concentrations of minerals, or bodies of rock that are, or may become, of potential economic interest as a basis for the extraction of commodity. In response to a comment received from Kent County Council regarding the Scoping Report a minerals assessment has been included.

9.1.7 A Contaminated Land Desk Study and Preliminary Interpretative Report has been prepared to support this chapter (DCO Document reference 7.4). This chapter should also be read in conjunction with Chapter 14 Road Drainage

and Water Environment (Volume 6.1) and the OCEMP (Appendix 17.1, Volume 6.3).

9.2 Legislative and Policy Framework

9.2.1 This section summarises the legislative and policy framework relevant to geology, soils and contaminated land.

European Policy

9.2.2 The Water Framework Directive (WFD) (EU (European Union)) Directive 2000/60/EC[1] is an overarching piece of European legislation specific to water quality. It aims to protect inland and coastal waters and prevent deterioration of aquatic ecosystems, including groundwaters. A key aim of the WFD is to achieve 'Good' ecological status for all waterbodies by 2015, with a secondary aim to gradually reduce the release of pollutants which may pose significant risk to aquatic ecosystems.

9.2.3 Special Protection Areas (SPAs) are strictly protected sites classified for rare and vulnerable birds, underwritten by EU Directive 2009/147/EC[2]. Special Areas of Conservation (SAC) are high-quality conservation sites designated under EU Directive 1992/43/EEC[3] and Ramsar Sites, wetlands of international importance, are designated under the Ramsar Convention[4]. These sites must be protected from contamination and potentially damaging construction activities.

National Policy

9.2.4 The primary legislative regime under which historical contaminated land is managed in the UK is Part IIA of the Environmental Protection Act (EPA), 1990. Part IIA principally deals with sites where individual historical contamination linkages present a "Significant Possibility of Significant Harm" (SPOSH) or a "Significant Possibility of Significant Pollution to Controlled Waters" (SPOSPCOW) representing an unacceptable level of contamination risk for each linkage. The Part IIA clean-up is the minimum which can be done on a cost basis to make and keep the site in a "just safe" condition for an existing use.

9.2.5 The Contaminated Land (England) Regulations 2006 (as amended) set out provisions relating to the identification and remediation of contaminated land under Part IIA of the EPA. The Regulations make provision for an additional description of contaminated land that is required to be designated as a special site where the Environment Agency is to be the enforcing authority.

[1] European Union, 2000: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32000L0060&from=EN, accessed August 2015

[2] European Union, 2009: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF, accessed August 2015

[3] European Union, 1992: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043, accessed April 2016

[4] The Convention on Wetlands of International Importance especially as Waterfowl Habitat, adopted February 1971

9.2.6 Risks from historical groundwater pollution can be considered under Section 161 of the Water Resources Act 1991. Section 161 allows the Environment Agency to recover the costs of cleaning up any poisonous, noxious or polluting matter or any solid waste matter that persons have caused or knowingly permitted to be present in controlled waters.

9.2.7 As the majority of sites impacted by historical contamination are not classed as “Contaminated Land” under Part IIA of the EPA, the remediation of any contamination present is generally managed through the planning regime. The 2012 National Planning Policy Framework (NPPF)[5] and 2014 National Policy Statement for National Networks (NPSNN)[6] provide guidance on contaminated land and protection from a planning perspective.

9.2.8 Geological and geomorphological features considered to be of national importance are designated SSSIs. They have some legal protection under the 1981 Wildlife and Countryside Act (WCA) against operations which may damage their interest. The WCA (as amended) provides statutory protection of SSSIs in England, some of which are of geological importance. SPAs and Ramsar Sites, as well as limestone pavements, are also protected under this act. Environmentally Sensitive Areas (ESAs) are agricultural areas benefiting from special protection. The importance of nature conservation, including areas with geological features, is also emphasised in the EPA.

9.2.9 The prevention of pollution is regulated by several pieces of legislation including the Environmental Permitting Regulations 2010, which regulates pollution control by requiring permits for emissions to, for example, air and water.

9.2.10 There are also a number of waste-related regulations which serve to protect soils from contamination by waste management, such as the Hazardous Waste (England and Wales) Regulations 2005 (as amended by Hazardous Waste (England and Wales) Regulations 2009), Environmental Protection (Duty of Care) Regulations 1991, Waste Management Licensing Regulations 1994 (as amended by Waste Management Licensing Regulations 1997), Landfill Directive 1999, Landfill Tax (Contaminated land) Order 1996 and Landfill (England and Wales) Regulations 2002 (as amended by The Landfill (England and Wales) Regulations 2004 and 2005).

9.2.11 Under the Control of Substances Hazardous to Health Regulations 2002 (COSHH) and the Construction and Design Management (CDM) Regulations 2015, where a developer knows or suspects the presence of contaminated soil, provision will be made to ensure that risks to the public and site workers are minimised.

[5] National Planning Policy Framework https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf, accessed August 2015

[6] National Policy Statement for National Networks https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf, accessed May 2015

9.2.12 In the United Kingdom "minerals" are defined in the Town and Country Planning legislation as "all substances in, on or under land of a kind ordinarily worked for removal by underground or surface working". Facilitating the sustainable use of minerals is covered in the NPPF[5] specifically requiring local authorities to include policies for extraction of mineral resource of local and national importance., taking into account the contributions that substitute or secondary and recycled materials and minerals waste would make to the supply of materials before considering the extraction of primary materials.

Local Policy

9.2.13 The following local policies have been identified in relation to geology, soils, minerals and contaminated land:

9.2.14 Policy EN4 taken from Ashford Borough Council (ABC) Local Plan 2000:

- *"Before determining any application relating to land which is or can reasonably be expected to be contaminated, applicants will be required to carry out a detailed survey and analysis to determine the presence or otherwise of hazardous substances in the soil, underlying geology and aquifers of both the application site and the area immediately surrounding it. In cases where contamination is shown to exist, conditions or legal agreements will be used to require appropriate measures to be taken to remove or render the contaminating substances harmless to human health and safety and ecological interests."*

9.2.15 Policy CS11: Biodiversity and Geological Conservation taken from ABC Local Development Framework (LDF) Core Strategy (2008):

- *"Development proposals should avoid harm to biodiversity and geological conservation interests, and seek to maintain and, where practicable, enhance and expand biodiversity by restoring or creating suitable semi-natural habitats and ecological networks to sustain wildlife in accordance with the aims of the National and Kent Biodiversity Action Plans. If, exceptionally, there are circumstances in which other considerations justify permitting development that causes harm to such interests, appropriate mitigation or compensation measures will be required."*

9.2.16 The Local Development Plan 2000 has been largely superseded by the Local Development Framework and Policy EN4 was not selected as a 'saved' policy. As previously stated ABC is also developing a new Local Plan up to 2030 and this will supersede the current Local Development Framework. ABC also defers to the NPPF in substitute of expired policies.

9.2.17 None of the policies in the list of saved policies to be retained from the 2000 Plan are significant to this assessment[7].

[7] Ashford Borough Local Plan 2000 Saved Policies – Updated June 2014: http://www.ashford.gov.uk/download.cfm?doc=docm93jijm4n4878.pdf&ver=7415, accessed May 2016

9.2.18 There are no current policies in relation to protection of agricultural quality soils.

9.2.19 Kent County Council are the minerals and waste planning authority for Kent and have produced the Minerals and Waste Local Plan 2013 – 2030[8] which will be adopted in July 2016.

9.2.20 Minerals and Waste Local Plan, Policy DM7: Safeguarding Mineral Resources states. Planning permission will only be granted for non-mineral development that is incompatible with minerals safeguarding, (114) where it is demonstrated that either:

1. *The mineral is not of economic value or does not exist.*
2. *That extraction of the mineral would not be viable or practicable.*
3. *The mineral can be extracted satisfactorily, having regard to Policy DM9, prior to the non-minerals development taking place without adversely affecting the viability or deliverability of the non-minerals development.*
4. *The incompatible development is of a temporary nature that can be completed and the site returned to a condition that does not prevent mineral extraction within the timescale that the mineral is likely to be needed.*
5. *Material considerations indicate that the need for the development overrides the presumption for mineral safeguarding such that sterilisation of the mineral can be permitted following the exploration of opportunities for prior extraction.*
6. *It constitutes development that is exempt from mineral safeguarding policy, namely householder applications, infill development of a minor nature in existing built up areas, advertisement applications, reserved matters applications, minor extensions and changes of use and buildings, minor works, non-material amendments to current planning permissions.*
7. *It constitutes development on a site allocated in the adopted development plan.*

Contaminated Land Guidance Documents

9.2.21 The framework for the assessment of potential land contamination is based on current guidance documents regarding the implementation of Part IIA of the EPA and the assessment of potentially contaminated land, with particular reference to:

- DEFRA (2012)[9]: “Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance.

[8] Kent County Council, July 2015 Kent Minerals and Waste Local Plan 2013 – 2030 Proposed Main and Additional Modifications

[9] Department for the Environment Food and Rural Affairs, 2012: *Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance*

- Contaminated Land Research Report SC050021/SR2[10] and SR3[11] describing the UK Contaminated Land Exposure Assessment Framework for assessing human health risks.
- British Standard (BS) 10175:2011[12], "Investigation of Potentially Contaminated Sites".
- British Standard (BS) 8485:2007[13], "Code of Practice for the Characterisation and remediation from ground gas in affected developments".
- CIRIA C665[14]: "Assessing Risks posed by hazardous ground gases to buildings";
- Environment Agency (2013)[15]: "Groundwater Protection Policy and Practice", GP3; and,
- Environment Agency (2004)[16]: Model Procedures for the Management of Contaminated Land, Contaminated Land Report 11.

9.3 Method of Assessment

9.3.1 This section describes the methodology which has been used in the assessment of geology and soils, including contaminated land, which may impact, or be impacted by, the construction of the Main and Alternative Schemes.

9.3.2 A combination of the sensitivity of the receptor and the magnitude of the impact has been used to determine the significance of effects upon geology, soils and risk of contamination. This has been used to inform the Environmental Statement ES) and to aid in the development of appropriate mitigation measures so as to avoid or minimise potential adverse effects.

Study Area

9.3.3 The study area is inclusive of all locations where physical works and ground disturbance would take place during the Main and Alternative Schemes, plus a 250m buffer around these locations. Such works would include, but not necessarily be limited to the following:

- M20 junction 10a, including two new bridges over the M20 and a new roundabout in the vicinity of the existing Highfield Road bridge.
- On and off slip roads for the new junction 10a.

[10] Environment Agency, 2008: *Human Health Toxicological Assessment of Contaminants in Soil*, Report ref. SC050021/SR2

[11] Environment Agency, 2008: *Updated technical background to the CLEA Model*, Report ref. SC050021/SR3

[12] British Standards Institution, 2013: *Investigation of potentially contaminated sites – Code of Practice*, BS10175:2011+A1:2013

[13] BS8485:2007 *Code of practice for the characterisation and remediation from ground gas in affected developments, ICS 91.120.99; 91.200*

[14] Wilson, S. *et al.*, 2007: *Assessing risks posed by hazardous ground gases to buildings*, CIRIA C665

[15] Environment Agency, 2013: *Groundwater Protection Policy and Practice*, GP3, V1.1

[16] Environment Agency, 2004: *Model Procedures for the Management of Contaminated Land, Contaminated Land Report 11*

- Minor works to the existing Lacton Farm Culvert.
- Construction of new Kingsford Street Footbridge.
- Demolition of existing Highfield Road Bridge.
- Remedial works to existing A20 Swatfield Bridge.
- Demolition of A2070 Church Road Footbridge.
- Construction of new A2070 Church Road Footbridge.
- Installation of new CCTV Mast and MS4 Gantry.
- Construction of new Animal Bridge over Aylesford Stream downstream of the M20 just outside the motorway boundary.
- Link road between M20 junction 10a and the A2070 Bad Munstereifel Road.
- Additional link from the existing junction 10 to the new link road, to the northwest of St Marys church, Sevington.
- Balancing and attenuation ponds for the management of surface water.
- Retaining structures to allow retention of existing vegetation and installation of noise barrier.

Significance Criteria

9.3.4 Geology Soils and Minerals - The assessment approach for geology and soils and the tables in this section follow the guidance presented in the Highways Agency Design Manual for Roads and Bridges (DMRB) Volume 11 Section 2 Part 5 HA (205/08) (Assessment and Management of Environmental Effects)[17]. The tables have been slightly adapted from the original documentation to provide representative examples.

9.3.5 Contaminated Land - Sensitivity categories are derived based on standards and targets set by government authorities such as Natural England, the Environment Agency and advisory bodies, such as the Construction Industry Research and Information Association (CIRIA).

9.3.6 The sensitivity of geological receptors is determined according to the methodology shown in Table 9.1 below.

Table 9.1 Scale of Evaluating the Sensitivity of Receptors

Value (Sensitivity)	Criteria	Typical Examples
Very High	Very high importance and rarity, international scale and very limited potential for	Geology: World Heritage Sites, sites protected under EU legislation (SAC, SPA, Ramsar Site). Soils: Agricultural land of Grade 1 quality. Minerals: Energy Minerals - minerals used to generate

[17] Highways Agency, 2008: Design Manual for Roads and Bridges (DMRB), Volume 11, Section 2, Part 5 HA (205/08)

Value (Sensitivity)	Criteria	Typical Examples
	substitution.	energy such as coal, oil and gas. Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing a regionally important resource or supporting site protected under wildlife legislation; or SPZ I.
		Future site users: Very sensitive land uses proposed such as residential housing with gardens, allotments. Built Environment: Sites of international Importance, World Heritage Sites.
High	High importance and rarity, national scale, and limited potential for substitution	Geology: Sites protected under UK wildlife legislation (SSSI, WCA, LNR). Soils: Agricultural land of Grade 2 quality. Minerals: poor Quality Energy minerals or Silica (industrial) sand for use in glass making. Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing locally important resource or supporting river ecosystem; SPZ II.
		Future site users: Sensitive land uses proposed such as schools, residential housing without gardens, open spaces. Built Environment: Listed buildings, Scheduled Monuments.
Medium	Attribute has a medium quality and rarity on regional scale.	Geology: Regionally Important Geological Sites (RIGS). Soils: Agricultural land of Grade 3 quality. Minerals: Construction aggregates – minerals used in building and engineering or to manufacture building and engineering products such as concrete. Controlled Water: Moderate classification of groundwater vulnerability; Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water; SPZ III.
		Future site users: Moderately sensitive land uses such as commercial developments and open spaces. Built Environment: Sites with local interest for education or cultural appreciation.
Low	Attribute has a low quality and rarity on local scale.	Geology: Rock exposures. Soils: Agricultural land of Grade 4&5 quality. Minerals: Poor quality materials suitable for us as general fill only Controlled Water: Deep Secondary aquifer with poor water quality not providing baseflow to rivers: Aquifer not used for water supplies (public or private).
		Future Site Users: Low sensitivity land use such as Industrial Sites, highways and rail. Built Environment: Infrastructure (e.g. Roads, railways, tramways).
Negligible	Very low importance and rarity, local scale.	Geology: No rock exposures. Soils: Urban classified soils. Minerals: No minerals. Controlled Water: Non-aquifer.

Value (Sensitivity)	Criteria	Typical Examples
		Future Site Users: No sensitive land use proposed.

9.3.7 Magnitude of impact is determined by the predicted deviation from the baseline conditions and the scale of impact. Quantifiable assessment of magnitude has been undertaken where possible. In cases where only qualitative impact assessment is feasible, magnitude has been defined as fully as possible. The methodology for determining the magnitude of an impact is shown in Table 9.2.

Table 9.2 Scale of Magnitude with respect to Impacts on Geological/Soil Receptors

Magnitude	Description
Major	Change in condition status of geological SSSI or RIGS. Generation of large volume of hazardous materials for disposal off site, or treatment of such material. Permanent impact on geological conditions. Physical removal or degradation (including loss of structure and contamination) of a large area of soil. Previous or on-going activities on or near to a site where severe harm/improvement to a defined receptor is very likely. Site investigation data indicating contamination on many sites impacted by current or former uses. Quantitative or qualitative risk assessment data estimating a significant likelihood of adverse/beneficial impacts from exposure/reduction in exposure to pollutants in the environment. Loss/improvement of special characteristics of a water resource. Change in General Quality Assessment grade, pollution/treatment of potable source, severe flood risk, loss/gain of fisheries. Any pollution inside Zone 1 or a groundwater protection zone of special interest. Sterilisation of 50% or more of mineral asset.
Moderate	Generation of hazardous and non-hazardous materials for disposal off site, or treatment of such materials. Temporary impact on geological conditions; and physical removal, degradation (including loss of structure and contamination) or improvement of a moderate area of soil. Previous or on-going activity where harm/improvement to a defined receptor is possible but severe harm/improvement is unlikely. Site investigation data indicating moderate contamination. Quantitative or qualitative risk assessment data estimating medium risk of adverse/beneficial impacts from exposure/reduction in exposure to pollutants in the environment. Impact on water resources. Reduction/increase in the production of fisheries, moderate changes insufficient to reduce water quality. Sterilisation of 15 - 50% of mineral asset.
Minor	Generation of inert and non-hazardous waste materials which may be suitable for reuse on site. No permanent impact on geological conditions. Physical removal, degradation (including loss of structure and contamination) or improvement of a minor area of soil. Greenfield site or previous on-going activities where harm/improvement to a defined receptor is unlikely. Site investigation data indicating significant contamination is unlikely. Quantitative or qualitative risk assessment data estimating low likelihood of adverse/beneficial impacts

Magnitude	Description
	from exposure/reduction in exposure to pollutants in the environment. Minor impact insufficient to impact on the use or characteristics of the water resource. Sterilisation of <15% of mineral asset.
Negligible	Physical removal, degradation (including loss of structure and contamination) or improvement of a very minor area of soil. Minimal impact on geological conditions and mineral assets.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

9.3.8 The likely severity of the effects are assessed using the matrix in Table 9.3 in conjunction with professional judgement to consider site specific factors that may be of relevance.

Table 9.3 Severity of Effect with Regards to Geology and Soil Receptors

Magnitude of Potential Impact	Value (Importance) of Attribute				
	Very High	High	Medium	Low	Negligible
Major	Very Large	Large / Very Large	Moderate / Large	Slight / Moderate	Slight
Moderate	Large / Very Large	Large / Moderate	Moderate	Slight	Neutral / Slight
Minor	Moderate / Large	Slight/ Moderate	Slight	Neutral/ Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral / Slight	Neutral
No Change	Neutral	Neutral	Neutral	Neutral	Neutral

9.3.9 The significance of effect is predicted with reference to Table 2.2 in DMRB as provided below in Table 9.4.

Table 9.4 Significance Criteria for Geology, Soils, Contaminated Land and Waste

Significance Category	Description and Examples		Significance
Neutral		Minimal effect on geological condition. Minor loss of urban soils. No discernible negative effect to buildings / infrastructure.	Not Significant
Slight	Adverse	Changes to Made Ground deposits only. Moderate / major loss / degradation of Grade 4 or 5 soils. Minor / moderate loss/ degradation of Grade 3 soils; Easily preventable, non-permanent health effects on humans. Minor low-level and localised contamination of on-site soils. Easily reparable damage to buildings / infrastructure.	
	Beneficial	Remediation of localised low levels of contamination.	

Significance Category	Description and Examples		Significance
		Remediation of non-sensitive water resource contamination. Minimal improvements to overall soil and water quality.	
Moderate	Adverse	Superficial disturbance to near surface deposits. Changes in geomorphology, large loss/ degradation of Grade 3 soils. Minor loss / degradation of Grade 1 or 2 soils. Sterilisation of low quality mineral resources. Easily preventable, permanent health effects on humans. Pollution of non-sensitive water resource or Low long term risk of pollution to sensitive water resource. Localised damage to buildings / infrastructure (on or off site).	Significant
	Beneficial	Remediation of localised moderate levels of contamination. Remediation of moderate, localised sensitive water resource contamination. Re-use of excavated soils on-site to avoid disposal to landfill.	
Large	Adverse	Moderate / Large loss / Degradation of Grade 2 soils; Moderate loss / degradation of Grade 1 soils. Sterilisation of high quality mineral resource. Medium / long-term (chronic) risk to human health. Medium long-term risk of pollution of sensitive water resources. Contamination of offsite soils.	
	Beneficial	Remediation of localised high levels of contamination. Remediation of significant, localised sensitive water resource contamination. Re-use of moderate quantities of excavated soils on-site to avoid disposal to landfill.	
Very Large	Adverse	Loss of exposed designated geological feature or large loss / degradation of Grade 1 soils. Short-term (acute) risk to human health. Short- term risk of pollution of sensitive water resources. Catastrophic damage to buildings / infrastructure.	
	Beneficial	Remediation of significant, widespread elevated levels of soil contamination/ sensitive water resource contamination. Re-use of significant quantities of excavated soils on-site to avoid disposal to landfill	

9.4 Consultation

9.4.1 With the exception of the consultation undertaken for the general purposes of the Environmental Impact Assessment (EIA), no external consultation has

been carried out specifically for the purposes of the geology and soils assessment.

9.5 Assumptions and Limitations

9.5.1 To the extent that this document is based on information obtained from ground investigations persons using or relying on it should recognise that any such investigation can examine only a fraction of the subsurface conditions. Also, in any ground investigation there remains a risk that pockets or "hot-spots" of contamination may not be identified, because investigations are necessarily based on sampling at localised points. It is also noted that much of the previous ground investigation data may predate current testing and contamination assessment guidelines. Furthermore, certain indicators or evidence of hazardous substances or conditions may have been outside the portion of the subsurface investigated or monitored and thus may not have been identified or their full significance appreciated.

9.6 Baseline Information

Spatial Scope

9.6.1 The spatial scope was defined in the M20 junction 10a Environmental Scoping Report[18] which identified the locations of likely geotechnical risk and contamination sources, where pathways and pollutant linkages could result from construction activities and where the geological conditions may impact on the Main and Alternative Schemes, or vice versa.

9.6.2 The spatial scope with respect to potential sources of contamination is inclusive of all locations where physical works and ground disturbance would take place during the Main and Alternative Schemes, plus a 250m buffer around these locations. It is unlikely that contaminant sources further away would impact the geology or soils features in the vicinity of the Main and Alternative Schemes, or contribute to local land contamination during construction of the Main and Alternative Schemes. Sources outside of 250m have been identified, but have been scoped out as they are unlikely to affect the Main and Alternative Schemes. Potential receptors are considered up to a distance of 250m from the Main and Alternative Schemes' extents.

Temporal Scope

9.6.3 The baseline scenario considers the sub-surface conditions on site as they exist at the time of writing in 2016 and the current impacts on any particular resources or receptors. Assessment of the construction period considers the impacts and associated impacts of construction on areas of potentially contaminated land or geological resources within the spatial scope of the proposed Main and Alternative Schemes and associated works, including the remediation of any contamination, if required.

[18]Highways Agency (2015) M20 J10a Scoping Report (341755-90-140-RE-02 Rev D)

9.6.4 The operational scenario considers the impact that any residual contamination could have on the general environment surrounding the proposed Main and Alternative Schemes and an assessment of the risks of ground pollution as a result of the operation of the schemes, and identification of mitigation measures to address these risks. The opening year for the Main and Alternative Schemes is currently estimated as 2020.

Data Sources

9.6.5 Information has been gathered from the following sources for the identification and assessment of impacts on geology and soils:

- M20 Junction 10A Access to the South of Ashford, Ground Investigation Report, January 2011, Prepared by: URS Corporation Ltd[19].
- M20 Junction 10A Access to the South of Ashford, Geotechnical Design Report, January 2011, Prepared by: URS Corporation Ltd[20].
- M20 Junction 10A Access to South Ashford, Geotechnical Preliminary Sources Study Report, November 2004, Prepared by: Parsons Brinckerhoff Ltd[21].
- Contaminated Land Desk Study and Preliminary Interpretative Report[22] DCO submission document number 7.4).
- Envirocheck Report (included in the appendices of the above report).
- British Geological Survey (BGS): Map and Map Data Viewers[23].
- BGS: Mining Plans Portal[24].
- Coal Authority (CA): Interactive Map Viewer[25].
- Natural England Agricultural Land Classification (ALC) Map: London and the South East, ALC007[26].
- Cranfield University Soilscapes[27].
- Environment Agency (EA): What's In Your Backyard? Interactive Maps[28].
- Magic Map Application: Interactive Maps[29].

[19] URS Corporation Ltd (2011) M20 Junction 10A Access to the South of Ashford, Ground Investigation Report, January 2011,

[20] URS Corporation Ltd (2011) M20 Junction 10A Access to the South of Ashford, Geotechnical Design Report:

[21] Parsons Brinckerhoff Ltd (2004) M20 Junction 10A Access to South Ashford, Geotechnical Preliminary Sources Study Report

[22] Mott MacDonald Grontmij (2015) Contaminated Land Desk Study and Preliminary Interpretative Report, HA514442-MMGJV-GEN-SMW-RE-Z-7401

[23] BGS Map and Map Data Viewers: http://bgs.ac.uk/data/mapViewers/home.html?src=topNav, accessed May 2015

[24] BGS Mining Plans Portal, http://194.66.252.141/Website/NonCoalMining/viewer.htm, accessed May2015

[25] CA Interactive Map Viewer: http://mapapps2.bgs.ac.uk/coalauthority/home.html, accessed May 2015

[26] Natural England AlC007: http://publications.naturalengland.org.uk/publication/14104, accessed May 2015

[27] Cranfield University Soilscapes: http://www.landis.org.uk/soilscapes/, accessed May 2015

[28] EA What's In Your Backyard: http://apps.environment-agency.gov.uk/wiyby/default.aspx, accessed May 2015

[29] Magic Map Applications: www.magic.gov.uk/magicmap.aspx, accessed May 2015

Topography

9.6.6 The topography of the area is relatively flat with the ground level approximately 50-55m Above Ordnance Datum (AOD) as shown in the Ordnance Survey Landranger Map 189[30]. The floodplain associated with the Aylesford Stream is relatively flat and in a moderate valley. The ground level of the floodplain lies between approximately 40 – 45m AOD. The ground level rises on both sides of the floodplain (north and south) to approximately 50 – 55m where the A2070 link road would run.

Regional Geology

9.6.7 The following information is summarised from BGS records and the M20 junction 10a Access to the South of Ashford, Ground Investigation Report19.

Superficial Deposits

9.6.8 Alluvium deposits were encountered below the topsoil or Made Ground up to a maximum depth of 7.00m bgl (below ground level) and a maximum thickness of 6.45m, typically comprising soft, occasionally firm, brown gravelly silty clay or silt, sandy silt or loose silty sand. A 0.2m thick peat horizon was encountered within the Alluvium in a Trial Pit (TP06) proximal to the Willesborough Garden Centre.

9.6.9 River Terrace deposits were encountered to a maximum depth of 5.5m bgl and a maximum thickness of 3.8m, typically comprising light grey or off white gravelly silty sand, gravel or cobbles of limestone, soft to firm silty clay or coarse sand or gravelly clayey silt.

Bedrock

9.6.10 Hythe Formation was encountered to a maximum depth of 11.6m bgl and a maximum thickness of 9.2m, typically comprising medium dense or dense sands, silty sands with bands of strong grey limestone or extremely weak fine grained grey sandstone. Fractures within the limestone of the Hythe Formation are described as medium to extremely closely spaced, rough, planar, undulating and occasionally stepped. In some cases discontinuity surfaces are stained orange brown but otherwise unaltered.

9.6.11 Atherfield Clay Formation was encountered to a maximum depth of 23.5m bgl and a maximum thickness of 13.6m, typically comprising stiff or very stiff fissured blue grey clay or silt of medium to very high strength.

9.6.12 Weald Clay Formation was encountered to a maximum depth 24.95m. Maximum thickness was not proven but is expected to be in excess of 120m[31]. The stratum typically comprised a stiff to very stiff fissured bluish grey and

[30] Ordnance Survey Landranger Map 189 Ashford & Romney Marsh Area 1:50000 Scale, Copyright 1994
[31] British Geological Survey (1992) British Regional Geology, The Wealden District, fourth edition, HMSO

light brown silty clay of high to very high strength, with occasional silt partings and shell fragments.

Regional Soils

9.6.13 Based on the Cranfield Soil and Agrifood Institute Soilscapes online map, the entire Main and Alternative Schemes areas are located over "Freely draining slightly acid but base-rich soils".

9.6.14 According to the Agricultural Land Classification of England and Wales (Ministry of Agriculture, Fisheries and Food 1988)[32], the Main and Alternative Schemes areas are located over land classified as Grade 2 and 3. Descriptions of these Grades are provided below. The description for Grade 1 is also provided for reference:

- **Grade 1 - Excellent quality agricultural land:** Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.
- **Grade 2 - Very good quality agricultural land:** Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.
- **Grade 3 - Good to moderate quality agricultural land:** Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.

9.6.15 Topsoil encountered is anticipated to be <1.00m in thickness.

9.6.16 The Envirocheck Report included as an Appendix to the Contaminated Land Desk Study and Preliminary Interpretative Report (DCO submission document number 7.4) indicates the anticipated background soil chemistry for soil underlying the Main and Alternative Schemes is as follows:

- Arsenic: <15 mg/kg; the Hythe Formation is anticipated to have higher concentrations of approximately 15-25 mg/kg arsenic;
- Cadmium: <1.8 mg/kg;
- Chromium: 60-90 mg/kg;

[32] Ministry of Agriculture, Fisheries and Food (1988) *"Agricultural Land Classification of England and Wales, Revised guidelines and criteria for grading the quality of agricultural land"*

- Lead: <150 mg/kg; and,
- Nickel: 15-30 mg/kg.

Minerals

9.6.17 The Hythe Formation, locally known as Kentish Ragstone, underlies the site, this has been identified by the Kent Minerals and Waste Local Plan and the Mineral Resource Information in Support of National, Regional and local Planning document for Kent[33] produced by the BGS as being a regionally important mineral resource.

9.6.18 The ragstone beds, usually between 0.15 and 1.0m thick are interbedded with loosely cemented sandstone known locally as “hassock”. The Hythe Formation varies in thickness between 30m in the Maidstone area to 10m in east Kent, with ragstone varying between 50 and 20 per cent of the rock. This limestone is the only significant local source of primary crushed rock aggregate in South East England. It is suitable for Type 1 roadstone, although not for wearing-course material.

9.6.19 Production costs are relatively high because of the need to separate the limestone from the Hassock Sand. Hassock Sand is sometimes sold as low grade fill.

9.6.20 The limestones within the Hythe Formation known as “Kentish Ragstone” contains a significant proportion of quartz sand grains making them durable but difficult to work. It has been extensively quarried for building stone in the county.

9.6.21 Historically the Hythe Formation has been quarried in Mersham Quarry to the north of the M20 on adjacent land to the north of Hythe Road and another unnamed quarry to the south of Hythe Road which extends beneath the existing M20 carriageway up to Kingsford Street to the south of the M20. These were subsequently utilised as landfills and their location is noted on Figure 2.3, Volume 6.2.

9.6.22 Recent ground investigations have indicated the Hythe Formation to be present near the surface to the south of the current M20 carriageway in the vicinity of the disused plant nursery. However, engineering descriptions appear to indicate that there is little limestone and the material is mainly hassock.

9.6.23 At the time of writing the are presently no plans to extract minerals from the study area itself It is considered unlikely that any quarrying could practicably be extracted in the vicinity of the proposed scheme due to the local constraints. The area in which it could be quarried is bounded to the north by

[33] British Geological Survey (2002) Mineral Resource Information in Support of National, Regional and Local Planning, Kent (comprising Kent, Medway and London Boroughs of Bexley and Bromley) British Geological Survey Commissioned Report CR/02/125N

the M20, to the west by a major A road and to the east by the village of Mersham.

9.6.24 The results of the minerals assessment have been shared with the Minerals Team from Kent County Council for further comment. .

Regional Environmentally Sensitive Sites

9.6.25 There are no designated sites relating to geological features beneath or in the vicinity of the proposed Main and Alternative Schemes.

9.6.26 The following designations are present, proximal to the Main and Alternative Schemes:

- Hatch Park SSSI approximately 380m south east of the boundary of the Main and Alternative Schemes, designated for its unimproved acidic grassland, a scarce habitat in Kent, and its ancient pollard woodlands, the latter supporting the richest epiphytic lichen community in the county.
- Ashford Green Corridors Local Nature Reserve lies approximately 25m west of the Main and Alternative Schemes boundary.

Hydrology and Hydrogeology

9.6.27 Groundwater and surface water features are also discussed in Chapter 14: Road Drainage and the Water Environment.

9.6.28 The Hythe Formation bedrock is classified by the Environment Agency as a Principal Aquifer, which is described as providing *"a high level of water storage. They may support water supply and/or river base flow on a strategic scale".*

9.6.29 The Atherfield Clay and Weald Clay Formations are classified as Unproductive Strata, described as *"rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow".*

9.6.30 The Sandgate Formation bedrock is classified as a Secondary A Aquifer, described *as "permeable layers capable of supporting water supplies at a local rather than strategic scale"*.

9.6.31 Both the River Terrace Deposits and Alluvium are classified by the Environment Agency as Secondary A Aquifers described as *"permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".*

9.6.32 The Main and Alternative Schemes do not overlie any Source Protection Zones (SPZ) and no sensitive groundwater abstractions are located within 250m of the schemes.

9.6.33 There are no water abstractions within the Main and Alternative Schemes boundary or within 250m of the schemes.

9.6.34 The Aylesford Stream passes below the M20 carriageway at approximate National Grid Reference (NGR) TR 04308 41205, then travels approximately east to west before passing below the A2070 Bad Munstereifel Road at approximate NGR TR 03631 41218. The Aylesford Stream is the only significant surface water feature within the Main and Alternative Schemes boundary.

Historical and Current Land Use

9.6.35 Historical maps[34] have been reviewed to determine the past land uses in the vicinity of the Main and Alternative Schemes. The findings are summarised in Table 9.5.

Table 9.5 Historical Land Use

Map, Scale and Year	Land Use
OS County Series: Kent,1:2,500, 1871	The majority of the land in the vicinity of the Main and Alternative Schemes appears to be open fields / farmland. The map shows the Hythe Road in approximately the same alignment as the present day. The Aylesford Stream is marked following the same course as the present day, and flows in a westerly direction. A bridge called Swatfield Bridge is marked as part of the Hythe Road, spanning the Old Mill Stream. A quarry is marked north of the Hythe Road, and an associated Limekiln is located to the north. A smaller area of earthworks is also shown to the south of Hythe Road.
OS County Series: Kent, 1:2,500, 1898 OS County Series: Kent, 10,560, 1898	Mersham Quarry and limekiln now marked as “Old Quarry” and “Old Limekiln”.
OS County Series: Kent, 1:2,500, 1907 OS County Series: Kent, 1:10,560, 1908	Part of the Hythe Road route now marked as Willesborough Street with associated surrounding developments including Lacton Hall, Little Lacton, Lacton Green and the Blacksmiths’ Arms Public House. An additional small oblong shaped quarry is noted to the south west of Hythe Road.
OS County Series: Kent, 1:2,500, 1933-1939	The Hythe Road is now marked as A20. The A20 / Hythe Road route has been extended to bypass Willesborough Street. Other small developments have been marked, including “The Warren”, “Summerhill”, and “Crooksfoot”, near Swatfield Bridge. An additional quarry is marked south of the Hythe Road, directly south of the Old Quarry.
OS County Series: Kent, 1:10,560, 1938-1940	Little change.
OS Plan, 1:2,500, 1960-1972	The Old Quarry is now marked as a Refuse Tip, a pond covers its north western corner. The 2 quarries to the south of Hythe Road are no longer present. A plant nursery is now marked here, in the same location as the present day. Residential and other development in the Willesborough area to the west has expanded significantly.

[34] National Library of Scotland , http://maps.nls.uk/, Accessed October 2015

Map, Scale and Year	Land Use
OS Plan, 1:10,000, 1975-1978	Residential and other development to the west has further increased. The Willesborough area is now moderately urbanised.
OS Plan, 1:10,000, 1985	Refuse Tip no longer marked. The M20 Motorway and junction 10 have been constructed.
OS Plan, 1:10,000, 1990-1993	Little change.

Contamination and Waste

9.6.36 The following features have been identified as sources of potential contamination:

- Historical Landfill: Mersham Quarry landfill site has been identified by the Environment Agency, north of the Hythe Road and east of the Aylesford Stream in the location of the Old Quarry identified in the historical maps. The site first received waste on the 31 December 1966 and last received waste on the 1 December 1974. The site accepted inert, commercial, and household waste types.
- Unnamed quarry (Hythe Road Quarry) marked on the 1933 - 1939 OS map south of the Hythe Road.
- Unnamed quarry (Nursery Quarry) marked on the 1907 - 1908 OS map in the same location as the existing disused plant nursery.
- Farms and associated agricultural practices.
- M20 carriageway construction (potentially contaminative construction materials and made ground introduced during the original construction of the motorway).
- Vehicle use and maintenance work on operational M20 carriageway;
- Willesborough Garden Centre.
- Disused plant nursery.

9.6.37 Contamination testing was undertaken during both the 2010 and the 2015 ground investigations targeting areas of concern identified above, the findings of the Generic Quantitative Risk Assessment[35] are summarised in Table 9.6.

Table 9.6 Generic Quantitative Risk Assessment summary

Receptor	Description	Residual Risk
Risk to Human Health		
Local Residents and General Public	**Soils** Majority of the contaminants fell below the generic assessment criteria for Commercial / Industrial Land use. Elevated concentrations of Polycyclic Aromatic Hydrocarbons identified in isolated locations in Mersham Quarry and discussed plant	Low

[35] Highways England, May 2016, Contaminated Land Desk Study and Preliminary Interpretative Report, M20 Junction 10A

Receptor	Description	Residual Risk
	nursery. Contact with any contaminated soils between local residents and the general public in these areas is unlikely and therefore the risk is minimised. Whilst no specific remediation is required for the protection of human health from in-situ soils, there is a potential for windblown dust to be generated during construction works which will require mitigation.	
	Ground Gas Elevated concentrations of ground gas which falls within the BS8485:2015[36] Characteristic Situation 2 scenario. Some excavation is proposed in the vicinity of the landfill, however, the impact on the gas regime is considered to be low. Any excavation into the landfill will create a preferential pathway for gas to disperse into the air rather than migrate through the ground to offsite receptors. There is not anticipated to be risk to local residents or the general public from ground gas that requires any specific remediation.	Low
Construction workers	**Soils** The assessment undertaken does not consider short term or acute exposures to soil contaminants therefore a risk assessment should be undertaken by the works contractor in accordance with the Control of Substances Hazardous to Health (COSHH) Regulations 2002 to determine the risk posed to Construction and Maintenance workers from the soil contamination present at the site and inform any necessary protection measures required.	Moderate
	Ground Gas The risks to construction and maintenance workers have been assessed by comparison of gas levels with the Health and Safety Executive Work Exposure Limits (WELs). All monitoring locations have recorded CO2 concentrations exceeding the 8 hour WEL and some recorded CO2 concentrations exceeding the 15 minute WEL. There is a potential for construction workers to have to enter confined spaces, mitigation measures will need to be put in place by the Contractor to minimise these risks.	Moderate
Risks to Controlled Waters		
Groundwater	Exceedances of numerous inorganic and organic contaminants were identified in water and leachate extract from soil tests in various locations across the site Hydrocarbons were encountered at concentrations considered to be a potential risk to groundwater. The Hythe Formation is classified by the Environment Agency as a Principal Aquifer and both the Head Deposits and Alluvium are classified as Secondary A Aquifers. Appropriate mitigation measures need to be considered for any works to be carried out in order to ensure that no pathways for contamination transportation are created, presenting a risk to important water bodies	Moderate / Low

Receptor	Description	Residual Risk
Risks to buried Structures		
Concrete / utility pipes	An assessment has confirmed that the natural ground underlying the site may contain pyrite which could adversely degrade concrete and therefore the most appropriate concrete materials should be selected to withstand these ground conditions.	Moderate

9.6.38 Asbestos was identified in 4 samples all collected from Made Ground associated with Willesborough Garden Centre (S6) and the disused plant nursery (S7). Where asbestos is suspected or found, advice on risk assessment and remediation should be sought from an appropriately qualified specialist to ensure appropriate measures are put in place during construction.

9.6.39 Waste classification undertaken as part of the preliminary investigation indicated that material excavated from the backfilled quarry areas and the former plant nursery could possibly be classified as hazardous waste should it require offsite disposal.

9.6.40 Some samples were classified as "potentially hazardous" due to the presence of TPH, however, concentrations fell below the inert waste landfill Waste Acceptance Criteria (WAC) threshold. In addition, as no free-phase product was encountered within any of the exploratory holes it is considered likely, these samples will be classified as non-hazardous.

9.6.41 "Uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction its natural state on the site from which it was excavated" is excluded from the Waste Framework Directive.

9.6.42 Uncontaminated Alluvium, Hythe Formation, Sandgate Formation, and Atherfield Clay Formation may therefore not be classified as waste. It is considered that reuse of such material in accordance with a duly made Environmental Permit or the CL:AIRE Code of Practice will provide necessary evidence that reuse activities fall outside of the waste management framework.

9.7 Mitigation and Compensation Measures

Construction

9.7.1 The following measures may be adopted during the construction stage to minimise effects upon geology, soils and contaminated land:

- Protection of soil structure and quality: Soils would be stripped, handled, stored and reinstated using best practice procedures, in accordance with appropriate guidelines, such as DEFRA's 2009 'Code of Practice for the Sustainable Use of Soils on Construction Sites'[37]. Other possible

[37] DEFRA, 2009: Code of Practice for the Sustainable Use of Soils on Construction Sites:

mitigation measures may include, but not be limited to, the use of a proprietary geotextile membrane to protect the existing ground condition, a layer of inert crushed granular material on the membrane to form temporary running surfaces for construction plant and reinforcement of access tracks. Guidance regarding the correct procedure for storage, handling and disposal of contaminated soils and the aforementioned measures would be detailed in a Soil Handling and Management Plan (SHMP) as part of the Construction Environmental Management Plan (CEMP). These mitigation measures have been provided in the Outline CEMP, contained in Appendix 17.1 of Volume 6.3, which will be updated by the Contractor prior to construction.

- Dust suppression: Dust would be suppressed using best practice methods as discussed in Chapter 5 Air Quality, Volume 6.1. The dust mitigation measures would also prevent the spread of potentially contaminated windblown material. The Outline CEMP (Appendix 17.1, Volume 6.3) also contains suggested dust suppression measures.
- Prevention of Contamination: The following measures have been highlighted in the Contaminated Land Desk Study and Preliminary Interpretative Report (DCO document submission number 7.4).
    - To mitigate short-term (acute) risks to construction workers, from contaminated soil and ground gas a safe system.
    - Safe systems of work should be implemented by the Contractor, workers should be appropriately trained and undergo induction to make them aware.
    - The earthworks would be carried out under a Materials Management Plan (MMP) in accordance with industry adopted guidance “The Definition of Waste: Development Industry Code of Practice _ Version 2”[38] published By CL:AIRE in March 2011 and an earthworks specification which will provide geotechnical and chemical acceptability criteria to which site won and imported materials would comply before being used during construction.
    - Hazardous substances such as excavated contaminated land, fuels, chemicals, waste and construction materials would be stored, handled, transported and disposed of in accordance with the CEMP. This would also outline emergency procedures to respond to potential accidental spillages and leaks.
    - During construction it is anticipated that the Hythe Formation (Principal Aquifer) and superficial deposits Head and Alluvium (Secondary A Aquifers) are likely to be encountered, with the potential for creation of transport pathways between contaminants in site soils and these controlled water receptors.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69308/pb13298-code-of-practice-090910.pdf, accessed October 2015

[38] CL:AIRE, 2011: The Definition of Waste: Development Industry Code of Practice, Version 2

However, given the moderate concentrations of inorganic contaminants encountered, it is considered that the risk to these aquifers can be sufficiently mitigated through appropriate measures including the following.

- Should open excavation be required in the area of historical landfills or quarry material, excavations would be backfilled immediately on completion of construction in order to prevent leachate generation by precipitation infiltration through the material.

- Where piling or penetrative ground improvement is required through potentially contaminated ground, the works would be carried out in accordance with the Environment Agency publications "Piling into contaminated sites"39 and “Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention”40 and a Foundation Works Risk Assessment may need to be undertaken.

- Using guidance in BRE Special Digest 1 (Concrete in Aggressive Ground), the ground conditions encountered along the route indicate a worst case scenario Design Sulphate Class of DS-4 and an ACEC Class of AC-4 using mobile groundwater conditions. Where concrete is to be utilised during construction the Contractor would ensure selection of appropriate concrete class in order to prevent corrosion and degradation of the material. It should be noted that the Design Sulphate classification may change following any further investigation and testing.

Operation

9.7.2 Due to the nature of the proposed Main and Alternative Schemes as a road development, the completed and operational Main and Alternative Schemes are not expected to result in any significant adverse effects for geology and soils or to increase the risk of contaminants being mobilised. However, during the operation of the new section of carriageway, there is a potential for fuels, oils and ethylene glycol to leak from cars which could impact on near surface soils. Chapter 14 Road Drainage and the Water Environment (Volume 6.1) considers the environmental risks associated with spillages from road activities.

[39] EA, 2002: *Piling into Contaminated Sites,* accessed October 2015

[40] EA, 2001: *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention,* accessed October 2015

9.8 Predicted Geology and Soils Effects

Main Scheme

Construction

9.8.1 The proposed Main Scheme would include a range of construction activities, which could result in adverse effects for geology and soils and risks of contamination. The main construction activities would include:

- Shallow excavation works – areas where shallow excavation works would be undertaken would result in the permanent removal of Made Ground and soils.
- Earthworks – where major earthworks would be required, a cut and fill balance would be aimed for, however surplus soils may be suitable for re-use elsewhere on the scheme depending on testing of the soils and providing the results fall within defined acceptability criteria.
- General Construction works – movement of materials, construction plant and storage of materials may lead to compaction for high grade agricultural soils, and storage of hazardous chemicals leading to secondary effects on soils and groundwater.
- Piling works – creation of pathways for contamination to pollute groundwater.

9.8.2 The following outlines the predicted environmental effects for each receptor (prior to mitigation). This includes information detailed in the Contaminated Land Desk Study and Preliminary Interpretative Report (DCO Document reference 7.4).

9.8.3 **Soils:**

- Permanent removal of soils where excavation works are carried out during earthworks and foundation construction.
- Potential for excess material to be generated which could be suitable for reuse elsewhere.
- Soil deterioration and consolidation may occur due to poor storage and handling or due to vehicle movements during construction and due to loading by the site.
- Construction is likely to involve digging new trenches for utilities and potentially diverting existing utilities, which would result in the temporary loss of soil and may impact on soil structure.
- Potential contamination of soils through contaminant mobilisation during excavations or accidental spills and leakages of hazardous substances.

9.8.4 **Geology:**

- Potential for permanent removal of geological strata during excavation of deeper sections of the Main Scheme.

9.8.5 **Groundwater:**

- Potential pollution of Principal Aquifer in bedrock and Secondary A Aquifers in superficial deposits.

9.8.6 **Surface water:**

- Potential for pollution of Aylesford Stream and other small water bodies.

9.8.7 **Construction and maintenance workers:**

- Potential for “significant harm” to construction and maintenance workers.

9.8.8 **Buildings, Structures, and Utilities:**

- Potential for ingress of contaminants through subsurface construction materials, especially when in contact with Alluvium which is known to contain pyrite material.

9.8.9 **Flora:**

- Potential for impairment of the re-instatement of landscape screening and grass development.

9.8.10 Table 9.7 summarises appropriate mitigation measures for the Main Scheme, and anticipated effects following the implementation of mitigation.

Table 9.7 Assessment of Effect after Mitigation (Main Scheme)

Receptor	Summary of Effects	Mitigation	Compliance Mechanism	Action By	Sensitivity of Receptor	Magnitude	Effect Without Mitigation	Effect With Mitigation
Soils	Permanent removal of soils where excavation works are carried out during earthworks and foundation construction.	The CEMP would contain a Materials Management Plan (MMP) which outlines a cut and fill balance method that can be employed to reduce the amount of material permanently removed from the area of the scheme. The Site Waste Management Plan (SWMP) also outlines the methodology of handling waste soils.	CEMP MMP SWMP	Contractor	High (removal of ALC Grade 2 soil)	Moderate	Large / Moderate Adverse	Slight Adverse
					Medium (removal of ALC Grade 3 soil)		Moderate Adverse	Neutral
	Potential for excess material to be generated which could be suitable for reuse elsewhere.			Contractor	High (removal of ALC Grade 2 soil)	Moderate	Large / Moderate Adverse	Slight Beneficial
				Contractor	Medium (removal of ALC Grade 3 soil)	Moderate	Moderate Adverse	Slight Beneficial
	Soil deterioration and consolidation may occur due to poor storage and handling or due to vehicle movements during construction and due to loading by the site.	Works would be undertaken in accordance with appropriate guidelines such as DEFRA's 2009 Code of Practice for the Sustainable Use of Soils on Construction Sites. Stripping of soils for temporary works, storage of materials and reinstatement upon completion using best practice procedures. Sequential stripping of topsoil and separate stockpiling of topsoil and subsoil. Stockpiles would be clearly defined. Tracked equipment would be used where possible, and traffic would be confined to designated routes to minimise compaction. This will be detailed in and supported by the proposed Soil Handling and Management Plan (SHMP) as part of the CEMP.	DEFRA 2009 Code of Practice for Sustainable Use of Soils on Construction Sites[41] BS 3882:2015 Specification for topsoil[42] SHMP	Contractor	High (removal of ALC Grade 2 soil)	Moderate ()	Large / Moderate Adverse	Slight Adverse
					Medium (removal of ALC Grade 3 soil)	Moderate	Moderate Adverse	Slight Adverse
	Construction is likely to involve digging new trenches for utilities and potentially diverting existing utilities which would result in the temporary loss of soil and may impact on soil structure.	A cut and fill balance has been carried out in the MMP within the CEMP to reduce the amount of material permanently removed from the area of the Scheme.	CEMP MMP	Contactor	High (removal of ALC Grade 2 soil)	Moderate(	Large / Moderate Adverse	Slight Adverse
					Medium (removal of ALC Grade 3 soil)	Moderate	Moderate Adverse	Slight Adverse
		Works would be undertaken in accordance with appropriate guidelines such as DEFRA's 2009 Code of Practice for the Sustainable Use of Soils on Construction Sites. BS 3882:2015 Specification for topsoil This will be detailed in and supported by the proposed Soil Handling and Management Plan (SHMP) as part of the CEMP.	DEFRA 2009 Code of Practice for Sustainable Use of Soils on Construction BS 3882:2015 Specification for topsoil SHMP	Contractor	High (removal of ALC Grade 2 soil)	Moderate	Large / Moderate Adverse	Slight Adverse
					Medium (removal of ALC Grade 3 soil)	Moderate	Moderate Adverse	Slight Adverse

[41] DEFRA, 2009: Code of Practice for the Sustainable Use of Soils on Construction Sites: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69308/pb13298-code-of-practice-090910.pdf, accessed August 2015
[42] BSI, 2015: BS 3882:2015 Specification for topsoil: http://shop.bsigroup.com/ProductDetail/?pid=000000000030297815, accessed August 2015

Receptor	Summary of Effects	Mitigation	Compliance Mechanism	Action By	Sensitivity of Receptor	Magnitude	Effect Without Mitigation	Effect With Mitigation
	Potential contamination of soils through contaminant mobilisation during excavations or accidental spills and leakages of hazardous substances.	Hazardous substances, including contaminated land, fuels, chemicals, waste and construction material, would be stored, handled, transported and disposed of, according to relevant legislation and best practice guidance to mitigate spillages and leaks. Procedures would be put in place should contaminated land be encountered including suitable management/ remediation. The Local Planning Policy sets out development requirements in relation to contaminate land. Recommendations are also provided in the interpretive report.	CEMP SWMP Ashford Borough Council Local Plan 2000 ABC LDF Core Strategy (2008) NPPF	Contractor	High (removal of ALC Grade 2 soil)	Moderate	Large / Moderate Adverse	Neutral / Slight Adverse
					Medium (removal of ALC Grade 3 soil)	Moderate	Moderate Adverse	Neutral / Slight Adverse
Geology	Potential for permanent removal of geological strata during excavation of deeper areas of the Scheme.	The CEMP would contain a MMP, which would outline a cut and fill balance method that can be employed to ensure as much material as possible that is removed from the works area is re-used in the Scheme.	CEMP MMP	Contractor	Low (Depth of excavations unlikely to significantly affect deep geological strata)	Moderate	Slight Adverse	Neutral
Minerals	Potential Sterilisation of mineral assets or disposal of naturally occurring resources. In addition the site area is confined and restricted on all sides by existing developments and roads.			Contractor	Low (borehole logs indicate presence of “hassock” near surface rather than good quality limestone material)	Minor	Slight Adverse / Neutral	Neutral
Groundwater	Potential pollution of Principal Aquifers in bedrock.	Open trench construction: open excavations, especially within or in the vicinity of landfill material, would be lined in order to inhibit water percolation and subsequent leachate generation. Where piling or penetrative ground improvement is required through contaminated ground, especially in the vicinity of source protection zones and aquifers, works would be carried out in accordance with the Environment Agency “Piling into contaminated sites” guidance and “Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention” and a Foundation Works Risk Assessment may be required to be undertaken. Hazardous substances, including contaminated land, fuels, chemicals, waste and construction material, would be stored, handled, transported and disposed	EA Model procedure for the Management of Land Contamination ABC Local Plan 2000 ABC LDF Core Strategy (2008) NPPF Piling and Penetrative Ground Improvement and Methods on Land Affected by Contamination: Guidance on Pollution Prevention[43] Piling into Contaminated Sites”[44]	Contractor	High	Moderate	Large / Moderate Adverse	Slight Adverse
	Potential for pollution of Secondary A Aquifers in superficial deposits.			Contractor	Medium	Moderate	Moderate Adverse	Slight Adverse
Surface Water	Potential for pollution of Aylesford stream and other small water bodies.			Contractor	Medium	Moderate	Moderate Adverse	Slight Adverse

[43] Environment Agency, 2001: Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention, National Groundwater & Contaminated Land Centre Report NC/99/73

[44] Environment Agency, 2002: Piling into Contaminated Site, National Groundwater & Contaminated Land Centre Report

Receptor	Summary of Effects	Mitigation	Compliance Mechanism	Action By	Sensitivity of Receptor	Magnitude	Effect Without Mitigation	Effect With Mitigation
		of, according to relevant legislation and best practice guidance to mitigate spillages and leaks. The Local Planning Policy sets out development requirements in relation to contaminate land.						
Human Health	Construction and maintenance workers: Harm to human health by ingestion / inhalation/dermal contact with contaminated soils	General mitigation measures would include: - contractor would implement safe systems of working that minimise exposure to contaminants; -Workers would be made aware of the risks posed due to contamination within the stockpiled material, for example through toolbox talks before undertaking any works; - All site operatives would be fully trained and there should be a trained and responsible manager on site during any movement of the stockpile.	Health and Safety at Work etc. Act 1974[45] Confined Spaces Regulations 1997 CEMP MMP ABC Local Plan 2000 ABC LDF Core Strategy (2008) NPPF	Contractor	Medium	Moderate	Moderate Adverse	Slight Adverse
	Future site users and local residents: Short term risk of exposure to contaminated dust through ingestion / inhalation / dermal contact.	Dust would be suppressed using best practice methods to prevent spread of potentially contaminated windblown material. Dust suppression measures would include wheel washing for vehicles leaving the site and re-vegetation of earthworks and exposed areas. Further detail regarding dust suppressing measures would be included in the CEMP.	CEMP	Contractor	Low	Minor	Slight Adverse / Neutral	Neutral
Structures and Utilities	Potential for ingress of contaminants through subsurface construction materials, especially when in contact with Alluvium which is known to contain pyrite material.	Where concrete is to be utilised during construction the Contractor would ensure selection of appropriate concrete class in order to prevent corrosion and degradation of the material. Appropriate selection of concrete, capable of withstanding ground conditions and contaminants identified in the interpretive report.	Detailed design process.	Contractor	Low	Major	Moderate Adverse	Neutral
Flora and Fauna	Potential for impairment of the development of landscape screening and grass development.	Stripping, handling, storage and reinstatement of soils, including topsoils, would be in accordance with best practice procedures and guidelines, such as DEFRA's 2009 'Code of Practice for the Sustainable Use of Soils on Construction Sites'. Topsoil would be imported where required to promote re-vegetation. Imported topsoil would be screened to ensure it meets the specifications and requirements set out in BS 3882:2015 Specification for topsoil. This will be detailed in and supported by the proposed Soil Handling and Management Plan (SHMP) as part of the CEMP.	DEFRA 2009 Code of Practice for Sustainable Use of Soils on Construction. BS 3882:2015 Specification for topsoil SHMP	Contractor	Low	Moderate	Slight Adverse	Neutral

[45] HSE, 1974: Health and Safety at Work etc. Act 1974, http://www.legislation.gov.uk/ukpga/1974/37/contents, accessed August 2015

Operation

9.8.11 During the operation of the scheme, there is a potential for fuels, oils and ethylene glycol to leak from cars which could impact on near surface soils. This can be mitigated by the collection of surface water, passing through an adequately sized fuel interceptor prior to discharge preventing pollution of watercourses and soils where appropriate. This is covered in more detail in Chapter 14 Road Drainage and Water Environment, Volume 6.1. In addition the HAWRAT assessment is presented as Appendix 14.3 Volume 6.6 of the ES.

Alternative Scheme

Construction

9.8.12 The construction of the Alternative Scheme would not have any significant effect on geology and soils. All non-significant effects are as reported above for the proposed Main Scheme and reference should therefore be made to Table 9.7 for the assessment of effects from the construction of the Alternative Scheme.

Operation

9.8.13 As above for the Main Scheme, the implementation of appropriate drainage system will mitigate the risks associated with spillages of fuels and chemicals which is covered in Chapter 14 Road Drainage and Water Environment, Volume 6.1.

9.9 Conclusions

9.9.1 The Main and Alternative Schemes have the potential to result in temporary, construction stage effects upon the quality and functionality of agricultural soils associated with removal, importation and structural changes to soils, as well as potential risks to human health and water resources including groundwater through the potential mobilisation of contaminants within contaminated soils and dust generation. As a result, construction stage effects upon geology, soils and contaminated land have been assessed in this section of the ES and in the Preliminary Interpretive Report, DCO Document 7.4.

9.9.2 Provided that the appropriate mitigation identified in Section 9.7 is applied and recommendations or requirements set out in the CEMP, MMP and future site Remediation Strategy are implemented, it is considered that there will be no resultant significant effects upon geology, soils and contaminated land during the construction or operational stages of either the Main or the Alternative Scheme.