

Southampton to London Pipeline Project

Volume 6

Environmental Statement (Volume B)
Chapter 11: Soils and Geology

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Contents

11	Soils and Geology	1
11.1	Introduction	1
11.2	Approach and Methods	2
11.3	Baseline Conditions	12
11.4	Design Measures.....	17
11.5	Potential Impacts (Without Mitigation).....	19
11.6	Mitigation	23
11.7	Residual Impacts (With Mitigation).....	23
11.8	References	23



11 Soils and Geology

11.1 Introduction

- 11.1.1 Soils and geology are key factors in determining the environmental character and quality of any given location or area. The rocks and superficial deposits beneath the ground's surface have a major influence on the landform, i.e. the topography and other geographical features of an area. The physical and chemical properties of the rocks and the overlying soils influence the type and variety of vegetation that will grow, agricultural quality, mineral resources, drainage, flood risk and water storage capacity. They also influence the transfer and distribution of contaminants potentially arising from current and previous land use.
- 11.1.2 The aspects considered in this Soils and Geology chapter include soils, geology, minerals, and land contamination.
- 11.1.3 Soils aspects include:
- impacts on agricultural soil; and
 - impacts on sensitive and vulnerable soils.
- 11.1.4 Geology aspects include:
- impacts on designated areas of geological interest;
 - unstable natural ground; and
 - suitability for trenchless construction.
- 11.1.5 Minerals aspects include:
- the presence of mineral safeguarding areas and minerals allocations and consents.
- 11.1.6 Land contamination aspects include:
- the presence of known or suspected potentially contaminated material associated with active and closed landfills. Also other potentially contaminative past activities.
- 11.1.7 Hydrogeology (including aquifers), water quality and human health aspects are only considered here when they may be the receptor to a potential pollutant linkage where the source is land contamination. Other aspects of hydrogeology and water quality are considered in Chapter 8 Water. Other aspects of human health are considered in Chapter 13 People and Communities and Appendix 13.4 Human Health Technical Note.
- 11.1.8 Ecological aspects including geology and hydrogeology dependent ecosystems are considered in Chapter 7 Biodiversity. However, where such systems or the underlying geology may be affected by contamination they are included within this chapter.

- 11.1.9 Agricultural aspects other than those detailed above are considered in Chapter 12 Land Use.
- 11.1.10 Aspects associated with potential contamination from the operation of the pipeline are covered in Chapter 14 Major Accidents.

Legislative and Policy Background

- 11.1.11 Chapter 2 Regulatory and Policy Context sets out the overarching policy relevant to the project including the Overarching National Policy Statement for Energy (EN-1). This is supported by National Policy Statement for Gas Supply Infrastructure and Gas Oil Pipelines (EN-4). EN-4 contains the following paragraph relating to soils and geology which has been considered within this chapter:
- Paragraph 2.23.3 *'When considering any application where the pipeline goes under a designated area of geological or geomorphological interest, the applicant should submit details of alternative routes, which either bypass the designated area or reduce the length of pipeline through the designated area to the minimum possible, and the reasons why they were discounted.'*
- 11.1.12 In addition, Appendix 2.1 Environmental Legislation and Policy includes legislation and national policy relevant to soils and geology. Appendix 2.2 Regional and Local Planning Policy provides a review of local policy considerations relevant soils and geology.

11.2 Approach and Methods

- 11.2.1 This section describes the methods used to establish the baseline and the approach to consider and assess the significance of potential effects on soils, geology, minerals and land contamination.
- 11.2.2 There is no pipeline specific guidance available for assessing and evaluating effects on soils and geology within the context of an Environmental Impact Assessment, therefore a bespoke methodology has been developed to assess soils, geology, minerals and land contamination, as described in the following sections.

Scope of Assessment

- 11.2.3 The scope of the soils and geology assessment has been informed by the Scoping Opinion provided by the Planning Inspectorate (2018) on behalf of the Secretary of State, following the submission of the Scoping Report (Esso, 2018).
- 11.2.4 Table 11.1 summarises the scope of the assessment for soils and geology. This table includes the references (for example ID 4.6.1) to the relevant paragraph response from the Planning Inspectorate in the Scoping Opinion. The boxes shaded in grey are the matters that have been scoped out of the assessment following the feedback from the Planning Inspectorate.

Table 11.1: Matters Scoped In and Out of the Assessment (Grey Shading Indicates Matters Scoped Out Following Feedback from the Planning Inspectorate)

Receptor	Matter / Potential Effect	Conclusion in the SR (July 2018)	Comments from the Planning Inspectorate in the Scoping Opinion (September 2018)
Soils	Loss of Best and Most Versatile (BMV) land during construction	Scoped out	(ID 4.5.1) The Inspectorate requires a definition of 'temporary' and further information on how the land will be restored. Scoped in.
	Deterioration of soil quality and of soil properties through handling and storage and deterioration of sensitive soils during construction	Scoped out	(ID 4.5.2) In the absence of detailed mitigation measures, the Inspectorate does not agree that this matter can be scoped out of the ES. Scoped in.
	Deterioration of soils important for sensitive ecological receptors during construction	Scoped out	(ID 4.5.3) The Inspectorate does not consider that this matter has been sufficiently addressed within the Biodiversity aspect chapter and therefore, does not agree that this matter can be scoped out of the ES. Scoped in under Chapter 7 Biodiversity.
	Land contamination and all other effects during operation	Scoped out	(ID 4.5.4) The Inspectorate agrees that significant effects during operation are unlikely. However, there remains a low risk of fuel leakage during operation. The Inspectorate would expect to see consideration of leaks and spills in the ES. Scoped in under Chapter 14 Major Accidents.
Geology	Sites of geological importance and geology during construction and operation	Scoped out	(ID 4.5.5) The Inspectorate agreed that this could be scoped out. However, since scoping, a designated area of geological interest has been identified and this has been assessed in the ES. Scoped in.
Mineral resources	Strategic importance of mineral resources within the area	Scoped in	Scoped in.
	Effects on minerals during construction	Scoped out	(ID 4.5.6) The Scoping Report did not include evidence of agreement with operating companies. It also identified gaps in the baseline information. Surrey County Council and Runnymede Borough Council provided information on existing mineral sites within their responses to the Scoping Opinion and these should be considered within the impact assessment. Scoped in.
Land contamination (during construction)	Potentially contaminated sites of medium/high sensitivity/ source potential	Scoped in	Scoped in
	Potentially contaminated sites of low sensitivity/source potential	Scoped out	(ID 4.5.7) The Inspectorate agrees that there are unlikely to be significant effects



Receptor	Matter / Potential Effect	Conclusion in the SR (July 2018)	Comments from the Planning Inspectorate in the Scoping Opinion (September 2018)
			and that this matter can be scoped out of the ES. Scoped out.
Land contamination (during operation)	Risks to human and environmental receptors during operation	Scoped out	No comments from Inspectorate. Scoped out.
Aquifers		Scoped out (in Water Chapter)	(ID 4.5.8) The Scoping Report states that aquifers will be assessed within the Water aspect chapter of the ES and acknowledges their role in the source-pathway-receptor model used in the land contamination assessment. The Inspectorate agrees that this is an appropriate approach and that this matter can be suitably assessed elsewhere within the ES; however, the Applicant should ensure cross reference is made to the Water chapter where appropriate. Scoped out

11.2.5 In addition to the points noted in Table 11.1, the Planning Inspectorate also raised the following comments to consider within the assessment:

- (ID 4.5.1a) Historically potentially contaminated sites: Industrial sites. Further information is required relating to the industrial estate drainage and catchment areas or whether underground tanks are used to confirm that these are classed as low risk.
- (ID 4.5.2a) Land contamination sites. Data regarding landfills, registered waste transport sites and other possible contamination sites of potential significance were not received in time for the Scoping Report. Details have been provided by Surrey County Council (SCC) and Runnymede Borough Council (RBC) with the Scoping Opinion and should be considered in the assessment.
- (ID 4.5.3a) Land contamination baseline: The ES needs to include information on pollution events in the contaminated land baseline including reference to a damaged multiproduct line.
- (ID 4.5.4a) The ES should be underpinned by relevant baseline information, including where necessary, conceptual site models.

11.2.6 In response to scoping opinion, industrial estates have now been added to the land contamination baseline assessment, together with information provided by SCC and RBC. Pollution events are also considered in the contamination baseline. Generic conceptual site models have been developed for the project, and individual conceptual site models have been developed for the scoped-in sites.

11.2.7 In addition to the scope outlined above, EN-4 asks for the risks from underground cavities and unstable ground to be understood (NPS EN-4 para. 2.23.1). EN-4 also asks for assessment of the suitability of geological conditions where the applicant proposes to use horizontal directional drilling (HDD) as the means of installing a pipeline under a National or European Site (NPS EN-4 para. 2.23.2). Potential



effects associated with any unstable ground including natural underground cavities or artificial ground, are addressed in the engineering design development, as are suitability of ground conditions for trenchless construction.. Therefore, effects associated with unstable ground affecting the integrity of the pipeline are not assessed as part of the Environmental Impact Assessment (EIA).

Study Area

- 11.2.8 For the purposes of this assessment, the route and Order Limits are broken down into eight separate sections, further details can be found in Chapter 3 Project Description:
- Section A – Boorley Green to Bramdean;
 - Section B – Bramdean to South of Alton;
 - Section C – South of Alton to Crondall (via Alton pumping station);
 - Section D – Crondall to Farnborough (A327 crossing);
 - Section E – Farnborough (A327 crossing) to Bisley and Pirbright Ranges;
 - Section F – Bisley and Pirbright Ranges to M25;
 - Section G – M25 to M3; and
 - Section H – M3 to the West London Terminal storage facility.

Soils

- 11.2.9 The study area for soils comprises the area directly affected by the project, that is the area within the Order Limits. Figure 11.1 Soil Types and Figure 11.2 Agricultural Land Classification show soil information for land within a 1km buffer of the Order Limits, to provide context within which to assess the information.

Geology

- 11.2.10 The baseline for geology is shown on Figure 11.3 Bedrock Geology and Figure 11.4 Superficial Geology, for information. However, the study area for geology is limited to the area of the Water Lane Site of Interest for Nature Conservation (SINC), which is designated in part for its geology (Figure 11.5 Water Lane Geological Site).

Mineral Resources

- 11.2.11 The study area for minerals comprises the area directly affected by the project, that is the area within the Order Limits (Figure 11.6 Minerals) This figure shows the available minerals data for the study area within a 1km buffer of the Order Limits, to provide context within which to assess the information.

Land Contamination

- 11.2.12 The study area for land that may be impacted by existing contamination that could affect the project, comprises a 250m buffer zone around the Order Limits. This buffer is based on the Guidance for the Safe Development of Housing on Land Affected by Contamination (Environment Agency, 2008). This buffer is a conservative but a



sensible approach in the context of the project, taking into account the distance over which contamination can migrate.

- 11.2.13 Figure 11.7 Potentially Contaminative Land Uses identifies sites within the study area that have the potential to be contaminated (with medium/high sensitivity/source potential) and Figure 11.8 shows those sites that hold current Environmental Permits for landfill and mining waste.

Baseline Conditions

- 11.2.14 The approach used to establish the baseline conditions has included a desk-based assessment of land use type. This was supported by site walkovers at specific locations identified during the desk-based assessment.

Desk-based Assessment

- 11.2.15 An initial desktop study was undertaken to identify the existing land use and committed development within the study area. The following resources were used:
- soil association data obtained from LandIS (Cranfield University, 2018);
 - provisional and post-1988 Agricultural Land Classification (ALC) data (Natural England, 2018);
 - 1:625,000 scale data downloaded from the British Geological Survey (BGS) website. These are Bedrock Geology, Superficial Deposits and Linear Features.
 - various mapping data from the BGS Web Map Services (BGS, 2018a) comprising Bedrock Geology, Superficial Deposits, Linear Features, Artificial Ground, Mass Movement, Geosure Landslides, Geosure Soluble Rocks, British Karst Database and the 1:25,000 scale Landslides metadata;
 - various data sets at 1:10,000 scale (Groundsure 2017 comprising Bedrock Geology; Superficial Deposits; Linear Features; Artificial Ground; Mass Movement;
 - aquifer potential and permeability data at a 1:50,000 scale (Groundsure, 2017);
 - borehole logs from the BGS;
 - geological Sites of Special Scientific Interest (SSSIs) data provided by Natural England (2018). Geological Conservation Review (GCR) sites data obtained from the Joint Nature Conservation Committee (2017);
 - information regarding the Water Lane SINC obtained from Hampshire Biodiversity Information Centre (HBIC), Sussex Geodiversity Partnership (2015);
 - data contained within the relevant minerals plans for SCC and Hampshire County Council (HCC) comprising information on Minerals Safeguarding Areas, existing minerals and waste sites, and Mineral Consultation Areas;
 - historical mapping at 1:1,250, 1:2,500 and 1:10,000 scale (Groundsure, 2018);
 - aerial photographs (Cyient, 2018);



- potentially contaminative land use data received from engagement with the local authorities and the Environment Agency (EA), and publicly available contamination assessments and ground investigations (where available);
- information and environmental monitoring data received from The Brett Group which operates a number of the authorised landfills within the study area in Sections G and H; and
- St James School also provided environmental reports for their land in Section H.

Site Walkover and Surveys

- 11.2.16 A site visit was undertaken to the Water Lane SINC on 18 October 2018. The purpose of the visit was to view the site and obtain a better understanding of the condition and context, to be able to assess potential impacts and potential options for mitigation (if required).
- 11.2.17 Data have also been collected as part of ongoing ground investigation (GI) as part of the project (see Figures 11.3 and 11.4 for location of boreholes, and Appendix 11.1 Soils and Geology Supporting Information, for further information). The GI comprises the drilling of boreholes, collection of soil and groundwater samples for chemical analysis, and soil gas and groundwater level monitoring.
- 11.2.18 Walkover surveys were undertaken between 15 and 25 October 2018 to assess potentially contaminated sites of interest identified through Scoping. The purpose of these surveys was to undertake visual inspections of the land to identify features associated with the possible current or historical contaminative uses which may affect, or be affected by, the project. Details of the findings of the walkover surveys, including survey dates, are provided in Appendix 11.1 Soils and Geology Supporting Information.

Engagement Relevant to the Assessment

- 11.2.19 Engagement has been undertaken with the EA to discuss the methodology for the assessment (9 July 2018), to obtain data on the historic and authorised landfill sites within the study area (31 August 2018) and to share information on approach to landfill and permitting (19 November 2018).
- 11.2.20 There have also been meetings with Spelthorne Borough Council and Runnymede Borough Council (6 August 2018) and Surrey Heath Borough Council (22 August 2018) to discuss the targeted GI and the approach to the scoping of sites.
- 11.2.21 There was also a meeting with the Brett Group (19 October 2018) to gather baseline information and to discuss the scope of the assessment.

Limitations of Assessment

- 11.2.22 Only limited post-1988 ALC data are available for the study area. Post-1988 ALC data are only available where site-specific surveys have been undertaken using the most recent ALC criteria (Ministry of Agriculture, Fisheries and Food, 1988). BMV land is defined as land in ALC Grades 1 to 3a. The provisional ALC data which are available for the whole of the study area do not differentiate between Subgrades 3a



(good quality) and 3b (moderate quality). It is assumed for this assessment that where Grade 3 is mapped by the provisional data, and post-1988 data are not available, this equates to Subgrade 3a land (that is, it is BMV land). This is a conservative assumption and may overestimate the amount of BMV land present within the baseline.

- 11.2.23 Information has been sought from third parties which hold baseline data (including the EA, Local Authorities and operators), however the information they hold is frequently very limited. This is not unusual for land contamination assessments in the UK and any data received adds value to the assessment made. Where there is a lack of third-party data, professional judgement has been used in interpreting other desk study information received.
- 11.2.24 Data requests were made to Winchester and Eastleigh District Councils about potential contaminated sites. The data was requested in March 2018 and had not been received at the time of writing. Data from other sources has been used instead and this is not thought to affect the quality of the assessment made.
- 11.2.25 It was not possible to undertake site walkovers to all potentially contaminated sites of interest identified through Scoping, due to access restrictions. Site walkovers were undertaken on 15 sites, and a further 20 sites were viewed from adjacent public areas. It was not possible to access or observe from adjacent areas, a further 15 sites. As a result, reliance has been made on aerial photos and historical mapping to identify current potential sources of contamination and migration pathways and this is not thought to affect the quality of the assessment made.
- 11.2.26 The GI is still ongoing and not all of the records were available at the point of assessment. Borehole logs were available for 19 boreholes, providing information on local geology close to potentially contaminated sites and information on the ground conditions for four potentially contaminated sites. Where data are currently unavailable, reliance has been made on published mapping and information from desk-based investigation of potentially contaminated sites and this is not thought to affect the quality of the assessment made.

Impact Significance

- 11.2.27 Impacts reported in this ES are adverse unless otherwise stated and are considered 'likely significant effects' in the context of the EIA Regulations when of moderate significance or above.
- 11.2.28 As explained in Chapter 6 Overview of Assessment Process, significance is determined using a three-step process:
 - 1) Identify value/sensitivity of a receptor.
 - 2) Determine magnitude of potential impact.
 - 3) Assign impact significance.
- 11.2.29 The following tables set out the criteria used to assess value/sensitivity and magnitude. Impact significance was then determined taking both these assessments into account, using the matrix approach provided in Section 6.3 of Chapter 6 Overview of Assessment Process.



Value/Sensitivity

11.2.30 The criteria used to determine the value and sensitivity of receptors specific to soils and geology are set out in Table 11.2. These criteria are based on the generic criteria presented in Chapter 6 Overview of Assessment Process.

Table 11.2: Criteria for Determining the Value/Sensitivity of Soil and Geology Receptors

Sensitivity/ Value	Criteria
High	<p>Soils:</p> <ul style="list-style-type: none"> • ALC Grades 1 (excellent quality) and 2 (very good quality); and • Peat soil associations. <p>Geology:</p> <ul style="list-style-type: none"> • Geology has a national designation (e.g. SSSI) and/or a very low capacity to accommodate change. <p>Mineral resources:</p> <ul style="list-style-type: none"> • Existing minerals sites, minerals preferred areas and minerals safeguarded sites. <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Human receptors i.e. construction workers and adjacent land users; and • Controlled waters, which for this sensitivity comprises: <ul style="list-style-type: none"> ➢ nationally or internationally important sites i.e. Ramsar sites, Special Areas of Conservation, Special Protection Areas and SSSIs; ➢ nationally and regionally important watercourses; ➢ public water supplies; and ➢ principal or highly productive aquifers with high aquifer vulnerability.
Medium	<p>Soils:</p> <ul style="list-style-type: none"> • ALC Subgrades 3a (good quality) and 3b (moderate quality). <p>Geology:</p> <ul style="list-style-type: none"> • Geology has a local or regional designation (e.g. Local Geological Sites – formerly Regionally Important Geological Sites (RIGS)) and/or a low capacity to accommodate any change. <p>Mineral resources:</p> <ul style="list-style-type: none"> • Minerals safeguarding areas and minerals consultation areas. <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Controlled waters, which for this sensitivity comprises: <ul style="list-style-type: none"> ➢ main rivers within a catchment; ➢ locally important watercourses; ➢ private water supplies serving three or more properties; and ➢ Secondary A Aquifers. • Property, which for this sensitivity comprises: <ul style="list-style-type: none"> ➢ crops and domesticated animals (grazing livestock); ➢ infrastructure; and ➢ buildings.
Low	<p>Soils:</p> <ul style="list-style-type: none"> • ALC Grades 4 (poor quality) and 5 (very poor quality). <p>Geology:</p> <ul style="list-style-type: none"> • Geology not listed but possessing key characteristics which may be locally important and/or has a high capacity to accommodate change. <p>Mineral resources:</p> <ul style="list-style-type: none"> • No mineral resources identified.



Sensitivity/ Value	Criteria
	<p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Controlled waters, which for this sensitivity comprises: <ul style="list-style-type: none"> ➢ minor watercourses or water bodies; ➢ low productivity aquifer (frequently designated as a Secondary B Aquifer); and ➢ private water supplies located within the vicinity of a mains water supply or used for agricultural purposes and not for drinking water purposes.
Negligible	<p>Soils:</p> <ul style="list-style-type: none"> • Urban and non-agricultural land. <p>Geology:</p> <ul style="list-style-type: none"> • Geology is non-distinctive and/or is likely to tolerate the proposed change, or there are no listed sites. <p>Mineral resources:</p> <ul style="list-style-type: none"> • No mineral resources identified. <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Controlled waters, which for this sensitivity comprise Unproductive Strata that are generally unable to provide usable water supplies.

Impact Magnitude

11.2.31 The criteria used to determine the magnitude of change are set out in Table 11.3. These are based on the generic criteria outlined in Chapter 6 Overview of Assessment Process.

Table 11.3: Impact Magnitude Criteria for Soils and Geology

Magnitude	Description
Large	<p>Soils:</p> <ul style="list-style-type: none"> • Permanent loss or sterilisation of high value soil resources. • Likely reduction of ALC by two or more grades. • Severe damage to peat soils. <p>Geology:</p> <ul style="list-style-type: none"> • Severe damage to the site so that it is unrecognisable compared to baseline conditions. • Improvement of the site so that key characteristics/features are significantly enhanced, or new features of interest are exposed. <p>Mineral resources:</p> <ul style="list-style-type: none"> • Long-term (years) loss/sterilisation of an entire existing minerals site, minerals preferred area or minerals safeguarded site. <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Contamination levels encountered in excess of assessment criteria (for human health, environment and/or property) requiring substantial remediation works or treatment, or qualitative risk assessment identifies one or more high-risk relevant pollutant linkage (as defined in Appendix 11.1 Soils and Geology Supporting Information). • Requirement for substantial re-engineering of landfill infrastructure and waste containment systems.
Medium	<p>Soils:</p> <ul style="list-style-type: none"> • Permanent loss or sterilisation of medium-value soil resources. • Likely reduction of ALC by one grade. • Moderate damage to peat soils. <p>Geology:</p> <ul style="list-style-type: none"> • Partial loss of the key characteristics of the site.



Magnitude	Description
	<ul style="list-style-type: none"> • Improvements to the key characteristics of the site. <p>Mineral resources:</p> <ul style="list-style-type: none"> • Long-term (years) loss/sterilisation of a substantial part of the identified reserve/resource or extraction. • Loss of access to the whole of the identified resource (although the reserve/resource remains intact). • Extraction and beneficial use of the entire identified reserve/resource (benefit). <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Contamination levels marginally above assessment criteria (for human health environment and/or property) requiring some treatment; or qualitative risk assessment identifies one or more moderate risk relevant pollutant linkage (as defined in Appendix 11.1 Soils and Geology Supporting Information). • Discharge of groundwater impacted by contamination in excess of assessment criteria (e.g. dewatering) for a few weeks. • Requirement for minor re-engineering of landfill infrastructure and waste containment systems.
Small	<p>Soils:</p> <ul style="list-style-type: none"> • Permanent loss or sterilisation of low or negligible value soil resources. • Reduction of soil quality but not likely to change ALC grade. • Minor damage to peat soils. <p>Geology:</p> <ul style="list-style-type: none"> • Noticeable but insignificant changes to sites of importance. <p>Mineral resources:</p> <ul style="list-style-type: none"> • Long-term (years) loss/sterilisation of a minor part (<30%) of the identified reserve/resource or extraction. • Extraction and beneficial use of part of the identified reserve/resource. <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Contamination levels below human health or environment assessment criteria but minor remediation/mitigation works required as a result of impact to property or infrastructure; or qualitative risk assessment identifies one or more moderate/low-risk relevant pollutant linkage (as defined in Appendix 11.1 Soils and Geology Supporting Information). • Requirement for re-engineering of landfill infrastructure (not extending into the landfill waste containment system).
Negligible	<p>Soils:</p> <ul style="list-style-type: none"> • No measurable change to quality of soil resources. <p>Geology:</p> <ul style="list-style-type: none"> • No noticeable change to site of importance. <p>Mineral resources:</p> <ul style="list-style-type: none"> • Short-term (weeks/months) loss of access to a minor part of the identified resource (although the reserve/resource remains intact). <p>Contamination derived from potentially contaminated sites:</p> <ul style="list-style-type: none"> • Contamination levels below human health, environment and property assessment criteria and no remediation required; or qualitative risk assessment identifies only low risk relevant pollutant linkages (as defined in Appendix 11.1 Soils and Geology Supporting Information). • Requirement for slight or negligible re-engineering of landfill infrastructure (not extending into the landfill waste containment system).



11.3 Baseline Conditions

11.3.1 This section summarises the baseline conditions for soils and geology. Further details of the baseline conditions can be found in Appendix 11.1 Soils and Geology Supporting Information.

Soils

Soil Types

11.3.2 The soil associations mapped within the study area are shown on Figure 11.1. The predominant soils are freely draining slightly acid to acid loamy and sandy soils, with more limited areas of freely draining lime-rich soils and seasonally waterlogged loamy and clayey soils. Peat soils (1024b - Adventurers' 2) are confined to Section F (Bisley and Pirbright Ranges to M25) and constitute approximately 1% of the overall Order Limits.

11.3.3 The soil associations within Section A (Boorley Green to Bramdean) are mainly freely draining loamy soils, but seasonally waterlogged loamy and clayey soils are mapped around the south of the section. Section B (Bramdean to South of Alton) is characterised by freely draining loamy soils – mainly slightly acid over superficial deposits, interspersed with shallow lime-rich soils often directly over chalk. Freely draining lime-rich loamy soils over chalk are dominant in Section C (South of Alton to Crondall), but freely draining slightly acid loamy soils are also common.

11.3.4 The most frequently occurring soil types within Section D (Crondall to Farnborough) are very acid sandy and loamy soils with variable soil-water regimes. Seasonally waterlogged loamy and clayey soils are also common in Section D. Section E (Farnborough to Bisley and Pirbright Ranges) contains mostly acid sandy and loamy soils of variable soil-water regimes. Very acid sandy and loamy soils with variable soil-water regimes are widespread across Section F (Bisley and Pirbright Ranges to M25) with a mix of other soils present such as seasonally waterlogged loamy and clayey soils. Section F also contains all of the mapped peat soils, which are situated to the east of Lightwater and southeast of Windlesham.

11.3.5 Section G (M25 to M3) comprises mainly seasonally waterlogged loamy and clayey soils, and Section H (M3 to the West London Terminal storage facility) contains only freely draining slightly acid loamy soils.

Soil Quality

11.3.6 Only limited post-1988 ALC data are available for the study area; for small areas of land near Four Marks (Section B), south of Crondall (Section C), and near Laleham (Section H). Figure 11.2 shows these areas of post-1988 ALC data, as well as the provisional ALC data for the remainder of the Order Limits 1km buffer. The ALC for the study area is also summarised in Table 11.4.

Table 11.4: ALC Grades for the Study Area

ALC Grade	Combined Pre- and Post-1988 ALC Data (ha)	Area of Combined Data as % of Order Limits
Grade 1	10.3	2.5



ALC Grade	Combined Pre- and Post-1988 ALC Data (ha)	Area of Combined Data as % of Order Limits
Grade 2	46.0	11.0
Grade 3 (undifferentiated)	170.0	40.6
Subgrade 3a	2.0	0.5
Subgrade 3b	5.1	1.2
Grade 4	37.5	9.0
Non-agricultural	107.6	25.7
Urban	39.4	9.4
Post-1988 other	0.8	0.2

- 11.3.7 The post-1988 ALC data show small areas of Grade 2 land in Sections C and H to the southeast of Crondall and southwest of Queen Mary Reservoir respectively. Subgrades 3a and 3b are mapped in Sections B and H to the southeast of Four Marks and southwest of Queen Mary Reservoir. 'Other land' is mapped southeast of Four Marks.
- 11.3.8 The provisional ALC data only provide a broad indication of potential ALC grades. However, they show BMV land to be potentially present for over half of the Order Limits, mostly Grade 3 (undifferentiated), in Sections A to C, southwest of Aldershot. For the remainder of the route, non-agricultural and urban land are most common with pockets of Grades 1, 2, 3 and 4.

Geology

- 11.3.9 There are no SSSIs or GCR sites designated for their geology within the study area (Natural England (2018), Joint Nature Conservation Committee (2017)). However, a review of designations for nature conservation (Chapter 7 Biodiversity) identified one site within the study area, Water Lane SINC where the criteria for designation included Regionally Important Geological Site (RIGS). The site has therefore been included within the environmental assessment, and in this chapter, to assess the impact to the geological feature. The location and photos of the site are shown on Figure 11.5.
- 11.3.10 A site visit was undertaken on 18 October 2018. It was observed that the trackway of Water Lane was present within a hollow beneath the surrounding ground level for the majority of the 2km length from Truncheants Lane in the northwest up to West Worldham in the southeast. The depth and character of the hollow varied throughout the length of the SINC, with the hollow up to around 4 to 5m below ground level with steep rocky sides at some locations. Outcrops of malmstone, hard siltstone and chalk were visible in the lane walls at multiple locations throughout the length of the lane. The hard siltstone 'Blue Rag' pavement was observed at several locations, with the dip of the bedrock coinciding with the gradient in the lane giving a more or less continuous pavement for more than 200m at one location. At the point where the Order Limits cross the site, the Water Lane trackway is at the same level as the surrounding fields, and no geological outcrops were visible.



Mineral Resources

- 11.3.11 Minerals data were available from HCC (2018), from Section A until where the pipeline crosses the A331, northeast of Farnborough within Section E. The following Mineral Consultation Areas are mapped by the Hampshire Minerals and Waste Plan within the study area (no Mineral Safeguarding Areas are identified within the study area):
- Soft Sand, based on Palaeogene Lambeth Group (sand) and sands of the London Clay Formation north of Boorley Green (approximately 9% of the Order Limits in Section A);
 - Brick Clay, based on the Palaeogene Lambeth Group (clay, silt and sand) west of Bishop's Waltham (approximately 5% of the Order Limits in Section A) and east of Crondall (approximately 11% of the Order Limits in Section D); and
 - Superficial Soft Sand and Gravel in the south of Section A (approximately 13% of the section), northeast of Alton (approximately 27% of the Order Limits in Section C) and southeast to northeast of Fleet (approximately 29% of the Order Limits in Section D).
- 11.3.12 Minerals data for the remainder of the route, comprising parts of Section E and Sections F to H, from SCC, were reviewed. Within this area, approximately one third of the study area from south of Lyne (Section F) to the end of the corridor at the West London Terminal storage facility (Section H) lies within designated Surrey Minerals Safeguarding Areas (for concreting aggregate).
- 11.3.13 Within the Minerals Safeguarding Areas there are two sites that lie partly within the study area in Section H designated as Preferred Areas for mineral development and allocated for mineral extraction. These are:
- Queen Mary Reservoir, Sunbury – gravels are dredged from the reservoir and processed at Queen Mary Quarry (to the west of the reservoir) to the east of the Order Limits.
 - Homers Farm, Bedfont – a permitted mineral working, from which the extraction of sand and gravel started in summer 2018. It is understood that the Order Limits would not intersect mineral extraction areas, and that quarrying operations will largely have ceased before installation of the project reaches the site.
- 11.3.14 In addition, a conveyor link is due to be established via a tunnel under Ashford Road between another Preferred Area – Manor Farm, Laleham – and Queen Mary Quarry to transport minerals for processing. The route of this conveyor would pass through the Order Limits and thus although Manor Farm, 100m west of the study area, is included in the baseline for minerals; and effects are considered on the site in Section 11.5. Site works are expected to start in 2019 at this permitted mineral working.

Land Contamination

- 11.3.15 The land contamination baseline comprises sites with a medium to high sensitivity or source potential for contamination, as defined in the scoping assessment. The sites within the study area which may potentially be affected by contamination from



historical and/or current uses are listed in Table 11.5, together with the rationale for scoping in. These include landfills and sites with specific historical land uses where it was considered that the ground may have been impacted by hazardous substances. These are third party private sites and as such it is not for the project to determine categorically, whether or not a site is contaminated, such that it is not suitable for its existing use, but more to determine the risk of encountering contamination such that it would affect the construction of the pipeline.

- 11.3.16 For each scoped-in site, a summary desk study, conceptual site model and qualitative risk assessment has been completed, as detailed in Appendix 11.1 Soils and Geology Supporting Information, Annex 11.1.A: Trenchless Crossings Through Potentially Contaminated Sites and Annex 11.1.B: Scoped-in Potentially Contaminated Site Desk Studies.

Table 11.5: Scoped-In Potentially Contaminated Site

No.	Site Name	Section	Rationale for Scoping In
1	Boorley Green Gas Valve Compound	A	Historical land use (gas valve compound) within the Study Area but outside Order Limits.
2	West Tisted	B	Reported site of illegal pipeline tapping. Within Order Limits.
3	Four Marks Golf Club (former landfill Southwood Farm)	B	Historical landfill site within the Study Area but outside Order Limits.
4	Farringdon Business Park	B	Current industrial estate within the Study Area but outside Order Limits.
5	Star Energy, Alton	C	Control of Major Accident Hazards (COMAH) site (oil terminal) located within the Study Area but outside Order Limits.
6	Alton Material Recovery Facility (former railway sidings)	C	Current material recovery facility with historical land use (railway sidings) within Order Limits.
7	Upper Froyle Land at Manor Farm (former landfill)	C	Historical landfill within the Order Limits.
8	Oak Park Golf Club (former tileries)	D	Historical land use (former tileries) within the Study Area but outside Order Limits.
9	Redlands/Wildlands House Area 1 (former landfill)	D	Historical landfill site within the Study Area but outside Order Limits.
10	Redlands/Wildlands House Area 2 (former landfill)	D	Historical landfill within the Study Area but outside Order Limits.
11	Ewshot Hill (former brick yard)	D	Historical land use (brick yard) within the Study Area but outside Order Limits.
12	Ewshot (former brick & timber yard)	D	Historical land use (brick and timber yard) within the Order Limits.
13	Former Queen Elizabeth II Barracks	D	Historical land use (military barracks) within Order Limits.
14	Pyestock Hill (former landfill)	D	Historical landfill within the Study Area but outside Order Limits.
15	Southwood (former military land)	D	Historical land use (military training ground) within the Order Limits.
16	Farnborough (Main) Station (former railway sidings)	E	Historical land use (railway sidings) within the Study Area but outside Order Limits.



No.	Site Name	Section	Rationale for Scoping In
17	Farnborough (Main) Station (former gas works)	E	Historical land use (gas works) within the Study Area but outside Order Limits.
18	Farnborough (Main) Station (former Powell Duffryn Fuels)	E	Former COMAH site within the Study Area but outside Order Limits.
19	Farnborough (North) Station (former gas works)	E	Historical land use (gas works) within the Study Area but outside Order Limits.
20	Farnborough (North) Station (former railway)	E	Historical land use (railway sidings) within the Order Limits.
21	South of Frimley Station (former landfill)	E	Historical landfill within the Order limits.
22	Frimley Station (former railway sidings)	E	Historical land use (railway sidings) within the Study Area but outside Order Limits.
23	Johnson Wax Ltd., Frimley	E	Former COMAH site within the Study Area but outside Order Limits.
24	Princess Royal Barracks	E	Historical land use (military land) within the Order Limits.
25	Red Road Hill Depot	F	Historical and current land use (landfill, scrap yard, vehicle maintenance) within the Study Area but outside Order Limits.
26	Chobham Car Spares	F	Current land use (vehicle servicing yard/scrap yard) within the Study Area but outside Order Limits.
27	Hanworth Trading Estate	G	Current industrial park within the Study Area but outside Order Limits.
28	Former Chertsey Gas Works	G	Former COMAH site within the Study Area but outside Order Limits.
29	Abbey Moor Golf Club (former landfill)	G	Historical landfill within the Order Limits.
30	Lavenders Landfill	G	Historical landfill within the Order Limits.
31	Old Littleton Lane Landfill	G	Historical landfill within the Order Limits.
32	Sheep Walk Landfill (Chertsey Road Tip)	G	Historical landfill within the Study Area but outside Order Limits.
33	Littleton Lane Landfill	H	Historical landfill within the Order Limits.
34	Laleham Landfill	H	Authorised landfill within the Order Limits.
36	Home Farm Landfill	H	Authorised landfill within the Order Limits.
38	South of Queen Mary Reservoir Landfill	H	Historical landfill within the Order Limits.
40	Queen Mary Quarry	H	Authorised landfill within the Order Limits.
41	White House Garage, Ashford	H	Historical land use (garage) and current land use (waste transport vehicle depot) within the Study Area but outside Order Limits.
42	Staines Bypass (former sewage works)	H	Historical land use (sewage works) within the Study Area but outside Order Limits.
43	47 Woodthorpe Road, Ashford	H	Historical land use (engineering site and other potentially contaminative uses) within the Study Area but outside Order Limits.
44	21-35 Woodthorpe Road, Ashford	H	Historical land use (electrical engineering works and printing works) within the Study Area but outside Order Limits.
45	Hitchcock & King (former railway sidings)	H	Historical land use (railway sidings and other contaminative land uses) and current use



No.	Site Name	Section	Rationale for Scoping In
			(timber depot) within the Study Area but outside Order Limits.
46	Scott Freeman Gardens, Ashford	H	Historical land use (gravel pit possibly filled) within the Study Area but outside Order Limits.
47	St. David's School (former landfill)	H	Historical landfill within the Order Limits.
48	Clockhouse Lane (former landfill)	H	Historical landfill within the Order Limits.
49	Former Bulldog Service Station	H	Historical land use (service station) within the Study Area but outside Order Limits.
50	Former Lionvale Service Station	H	Historical land use (service station) and current land use (MOT garage) within the Study Area but outside Order Limits.
51	Homers Farm	H	Mineral extraction site within the Order Limits where historical contamination has been identified.
52	West Bedfont (former sewage works and landfill)	H	Historical land use (sewage works) and historical landfill within the Order Limits.
53	Esso West London Terminal	H	COMAH site and historical landfill within the Order Limits.

Future Baseline in the Absence of the Project

- 11.3.17 It is not anticipated that the baseline would significantly change over the 60-year design life of the project.

11.4 Design Measures

- 11.4.1 All commitments are listed within the Register of Environmental Actions and Commitments (REAC), which is included within Chapter 16 Environmental Management and Mitigation. Commitments include embedded design measures, good practice measures and mitigation required to reduce a significant effect.
- 11.4.2 Chapter 4 Design Evolution provides a summary of the environmental considerations that have influenced the design through this process, with iterative updates and improvements to reach the fixed design submitted for development consent. The embedded design measures have been built into the designs, for example through the amendment to the Order Limits to avoid a sensitive feature. Examples include:
- Water Lane SINC. The location of the route crossing the Water Lane SINC was refined to select the one location where the trackway is at grade. This would reduce disturbance of the geological site.
 - Manor Farm Preferred Area for mineral development. An option through the open space of Manor Farm mineral site was considered but not selected.
 - Laleham authorised landfill. The Order Limits through Laleham landfill has been refined.
 - Sheep Walk historical landfill. An option including a trenchless crossing launch point (or exit) within an area of known non-inert landfill with evidence of a clay liner, was not selected.



- Homers Farm proposed mineral extraction site. The Order Limits at Homers Farm have been refined.

11.4.3 This chapter contains a number of project commitments to reduce impacts on the environment. These are indicated by a reference number like this (G20). Good practice measures are set out in the REAC and secured through Development Consent Order requirements such as the Code of Construction Practice.

11.4.4 The good practice measures that are most relevant to soils and geology are listed in Table 11.6. These are applicable to all areas unless stated otherwise. The following assessment is based on these good practice measures being in place.

Table 11.6: Good Practice Commitments

Ref	Commitment Description
O7	Where required, water stops (or “stanks”) would be installed at intervals through the pipe bedding and side fill.
G61	Construction within Bourley and Long Valley SSSI, Colony Bog and Bagshot Heath SSSI and Chobham Common SSSI would be in accordance with Annex B of the Habitat Regulations Assessment. Where necessary, detailed methodologies would be agreed with Natural England prior to commencement. All construction works would be in accordance with the detailed methodologies.
G143	The quality of water generated by dewatering would be tested prior to discharge.
G150	The contractor(s) would produce a Soil Management Plan. In developing the plan, the contractor would take note of the principles within the guidance “Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Department for Environment, Food and Rural Affairs, 2009)”, and “Good Practice Guide for Handling Soils (Ministry of Agriculture, Fisheries and Food, 2000)”. The Soil Management Plan would include, but not be limited to: <ul style="list-style-type: none"> • specification of maximum storage periods, angles and heights of soil stockpiles; • reference to published soil types; • specification for where a soils watching brief may be required; • controls on use of construction machinery in areas where soils have not been stripped; and • specification of the role of the Suitably Experienced Person (SEP).
G148	Where identified in the Soil Management Plan, a Suitably Experienced Person (SEP) would be employed to oversee the management of soil during soil stripping, handling, storage and reinstatement.
G151	A methodology would be produced for stripping, handling, storage and replacement of all soils to reduce risks associated with soil degradation. This would include: <ul style="list-style-type: none"> • identification of appropriate plant to strip, reinstate and otherwise handle soils; • methods for compaction and grading of stockpiles; • methods for working in naturally wet soils; and • specification of appropriate decompaction measures to be used during reinstatement.
G154	Where topsoil stripping is required, the normal working practice (where not otherwise specified within a methodology document) would be to strip full depth of topsoil (where present) from: <ul style="list-style-type: none"> • construction compounds and logistics hubs; • access roads; • across the working width; and • any other areas to be trafficked. The topsoil would be reinstated above the subsoil.
G155	Topsoils and subsoils intended for reinstatement would be temporarily stockpiled as close to where they were stripped from as practicable.



Ref	Commitment Description
G157	Appropriate techniques would be used when necessary to provide protection for subsoils from compaction and smearing in areas subject to heavy trafficking. The specific protection measures and their required locations would be set out in the appointed contractor's methodology document and agreed between the contractor(s) and overseeing Suitably Experienced Person (SEP) prior to construction commencing.
G158	Stripping and reinstatement of topsoils would only be carried out when topsoils are in a reasonably dry state.
G159	Different soil types and made ground would be stripped and stored separately where applicable.
G71	<p>For all areas, the following strategic approach would be taken for the management of both known and unknown land contamination:</p> <ul style="list-style-type: none"> • a desk based qualitative risk assessment would be undertaken on the basis of available information to ascertain areas of known and unknown contamination; • working methodologies would be produced based on the assessment; • contingency plans would be developed for dealing with various forms of known or unknown contamination to allow work to progress with limited delay. These procedures would clearly define methods for dealing with any areas of unexpected contamination to manage immediate risks and prevent any contamination, ground gas, airborne contaminants or odour spreading from the affected area, and for appropriate disposal. Measures would contain protocols for dealing with areas of potential asbestos-containing materials, should they be encountered. <p>For areas where potential contamination is known or strongly suspected to be present as a result of past activities, the following would also be undertaken:</p> <ul style="list-style-type: none"> • ground investigation information would be shared and developed as appropriate; • risks to receptors would be assessed, and mitigation and working methods to control those risks would be developed. Risks would include: encountering contaminated dust, soils and groundwater; and where the presence of ground gas and/or vapours may lead to confined space risks, such as in excavations; • a Suitably Experienced Person (SEP) would ensure that risk areas are identified, working methods followed and mitigation carried out appropriately; • made ground and materials known or strongly suspected of being contaminated would be segregated from natural and inert materials; and • ground arisings deemed unsuitable for re-use within the project would be disposed of appropriately for example to a soil treatment centre or landfill.
G75	<p>Where the route passes through areas where there are active Environmental Permits (for example authorised landfill sites), the contractor(s) would work with the permit holder to comply with the permit requirements. This could include:</p> <ul style="list-style-type: none"> • seek agreement from permit holders and regulators to allow works to proceed; • reinstate surface restoration materials; • reinstate artificial geological barriers (where present); and • if applicable to site, work in accordance with relevant quality assurance procedures.

11.5 Potential Impacts (Without Mitigation)

11.5.1 This section sets out the potential significant impacts of the project on soils and geology. It assumes that the relevant embedded design measures and the good practice measures (set out in Table 11.6) are in place before assessing the effects.

Soils

11.5.2 Soils could be affected in several ways during stripping, handling and storage, including:



- deformation through compaction and smearing arising from trafficking and handling of the soils;
- mixing of topsoils and subsoils or soils with distinctly different properties, leading to a degradation of soil quality; and
- biological, chemical and physical changes during storage due to natural compaction and anaerobic conditions arising in the core of the stockpile, although these would be largely reversible upon reinstatement.

11.5.3 As a reasonable worst-case scenario, it is assumed that all the soils identified within the Order Limits would be affected, such that ALC grades/subgrades 1 (high value receptor), 2 (high value receptor), 3a (medium value receptor), 3b (medium value receptor) and 4 (low value receptor) would be affected. Approximately 3.3ha of peat soils (high value) would also be affected.

11.5.4 However, the good practice measures found in the REAC (Chapter 16 Environmental Management and Mitigation) and Table 11.6, would limit this through careful planning and management of soil resources. This includes measure G61, which states that appropriate construction methods would be used within ecologically sensitive sites to protect soils such that they continue to support ecosystem functions; this applies particularly to peat soils which are vulnerable to damage during trafficking and handling. Refer to Chapter 7 Biodiversity for further details.

11.5.5 The magnitude of change would be small across the identified soil receptors, since the ALC grades of the soils are unlikely to be reduced and any damage to peat soils is likely to be minor and short term. In addition, the proportion of ALC grades 1 and 2 soils and peat soils within the Order Limits is relatively small, at approximately 13% and 1% of the total area of the Order Limits respectively. The predominant soils impacted would be those classified as Subgrade 3a or 3b (both medium value), with over 42% of the Order Limits mapped as having such soils.

11.5.6 Therefore, on the basis of professional judgement, it is considered that a minor adverse impact would occur across the range of soil receptors. This can be considered a temporary impact because the quality of the soils should recover over the short term following adherence to the good practice measures. For the purposes of assessment, a short-term duration is assumed to be less than six months based on the criteria set out in Chapter 3 Project Description Short-term in this context is defined as less than five years. The quality of the majority of soils is likely to recover over a short period considering both the good practice measures and the generally short period over which soils would be temporarily displaced.

Geology

11.5.7 Water Lane SINC is approximately 2km in length and perpendicular to the Order Limits but generally less than 10m wide. Therefore, the area of the site potentially affected by the project is limited to the 30m wide working area of the Order Limits.

11.5.8 The majority of the geological site is a sunken lane, with the lane bed below the surrounding fields, with bedrock locally exposed in the lane walls and floor. The position of the Order Limits crossing point is the one location along the entire length



of the Water Lane SINC where the existing trackway is at grade with the surrounding land. There are no geological outcrops and there is an existing farmer's track crossing the lane at this location (Figure 11.5). The proposal is for the pipeline installation to be open cut through this section.

- 11.5.9 Open cut methods are proposed at this location which would have a very short-term impact on the geological site during installation. When reinstated to the current ground conditions in accordance with the good practice measures in the REAC, it would have a negligible medium to long-term impact on the character of the geological site.

Minerals

- 11.5.10 Three high value Preferred Areas for mineral development were identified in section 11.3 as potentially being affected by the project. All within Section H, these are:
- Queen Mary Reservoir;
 - Manor Farm (including the gravel conveyor under Ashford Road); and
 - Homers Farm.
- 11.5.11 Engagement has been undertaken with the relevant parties to understand the proposed operations at these sites. These discussions are ongoing as part of the landowner agreements to enable continued operation of the sites during installation. Sterilisation of mineral extraction is also calculated as part of compensation discussions.
- 11.5.12 With respect to Queen Mary Reservoir, the pipeline only intersects the western extremities of the site and the pipeline would not disrupt minerals processing at the quarry. It is also assumed for the assessment that the proposed gravel conveyor link between Queen Mary Quarry and Manor Farm would not be disrupted by installation of the pipeline. Therefore, no impacts are predicted on Queen Mary Quarry or Manor Farm. Extraction of sand and gravel commenced at Homers Farm in summer 2018 and is expected to have largely ceased before installation of the pipeline reaches the site. Therefore, no impact would occur on this site.
- 11.5.13 The Order Limits also intersect a number of medium value Mineral Consultation Areas and Mineral Safeguarding Areas in Sections A to D and F to H respectively. The presence of the pipeline would restrict access to the mineral resources in these areas during operation, due to the easement and requirement for safe working methods in proximity to the pipeline. In total, approximately 96ha of Mineral Consultation Areas and Mineral Safeguarding Areas combined are covered by the Order Limits, compared to around 3800ha of these designations within a 1km buffer zone. The proportion of the potential resources affected is minor in all cases since the county-wide safeguarded areas are very large and also include substantial buffers around the minerals. Accordingly, a small magnitude of change is predicted from long-term sterilisation of a minor part of the resources, such that a minor impact would occur.



Land Contamination

- 11.5.14 A qualitative risk assessment has been undertaken in accordance with the process of contamination risk assessment as defined within CLR11 (Environment Agency and Defra, 2004), and is reported in Appendix 11.1 Soils and Geology Supporting Information. The risk assessment approach is different to the other ES chapters, as it assesses the risks in the absence of good practice measures first. This is in line with CLR11 guidelines (Environment Agency and Defra, 2004).
- 11.5.15 Where potential risks greater than moderate/low have been identified (without the benefit of good practice commitments within the REAC), these have been brought forward as identified receptors in accordance with the methodology described in Section 11.2.
- 11.5.16 No potential risks greater than moderate/low have been identified for the following receptors:
- adjacent buildings;
 - adjacent grazing animals;
 - surface waters; and
 - landfill infrastructure.

Impacts to Human Health

- 11.5.17 The pipeline route crosses a number of landfill sites and other potentially contaminative land uses. The potential exists for contaminated waste, soils, gas, vapour and shallow groundwater to be exposed during installation. These may pose a potential risk to construction workers and adjacent land users if not managed appropriately. However, the good practice measures contained within the REAC would reduce the risks to human health, and as such, no further assessment has been undertaken as no impact would occur.

Impacts to Groundwater

- 11.5.18 The pipeline installation could in theory create a new potential pathway for the migration of landfill leachate and contaminated groundwater, where trenches and trenchless crossings are constructed through or adjacent to potentially contaminated sites or landfills. Similarly, pre-existing contaminants could theoretically migrate vertically into underlying aquifers, should an impermeable confining layer be breached, and/or they could migrate along the trench and discharge to sensitive surface waters. For all potentially contaminated sites assessed with a potential risk of moderate/low or above, no impermeable confining layers are expected within the area of installation.
- 11.5.19 The uncontrolled discharge of contaminated groundwater during dewatering of excavations could discharge contaminated water to surface waters. The good practice measures contained within the REAC would limit the identified potential risks to groundwater.
- 11.5.20 As such, no further assessment has been undertaken as no impact would occur.



11.6 Mitigation

- 11.6.1 There are no significant impacts expected on soils and geology. Therefore, no mitigation measures have been identified.

11.7 Residual Impacts (With Mitigation)

- 11.7.1 The assessment has concluded that there are no significant residual impacts on soils and geology during construction or operation.

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