Hampshire Water Transfer and Water Recycling Project

Environmental Statement – Chapter 11 Land quality and ground conditions

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Contents

11 Land quality and ground conditions 1
11.1 Introduction 1
11.2 Legislation, policy and guidance 3
11.3 Consultation, scoping and engagement 18
11.4 Primary and tertiary mitigation 23
11.5 Assessment methodology 27
11.6 Assumptions and limitations 37
11.7 Baseline conditions 38
11.8 Assessment of likely significant effects 117
11.9 Additional mitigation, monitoring and enhancement 173
11.10 Summary of residual effects 174
References 176

Tables

Table 11-1 List of relevant legislation 3
Table 11-2 List of relevant national policy 5
Table 11-3 List of relevant local policy 9
Table 11-4 List of relevant guidance and standards 16
Table 11-5 EIA Scoping Opinion - Planning Inspectorate comments 19
Table 11-6 Summary of the scope for land quality and ground conditions assessment 28
Table 11-7 Land quality and ground conditions study area 29
Table 11-8 Data sources used to inform the land quality and ground conditions assessment 30
Table 11-9 Definition of sensitivity for a land quality and ground conditions receptor 32
Table 11-10 Definition of value levels for land quality and ground conditions 34
Table 11-11 Definition of magnitude of impacts for land quality and ground conditions 35
Table 11-12 Land quality and ground conditions significance of effect matrix 37
Table 11-13 Definition of effect significance 37
Table 11-14 Preliminary potential source-pathway-receptors present within the Water Recycling Plant site 39
Table 11-15 Geology encountered during previous phases of ground investigation within the West Cell 41
Table 11-16 Geology encountered during previous phases of ground investigation within the East Cell 41
Table 11-17 Summary of Proposed Development specific ground investigations within the location of the Water Recycling Plant site [38] 42
Table 11-18 Groundwater encountered during previous phases of ground investigations within the Water Recycling Plant site 43
Table 11-19 Groundwater encountered during Proposed Development specific ground investigations within the Water Recycling Plant site [38] 44
Table 11-20 Groundwater monitoring during Proposed Development specific ground investigations within the Water Recycling Plant site [38] 44
Table 11-21 Potentially contaminative land uses within the Water Recycling Plant site 46
Table 11-22 Preliminary potential source-pathway-receptors present along the route of the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site 50

Table 11-23 Geology encountered during Proposed Development specific ground investigation for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site 51
Table 11-24 Groundwater encountered during Proposed Development specific ground investigations for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site 53
Table 11-25 Groundwater monitoring summary during Proposed Development specific ground investigations for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site 53
Table 11-26 Potentially contaminative land uses along the route of the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site 55
Table 11-27 Preliminary potential source-pathway-receptors present along the route of the Pipelines between the Water Recycling Plant site and Bedhampton Springs 56
Table 11-28 Summary of the Proposed Development specific ground investigations for the Pipelines between the Water Recycling Plant site and Bedhampton Springs 58
Table 11-29 Licenced groundwater abstractions 59
Table 11-30 Groundwater monitoring summary for the Pipelines between the Water Recycling Plant site and Bedhampton Springs 60
Table 11-31 Groundwater encountered during Proposed Development specific ground investigations for the Pipelines between the Water Recycling Plant site and Bedhampton Springs 60
Table 11-32 Groundwater monitoring summary for the Pipelines between the Water Recycling Plant site and Bedhampton Springs 60
Table 11-33 Potentially contaminative land uses along the Pipelines between the Water Recycling Plant site and Bedhampton Springs 62
Table 11-34 Preliminary potential source-pathway-receptors present along the route of the Pipelines between the Water Recycling Plant site and Otterbourne Water Supply Works 64
Table 11-35 Geology encountered during previous phases of ground investigation along the route of Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 73
Table 11-36 Geology encountered during Proposed Development specific ground investigation (Phase 2 and Phase 3B/3C) along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 77
Table 11-37 Geology encountered during Proposed Development specific ground investigation (Phase 1 and Phase 3A) within the shafts located along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 83
Table 11-38 Licenced potable groundwater abstractions 87
Table 11-39 Groundwater encountered during previous phases of ground investigations along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 87
Table 11-40 Groundwater encountered during Proposed Development specific ground investigation along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 89
Table 11-41 Potentially contaminative land uses along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 97
Table 11-42 Visual and olfactory evidence of contamination encountered during the Proposed Development specific ground investigation along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 102
Table 11-43 Refined source-pathway-receptor model for the Water Recycling Plant site 119
Table 11-44 Refined source-pathway-receptor model for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site 127
Table 11-45 Refined source-pathway-receptor model for the Pipelines between the Water Recycling Plant site and Bedhampton Springs 136
Table 11-46 Refined source-pathway-receptor model for the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works 149
Table 11-47 Summary of residual effects 174

11 Land quality and ground conditions

11.1 Introduction

11.1.1 This document has been updated at Deadline 1 to update the cross referencing to ES Appendix 11.2 Geotechnical and geo-environmental reports (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). References to other Application documents have not been updated from the original submission. Please refer to the latest version of the Guide to the Application (Document reference 1.3, Volume 1) for the list of current versions of documents.

11.1.2 This chapter provides the assessment of the likely significant effects on land quality and ground conditions from the construction, operation and decommissioning of the Hampshire Water Transfer and Water Recycling Project (hereafter referred to as the 'Proposed Development'), which is being progressed by Southern Water Services Limited ('the Applicant'.

11.1.3 This chapter details the legislation, policy and guidance that is relevant to land quality and ground conditions, summarises the engagement and consultation undertaken to date, sets out the scope and methodology of assessment, and describes the baseline environment. Following this, the likely significant effects of the Proposed Development on land quality and ground conditions are assessed taking account of embedded primary and tertiary mitigation within the design. The need for any secondary mitigation is then considered along with any proposals for monitoring and/or enhancement. The chapter concludes with a summary of residual effects.

11.1.4 Whilst this Environmental Statement (ES) presents an assessment of the effects that may occur from decommissioning activities of the Proposed Development, the Applicant is not seeking consent for decommissioning.

11.1.5 Land quality and ground conditions aspects considered within this chapter for the Proposed Development are:

1. Land quality: potential sources of contamination (PSCs) based on historical and current land uses.
2. Ground conditions: designated environmental sites, underlying geological and hydrogeological conditions and how these may interact or be impacted by potential sources of ground contamination. In addition, consideration of the effects arising from the ground conditions and how likely these are to have an effect on human health, controlled waters (surface waters and hydrogeology) and designated sites (ecological and geological).

11.1.6 This chapter should be read in conjunction with ES Chapter 3 Description of the Proposed Development, Volume I, (Document reference 6.1, DCO Volume 6) which describes the development parameters against which the effects considered in this chapter have been assessed.

11.1.7 In addition, this chapter should be read alongside relevant parts of other chapters in Volume I, namely:

1. ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6) - the assessment of migration and discharge of contamination into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats they support, which are outlined in this chapter, is informed by the receptors identified in ES Chapter 8 Terrestrial and freshwater biodiversity. This is assessed in section 11.8.
2. ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6) – the assessment of mobilisation or introduction of new sources of contamination impacting on agricultural land and its productivity, which are outlined in this chapter, is informed by the receptors identified in ES Chapter 12 Land use and agriculture.
3. ES Chapter 16 Resources and waste management, Volume I (Document reference 6.1, DCO Volume 6) – sets out the assessment of waste to be generated from the Proposed Development, informed by the predictions of levels of contamination of excavated material and the underlying geology presented in this chapter. ES Chapter 16 Resources and waste management also presents the assessment of potential effects on identified mineral resources.
4. ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) – Potential impacts associated with reduction in groundwater quality as a result of increased turbidity are discussed in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6).
5. ES Chapter 20 Cumulative and in-combination effects, Volume I (Document reference 6.1, DCO Volume 6) – an assessment of the cumulative effects i.e. effects from the interrelationship between the Proposed Development and other developments, and an assessment of the in-combination effects i.e. effects from the interaction between the individual effects of the Proposed Development.

11.1.8 The receptors identified within the baseline condition sections of each of the other relevant chapters highlighted within points 1–5 above are also considered as land quality and ground conditions receptors. Information on the shared receptors from each of the other relevant chapters has aided in informing the assessment within ES Chapter 11 Land quality and ground conditions, Volume I (Document reference 6.1, DCO Volume 6).

11.1.9 This chapter is supported by the following appendices, all contained in ES Volume II (Document reference 6.2, DCO Volume 6):

1. ES Appendix 11.1 Response to Havant Borough Council Environmental Control Officer (Document reference 6.2, DCO Volume 6)
2. ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (this document is made up of 18 documents) (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents).

11.2 Legislation, policy and guidance

11.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on land quality and ground conditions.

Legislation

11.2.2 Table 11-1 lists the legislation relevant to the assessment of the likely significant effects on land quality and ground conditions.

Table 11-1 List of relevant legislation

Legislation	Relevance to assessment
Environmental Protection Act 1990 (Part 2A): Contaminated Land [1]	The Environmental Protection Act 1990 makes provision for the improved control of pollution arising from certain industrial and other processes. Section 78A of the Environmental Protection Act provides the statutory definition of contaminated land: "'*Contaminated Land' is any land which appears to the local authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land that–* *a) significant harm is being caused or there is a significant possibility of such harm being caused; or* *b) significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused* […]" The definition in the Act further notes that in making an assessment against those criteria, the local planning authority is also to consider guidance issued by the Secretary of State (SoS) under Section 78YA (the contaminated land statutory guidance). The Act provides the regulatory basis for the identification, designation and remediation[1] of contaminated land. The National Policy Statement for water resources infrastructure (NPSWRI) provides that for developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination. It states that risks would require consideration in accordance with the contaminated land statutory guidance as a minimum. There are no sites located within the Order Limits of the Proposed Development that are defined as contaminated land on relevant local planning authority registers under the contaminated land statutory definition.
Environmental Damage (Prevention and Remediation) (England) Regulations 2015 [2]	The Environmental Damage (Prevention and Remediation) (England) Regulations are relevant to land quality and ground conditions as they require operators of certain activities to avoid causing damage, reduce damage and remediate natural habitats, protected species, Sites of

[1] Remediation (remedial work): where it is not possible to mitigate (i.e. avoid) a significant adverse effect, these are the mitigation measures to reduce the effect.

Legislation	Relevance to assessment
	Special Scientific Interest (SSSI), water and land in certain circumstances.
Construction (Design and Management) Regulations 2015 [3]	The Construction (Design and Management) Regulations are the main set of regulations used to manage the health, safety and welfare in the context of construction projects. The legislation is relevant to the land quality and ground conditions assessment with respect to impacts land or ground conditions may have on health and safety during the design, construction, operational and decommissioning phases of the Proposed Development.
Environmental Permitting (England and Wales) Regulations 2016 [4]	The Environmental Permitting (England and Wales) Regulations provide a consolidated system of environmental permitting in England and Wales. They define the term "*regulated facility*" and require every regulated facility to be operated under and in accordance with an environmental permit. They also set out the procedures in relation to environmental permits and make provision with respect to administration and enforcement. This legislation is pertinent to this chapter due to the presence of both permitted and non-permitted historical landfills, waste sites and commercial activities within the Order Limits.
Groundwater (Water Framework Directive) (England) Direction 2016 [5]	The Groundwater (Water Framework Directive) (England) Direction, which is informed by Directive 2006/118/EC, sets out obligations on the Environment Agency (EA) to protect groundwater, including monitoring and setting threshold values for both existing and new pollutants in groundwater. This legislation is relevant to land quality and ground conditions as it provides a framework for determining the sensitivity of groundwater resources within the Order Limits and provides the basis for which threshold values of pollutants should be set in order to determine whether unacceptable risks are posed to groundwater resources.
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 [6]	The Water Environment (Water Framework Directive) (England and Wales) Regulations, which is informed by Directive 2000/60/EC, sets an environmental objective for surface waterbodies and groundwater bodies and includes a requirement to ensure no deterioration from current status. This legislation is relevant to land quality and ground conditions as it provides a framework for determining the sensitivity of waterbodies located wholly or partially within the bounds of the Order Limits. The water quality of those bodies is assessed in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6).

National policy

11.2.3 The primary policy for determining the application for the Development Consent Order (DCO) for the Proposed Development is the NPSWRI. This sets out policies to guide how DCO applications for water resources infrastructure should be decided and how the effects of such infrastructure are considered.

11.2.4 Table 11-2 lists the paragraphs from the NPSWRI and other national policy that are relevant to the land quality and ground conditions assessment. It also sets out where these policy requirements are addressed within the chapter.

Table 11-2 List of relevant national policy

Relevant paragraph reference	Summary of policy requirement	Where addressed in chapter
National Policy Statement for water resources infrastructure 2025 [7]		
3.8.1, 3.8.6	Environmental Regulation – These paragraphs set out how the Applicant should consult with relevant consenting authorities, for example the EA, to discuss the requirements for construction and operational activities and any environmental permits that need to be applied for.	Engagement with the EA, and other relevant stakeholders has been undertaken through a series of Biodiversity and Water Environment Environmental Impact Assessment (EIA) Working Group and Technical Working Group meetings. Engagement is an ongoing process with the engagement undertaken to date discussed in section 11.3. Details of the consents and licenses that are to be submitted as part of the DCO application to reduce environmental impacts are included within the Other Consents and Licences Position Statement, (Document reference 5.5, DCO Volume 5).
3.8.8	Environmental Regulation – This paragraph highlights that the SoS should be satisfied that the development consent can be granted taking full account of environmental impacts, including that potential effect from pre-existing sources of contamination in and around the Proposed Development are not such that unacceptable cumulative effects could occur when the Proposed Development is added.	Potential sources of contamination within the Order Limits, as well as within the 250m buffer zone (see section 11.5 for a description of the land quality and ground conditions study area), are discussed in section 11.7. Additional information on these areas is included within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) . An assessment of the potential impacts, and proposed mitigation measures, are set out in sections 11.4 and 11.8. An assessment of the potential cumulative effects between the Proposed Development and other developments is set out in ES Chapter 20 Cumulative and in-combination

Relevant paragraph reference	Summary of policy requirement	Where addressed in chapter
		effects, Volume I (Document reference 6.1, DCO Volume 6).
3.12.3, 3.12.4	Health - These paragraphs set out the requirement for the Applicant to identify and assess likely significant health impacts and identify potential mitigation measures to reduce impacts on human health. The assessment should consider impacts associated with the Proposed Development alone and cumulatively with other projects.	Potential human health impacts in respect of land quality and ground conditions (herein referred to as 'human health impacts' within this chapter), and proposed mitigation measures during construction, operation and decommissioning are set out in sections 11.4 and 11.8. An assessment of the potential cumulative effects between the Proposed Development and other developments is set out in ES Chapter 20 Cumulative and in-combination effects, Volume I (Document reference 6.1, DCO Volume 6).
4.3.5, 4.3.6, 4.3.7, 4.3.11, 4.3.14, 4.3.15, 4.3.17	Biodiversity and nature conservation - These paragraphs require any likely significant effects on internationally, nationally and locally designated ecological or geologically sensitive sites to be identified, assess the potential impacts on identified sites and any measures that would reduce potential impacts on these features.	No designated geological sites are located at or within 250m of the Order Limits (referred to as the study area, see section 11.5). As such, an assessment of the potential impacts to these features has not been undertaken (see section 11.5). Ecologically designated sites at or within 250m of the Order Limits are discussed in section 11.7. Impacts on these designated sites in relation to the potential introduction of new sources of contamination or the mobilisation of pre-existing contamination are discussed in section 11.8 of this chapter. All other impacts to ecologically designated sites associated with the Proposed Development are discussed within ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6).
4.10.4, 4.10.5, 4.10.9, 4.10.17, 4.10.24	Land use including open space, Green Infrastructure and green belt - These paragraphs highlight that development of land will impact upon soil resources through physical loss and damage (via contamination and structural damage). The paragraphs also highlight that when a	Proposed Development specific ground investigations have been undertaken in order to identify potential risks associated with contamination. The Proposed Development specific ground investigations have targeted areas of previously developed land as well as providing coverage within the Order Limits as a whole. Details of areas of previously developed land that have

Relevant paragraph reference	Summary of policy requirement	Where addressed in chapter
	development is proposed in an area of previous development, an assessment should be undertaken to identify potential risks associated with contamination. This assessment should be undertaken in accordance with contaminated land statutory guidance. The assessment should also consider potential mitigation measures to reduce the identified risks posed, including proper management of excavated soils.	been identified within the Order Limits, as well as within the 250m buffer zone, (see section 11.5 for a description of the land quality and ground conditions study area), are discussed in section 11.7. Additional information on these areas is included within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). The interpretative reports and the assessment undertaken within this chapter (see section 11.8) has been undertaken in accordance with contaminated land statutory guidance as outlined within section 11.2. Potential impacts on the structural properties of soils as a result of the Proposed Development are discussed within ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6).
4.15.1, 4,15,2, 4.15.4, 4.15.5, 5.15.6, 4.15.12	Water quality and resources – These paragraphs highlight that development of water infrastructure could adversely impact upon the water environment, including groundwater and surface water bodies. They also highlight the need to prevent pre-existing and new developments from contributing to water pollution and that any ES should include an assessment of the potential impacts to water quality and water resources. The assessment should also consider potential mitigation measures to reduce the identified risks posed.	Potential groundwater and surface water impacts in relation to land quality and ground conditions and proposed mitigation measures during construction, operation and decommissioning are set out in sections 11.4 and 11.8. All other impacts to water resources with the Proposed Development are discussed within ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6).
National Planning Policy Framework 2025 [8]		
187	Conserving and enhancing the natural environment – This	In relation to land quality and ground conditions, the existing environment is

Relevant paragraph reference	Summary of policy requirement	Where addressed in chapter
	paragraph sets out how planning policies and decisions should contribute to and enhance the natural environment through, for example, protecting sites of geological value and soils. The paragraph notes that decisions and planning policies should prevent new and existing developments from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of pollution.	discussed in section 11.7, with additional information included within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). An assessment of the potential impacts, and proposed mitigation measures, are set out in sections 11.4 and 11.8.
196, 197	Ground conditions and pollution – The paragraphs state that planning policies and decisions should ensure that sites are suitable for their proposed end use taking into account ground conditions, risks from contamination and potential cumulative effects. It also states that adequate site investigation information should be available to assess potential risks and that after remediation, should it be required, the land should not be capable of being determined as contaminated land under Part 2A of the Environment Protection Act 1990. The responsibility for securing a safe development, in terms of the presence of potential contamination, is considered to rest with the developer/landowner.	Ground investigations undertaken within the Order Limits as well as areas of previously developed land (within the study area), are discussed in section 11.7. Additional information with regards to the ground investigations, their findings and areas of previously developed land are included within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). An assessment of the potential impacts, and proposed mitigation measures, are set out in sections 11.4 and 11.8. An assessment of potential cumulative effects on land quality and ground conditions receptors as a result of the Proposed Development and other projects is included in ES Chapter 20 Cumulative and in-combination effects, Volume I (Document reference 6.1, DCO Volume 6).
201	Ground conditions and pollution – The paragraph states that the focus of planning policies and decisions	The existing environment is discussed in section 11.7, with additional information included within ES Appendix 11.2 Geotechnical and geo-

Relevant paragraph reference	Summary of policy requirement	Where addressed in chapter
	should be based on whether the Proposed Development is an acceptable use of land, rather than the control of processes or emissions.	environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). An assessment of the potential impacts, and proposed mitigation measures, are set out in sections 11.4 and 11.8.

Local policy

11.2.5 The local policies listed in Table 11-3 are considered relevant to the land quality and ground conditions assessment of the Proposed Development. While the SoS is required to determine an application for development consent in accordance with the NPSWRI, it may be that the SoS considers aspects of local policy to be matters that are important and relevant to the determination. In the event that there is any conflict between the local policy and the NPSWRI, the NPSWRI would prevail for the purposes of decision making given the national significance of the infrastructure.

11.2.6 Adopted and emerging development plan policies have also been considered. Adopted and emerging planning policy that are relevant is included in Table 11-3.

Table 11-3 List of relevant local policy

Local planning authority	Relevant local policy	Relevance to assessment
East Hampshire District Council (EHDC)	East Hampshire District Local Plan: Joint Core Strategy (Adopted – June 2014) [9] • CP26 Water Resources/Water Quality. • CP27 Pollution	CP26 is relevant to the land quality and ground conditions assessment as it outlines that groundwater and surface water resources should be protected from developments. The assessment within this chapter identifies groundwater and surface water receptors located within and surrounding the Order Limits (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) and assesses the potential risks to those receptors as well as how those risks could be mitigated (see sections 11.4 and 11.8). Policy CP27 outlines that new developments should not result in unacceptable risks to the environment and human health receptors both

Local planning authority	Relevant local policy	Relevance to assessment
		within the footprint of the development and areas surrounding it. The land quality and ground conditions assessment has identified the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated (see section 11.4 and 11.8).
	Our Local Plan 2021 – 2040 Regulation 18 [10] – emerging Local Plan (January 2024) • NBE8 Water quality, supply and efficiency • NBE13: Protection of natural resources	Policy NBE8 is relevant to the land quality and ground conditions assessment as it outlines that the water environment should not deteriorate during construction and operation of a development. The land quality and ground conditions assessment has identified potential groundwater and surface water receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how those risks could be mitigated (see sections 11.4 and 11.8). Policy NBE13 outlines that new developments should not result in unacceptable risks to the environment and human health receptors both within the footprint of the development and areas surrounding it. The assessment within this chapter has identified the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) the impacts that may result from the construction, operation and decommissioning of

Local planning authority	Relevant local policy	Relevance to assessment
		the Proposed Development and how these risks can be mitigated (see sections 11.4 and 11.8).
Eastleigh Borough Council (EBC)	Eastleigh Borough Local Plan (2016 – 2036) Adopted April 2022 [11]: • Policy DM8: Pollution	Policy DM8 highlights that a development would not be permitted if it were to result in land contamination and the requirement for land defined as 'contaminated land' under Part 2A of the Environmental Protection Act 1990 to be remediated to a standard deemed not to fall under this designation. There are no sites located within the Order Limits of the Proposed Development that are defined as contaminated land on EBC registers under the contaminated land statutory definition. The policy also highlights that a development would not be permitted if it is likely to cause unacceptable environmental impacts through pollution of surface, underground, coastal waters or other watercourses. Potential impacts to controlled waters that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated are discussed in sections 11.4 and 11.8. The policy is considered relevant to the land quality and ground conditions chapter as it outlines the measures required to ensure that unacceptable risks are not posed to human health and the environment through contamination. It also highlights the need to carry out remediation works, where required, within the Order Limits.
Fareham Borough Council (FBC)	Fareham Local Plan 2037 (Adopted April 2023) [12]: • Policy D2: Ensuring Good Environmental Conditions • Policy D4: Water Quality and Resources	Policy D2 outlines that new developments should not result in unacceptable risks to the environment and human health receptors both within the footprint of the development and areas surrounding it. The land quality and ground conditions assessment has identified the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated (see sections 11.4 and 11.8).

Local planning authority	Relevant local policy	Relevance to assessment
		Policy D4 is relevant to the land quality and ground conditions assessment as it outlines that groundwater and surface water resources should be protected from developments. The assessment within this chapter identifies groundwater and surface water features located within and surrounding the Order Limits (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), and assesses the potential risks to those receptors as well as how those risks could be mitigated (see sections 11.4 and 11.8).
Havant Borough Council (HBC)	Havant Borough Core Strategy (Adopted March 2011) [13]: • Policy DM10: Pollution	Policy DM10 outlines that new developments should not result in unacceptable risks to the environment and human health receptors. The land quality and ground conditions assessment has identified the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated (see sections 11.4 and 11.8).
	Havant Borough Local Plan (Allocations) (Adopted July 2014) [14]: • Policy BD11 Site specific development requirements • Policy DM17 Contaminated land	Policy BD11 outlines the specific requirements for developments located within the 'Brockhampton West' site. Harts Farm Way historical landfill, where the Water Recycling Plant (WRP) site is proposed, is located within the Brockhampton West site (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). The policy is considered relevant to the land quality and ground conditions assessment as it outlines the need for appropriate surveys and reports to address potential ground quality and landfill gas issues.

Local planning authority	Relevant local policy	Relevance to assessment
		Policy DM17 outlines that appropriate investigation of potential risks associated with contaminated land are conducted to ensure that identified risks are mitigated. Ground investigations have been undertaken within the Order Limits, the interpretative reports for each phase of ground investigation are included as ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). The findings of each phase of ground investigation, and desk-based studies, have been used to inform the baseline conditions of the Proposed Development with respect to land quality and ground conditions (see section 11.7). The land quality and ground conditions assessment has identified the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents),the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated (see sections 11.4 and 11.8).
	Building a Better Future [15] – emerging Local Plan (January 2025)	Although individual policies associated with land quality and ground conditions are not included within the emerging Local Plan, discussions in relation to contamination and development of brownfield land sites are included. As such, it is anticipated that the plan, once formally issued, will include policies relevant to the land quality and ground conditions chapter. The current baseline, including the presence of potentially contaminative land uses, within the Order Limits (and within 250m) is included in section 11.7.
Portsmouth City Council (PCC)	Portsmouth Plan (The City Local Plan 2001 – 2011 (Adopted July	Policy DC21 highlights the need for planning applications for developments on or near contaminated land to ensure that appropriate and

Local planning authority	Relevant local policy	Relevance to assessment
	2006, amended January 2012) [16] • DC21 Contaminated land	sufficient measures to deal with the contamination are undertaken in order to address the long-term safety of the development and management of the site. The policy is considered relevant to this chapter as it outlines the need for measures to mitigate receptors from risks posed by contaminated land.
	Pre-Submission Portsmouth Local Plan 'Regulation 19' Draft for consultation (Emerging July 2024) • Development Management Policy PLP37: Contaminated Land	PLP37 highlights the need for planning applications for developments on or near contaminated land to include measures that would sufficiently mitigate potential risks to receptors. The policy is considered relevant to this chapter as it outlines the need for measures to mitigate receptors from risks posed by contaminated land.
South Downs National Park Authority (SDNPA)	South Downs Local Plan (2014–2033) (Adopted 2 July 2019) [17]: • Strategic Policy SD17: Protection of the Water Environment • Development Management Policy SD55: Contaminated Land	Policy SD17 is relevant to the land quality and ground conditions assessment as it outlines that groundwater and surface water resources should be protected from developments. The assessment within this chapter identifies groundwater and surface water features located within and surrounding the Order Limits (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) and assesses the potential risks to those receptors as well as how those risks could be mitigated (see sections 11.4 and 11.8). Policy SD55 highlights the need for planning applications on, near or on suspected contaminated land to include measures that would sufficiently mitigate potential risks to receptors. The policy is considered relevant to this chapter as it outlines the need for measures to mitigate receptors from risks posed by contaminated land. Proposed mitigation measures relevant to the land quality and ground conditions assessment are discussed in section 11.4 of this chapter.
Winchester City Council (WCC)	Winchester District Local Plan Part 2 Development Management and Site	Policy DM19 outlines that appropriate investigation of potential risks associated with contaminated land are undertaken to ensure that identified risks are mitigated.

Local planning authority	Relevant local policy	Relevance to assessment
	Allocations (Adopted April 2017) [18]: • Policy DM19: Development and Pollution	Several phases of ground investigations have been undertaken within the Order Limits of the Proposed Development. A summary of the findings of the ground investigations is provided within section 11.7 with additional details provided within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). The land quality and ground conditions assessment has identified the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated (see sections 11.4 and 11.8).
	Winchester District Local Plan Review 2006 – Saved Policies (Adopted July 2006) [19]: • DP13: Development on Contaminated Land	Policy DP13, a Saved Policy of the 2006 Winchester District Local Plan highlights the need for planning applications near or on suspected contaminated land to include measures that would sufficiently mitigate potential risks to receptors. The policy is considered relevant to this chapter as it outlines the need for measures to mitigate risks posed by contaminated land.
	Your Place Your Plan. Local Plan. Regulation 19 Document for Consultation (Adopted March 2026) [20]: • Policy D7 Development standards • Policy D8 Contaminated land • Policy NE17 Rivers, watercourses and their settings	Policy D7 highlights that developments should comply with all national statutory standards relating to environmental quality (those relevant to land quality and ground conditions are discussed in Table 11-2). Policy D8 highlights that should a development be located on land known or suspected of being contaminated (or likely to be impacted by contamination within the vicinity of the site), permission would only be granted where there are no unacceptable impacts to human health, groundwater, surface water or the wider environment. The land quality and ground conditions assessment has identified the potential sources of contamination, the potential receptors that may be impacted by the Proposed Development (see section 11.7 and ES Appendix

Local planning authority	Relevant local policy	Relevance to assessment
		11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents),the impacts that may result from the construction, operation and decommissioning of the Proposed Development and how these risks can be mitigated (see sections 11.4 and 11.8). NE17 outlines that developments should include measures to eliminate risk of pollution to groundwater and surface water. The assessment within this chapter identifies groundwater and surface water features located within and surrounding the Order Limits (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) and assesses the potential risks to those receptors as well as how those risks could be mitigated (see sections 11.4 and 11.8).

Guidance, standards and advice

11.2.7 In addition, the land quality and ground conditions assessment has been undertaken in accordance with relevant guidance and has been compiled in accordance with professional standards. The guidance and standards which relate to this assessment are detailed in Table 11-4.

Table 11-4 List of relevant guidance and standards

Guidance	Description	Relevance to assessment
EA (2025) Land Contamination Risk Management Framework [21].	The EA guidance provides an update to the former EA Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11). The guidance aims to help those assessing potentially contaminated sites to identify and assess their risks to sensitive receptors, make appropriate decisions in relation to the outcome of the assessment and identify the required actions necessary, e.g. implement remediation if considered necessary.	This guidance is relevant to land quality and ground conditions as it provides a framework for the assessment of the risk contaminated land poses to the Proposed Development and determining management measures to reduce potentially unacceptable risks to land quality and ground conditions receptors.

Guidance	Description	Relevance to assessment
EA (2018) The Environment Agency's Approach to Groundwater Protection Position Statements (under review) [22].	These position statements provide information relating to the EAs approach to managing and protecting groundwater. They detail how the EA delivers government policy for groundwater and adopts a risk-based approach where legislation allows. The primary aim of all of the position statements is the prevention of pollution of groundwater and protection of it as a resource.	This guidance is relevant to land quality and ground conditions as it provides a framework for determining the sensitivity of groundwater resources within the Order Limits.
Highways England (2020) LA 104 Environmental Assessment and Monitoring [23].	This guidance sets out the requirements and processes that should be followed when assessing the environmental impacts of a project. It also provides a steer as to which policies and legislation should be referred to for each stage of the EIA process.	This guidance is relevant to land quality and ground conditions as it sets out the steps required to complete a robust assessment of the potential impacts to identified receptors as a result of the construction, operation and decommissioning of the Proposed Development.
Construction Industry Research and Information Association (CIRIA) (2001) Contaminated Land Risk Assessment – A Guide to Good Practice, C552 [24].	This guidance sets out the key elements of contaminated land risk assessment practices and procedures.	This guidance is relevant to land quality and ground conditions as it provides a framework for assessing the risk contaminated land poses to the Proposed Development.
EA (2010) Guiding Principles for Land Contamination. The Guiding Principles for Land Contamination (GPLC): • GPLC 1 – Introduction [25] • GPLC 2 – Frequently Asked Questions, technical information, detailed advice and references [26] GPLC 3 – reporting checklist [27]	The aims of these documents are to provide guidance to those who are involved with contaminated land, encourage good practice, promote compliance with regulatory requirements and to provide reference to applicable guidance.	Although this guidance has been withdrawn, it is still considered to be relevant to land quality and ground conditions as it provides a framework for assessing the risk contaminated land poses to the Proposed Development.
Hampshire and Isle of Wight Contaminated Land Liaison Group	This guidance outlines the stages, types of reports, ground investigations and remedial activities	This guidance is relevant to land quality and ground conditions as it provides a framework for

Guidance	Description	Relevance to assessment
(2005) Development on Potentially Contaminated Land [28].	that may be required as part of the process of assessing the potential risks associated with development on potentially contaminated land.	assessing the risk contaminated land poses to the Proposed Development.
HBC (2011) Borough Design Guide [29].	This design guide states that development sites typically have constraints, and this can include contamination risks from soils and land uses.	The guide is relevant to land quality and ground conditions as it sets out the recommendations for mitigation measures to reduce the potential impacts from the Proposed Development.
EHDC (2014) Development on Potentially Contaminated Land [30].	These two pieces of guidance outline the procedures that should be followed if a Proposed Development is located within an area of contaminated land. They discuss the types of reports, and ground investigations, that may be required to be submitted to the local planning authority.	This guidance is relevant to land quality and ground conditions as it aids in identifying what information to incorporate in assessments of the potential risks to receptors from contamination.
WCC (2014) Development on Potentially Contaminated Land [31].		
PCC (2020) Contaminated Land Guidance for Developers [32].	The guidance sets out the regulatory frameworks in relation to developments on potentially contaminated sites. It outlines the procedures that should be followed if a Proposed Development is located within an area of contaminated land. In addition, it discusses the types of reports, and ground investigations, that may be required to be submitted to the local planning authority.	This guidance is relevant to land quality and ground conditions as it aids in identifying what information is required to assess the potential risks to receptors from contamination.

11.3 Consultation, scoping and engagement

Consultation

11.3.1 Feedback received from stakeholders for each consultation relevant to land quality and ground conditions is summarised within the Consultation Report (Document Reference 5.1, Volume 5) including how the Proposed Development has had regard to the feedback. These cover the consultation responses for the following consultations:

1. Summer 2022 Consultation
2. Summer 2024 Consultation
3. Spring 2025 Consultation
4. Autumn 2025 Consultation
5. Spring 2026 Consultation

Environmental Impact Assessment scoping

11.3.2 An EIA Scoping Opinion was adopted by the Planning Inspectorate on behalf of the SoS on 31 August 2023. A full list of the EIA Scoping Opinion comments and responses is provided in ES Appendix 5.3 Response to EIA Scoping Opinion, Volume II (Document reference 6.2, DCO Volume 6).

11.3.3 Comments received in relation to land quality and ground conditions are set out in Table 11-5, describing how and where these are addressed in the ES.

Table 11-5 EIA Scoping Opinion - Planning Inspectorate comments

EIA Scoping Opinion ID	Summary of EIA Scoping Opinion comment	How the ES addresses the EIA Scoping Opinion comment	Where addressed in the ES
ID 3.6.1	The EIA Scoping Opinion noted that due to the absence of geologically sensitive sites within the scoping area or the 250m buffer zone, potential impacts on these receptors could be scoped out of the land quality and ground conditions assessment.	Although route refinement has been undertaken following the submission of the EIA Scoping Report, it remains the case that the Order Limits do not interact with any geologically sensitive sites.	N/A
ID 3.6.2	The EIA Scoping Opinion stated that there was a need for greater detail to be provided regarding the maintenance activities that may be required during the operation of the WRP site, and an assessment of the potential impacts associated with these activities should be undertaken.	An assessment of potential operational impacts of the WRP site, which includes an assessment of maintenance activities that may be required during the operational phase, with regards to land quality and ground conditions has been undertaken within this chapter.	Section 11.8
ID 3.6.3	The EIA Scoping Opinion stated that the scope of ground investigations should have sufficient coverage to ensure baseline conditions are understood for all areas where significant effects may occur. Details in relation to the scope of any ground investigations within the Order Limits should be discussed with the relevant consultation bodies and local planning authorities.	Proposed Development specific ground investigations were undertaken for each component part of the Proposed Development between July 2022 and May 2024. The coverage of each phase of the specific ground investigation (Phases 0, 1, 2, 3A, 3B and 3C) is discussed within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). Engagement with stakeholders with regards to the scope of the Proposed Development specific Ground Investigations has been undertaken. This engagement was undertaken in relation to the potential effects that may occur as a result of the GIs.	Paragraphs 11.3.4 to 11.3.8 inclusive.

EIA Scoping Opinion ID	Summary of EIA Scoping Opinion comment	How the ES addresses the EIA Scoping Opinion comment	Where addressed in the ES
ID 3.6.4	The EIA Scoping Opinion stated that details regarding any remediation that may be required and how it will be secured should be provided, as well as an assessment of any likely significant effects which could occur as a result of remediation.	Remediation requirements are not yet confirmed for all elements of the Proposed Development as, in some instances, they depend on detailed design and the completion of further post consent ground investigations (as discussed below). Where this is the case, it is not possible to describe specific remediation measures within the ES. However, where remedial measures have already been identified and requirements are clear, these are discussed within the ES, with an outline remediation strategy for the WRP included within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents).The identified remediation measures include, for example, the incorporation of ground gas protection measures into the design of the WRP site, as well as details of materials handling and disposal methods (see the assessment provided within ES Chapter 16 Resources and waste management, Volume I (Document reference 6.1, DCO Volume 6)). Whether remediation requirements are known or not yet confirmed, any necessary remediation works would be undertaken in accordance with relevant guidance and legislation in place at the time of the works, with the measures bespoke to the risks identified. These bespoke measures may include, but are not limited to, ground gas protection measures, venting systems, bespoke drainage, removal of soils deemed to pose an unacceptable risk to either the Proposed Development or nearby land quality and ground conditions receptors etc. Further post consent ground investigation, including monitoring should it be considered necessary, will be undertaken in areas considered to potentially pose an unacceptable risk to land quality and ground conditions	Section 11.4.

EIA Scoping Opinion ID	Summary of EIA Scoping Opinion comment	How the ES addresses the EIA Scoping Opinion comment	Where addressed in the ES
		receptors. The findings of the post consent ground investigation will be interpreted and compared against relevant screening criteria, this will aid in the determination of whether an unacceptable risk is posed and informing whether a remediation strategy is required. Where remediation strategies are required, these will be issued post consent as separate documents and be developed following the guidance provided in the EAs Land Contamination Risk Management Framework [21] as described within the Outline CEMP (Document reference 7.1, DCO Volume 7).	
ID 3.6.5	The EIA Scoping Opinion stated that the land quality and ground conditions assessment should include details and impacts associated with the storage and usage of oils, fuels and chemicals during construction (already scoped in for operation) and an assessment of how groundwater could potentially be contaminated by the storage and usage of these resources should be undertaken.	An assessment of the potential impacts to groundwater, inclusive of potential impacts associated with the storage and usage of oils, fuels and chemicals during the construction phase, is provided in response to feedback from the EIA Scoping Opinion.	Section 11.8.
ID 3.6.6	The EIA Scoping Opinion noted the absence of a key on the figures supporting the land quality and ground conditions scoping chapter and that any figures supporting the ES chapter should clearly present baseline information.	The figures supporting the ES chapter contain a key and clearly present the baseline information relevant to the land quality and ground conditions assessment.	ES Figures 11.1 to 11.6, Volume III (Document reference 6.3, DCO Volume 6).

Engagement

11.3.4 This section provides details of the ongoing technical engagement that has been undertaken with stakeholders in relation to land quality and ground conditions.

Environmental Impact Assessment working groups

11.3.5 Five EIA Working Groups have been established as forums for ongoing engagement with statutory bodies regarding the Proposed Development. These Working Groups when combined cover all of the assessment topics considered by the EIA. A full description of each of the EIA Working Groups, the key stakeholders, and an overview of the topics presented can be found in ES Chapter 5 EIA approach and methodology, Volume I (Document reference 6.1, DCO Volume 6).

This section presents a summary of the topics covered in the EIA Working Groups which are of relevance for the land quality and ground conditions assessment.

11.3.6 The Biodiversity and Water Environment EIA Working Group, which includes land quality, hydrogeology, water, marine ecology and terrestrial/freshwater ecology, has been the main forum for engagement for land quality and ground conditions. There have been 12 Biodiversity and Water Environment EIA Working Group meetings between Summer 2022 and DCO application. Technical officers from EHDC, EBC, EA, FBC, Forestry Commission, Hampshire County Council, HBC, Marine Management Organisation, Natural England (NE), PCC, SDNPA, and WCC attended the EIA Working Group meetings.

11.3.7 The following overarching themes were covered across the EIA Working Group meetings:

1. Introduction and background to the Proposed Development.
2. Overview of the baseline environment.
3. Overview of EIA scoping which included setting out the proposed approach to EIA Scoping, providing an overview of the EIA Scoping Report and seeking feedback on the EIA Scoping Opinion.
4. An overview of the Preliminary Environmental Information (PEI) Report, including setting out the baseline and approach to mitigation, as well as providing an overview of the PEI Report findings.
5. Updates on the approach to design and the development of the design of the Proposed Development.
6. Briefings on the materials to be consulted on, including design and environmental assessment related matters, ahead of the Summer 2022, Summer 2024 and Spring 2025 Consultations.
7. Approach to mitigation, Commitments Register (ES Appendix 5.5 Commitments Register, Volume II (Document reference 6.2, DCO Volume 6)) and associated management plans are provided with the DCO application.
8. Consultation feedback and updates on scheme development, and design principles following the Summer 2024 Consultation and PEI Report.
9. Updates on EIA progress and development of mitigation, including management plans and the Commitments Register.
10. An overview of the ES, including setting out the baseline and any updates from the PEI Report, as well as providing an overview of the findings of the EIA.

11.3.8 Comments received as part of the EIA Working Groups and matters resolved in relation to land quality and ground conditions included:

1. A query from the EA as to whether the assessment within this chapter included an assessment of the potential impacts of tunnelling on groundwater receptors. It was confirmed to the EIA Working Group that this assessment includes impacts associated with tunnelling.
2. A query from NE in relation to leaching of contaminants into ecologically designated sites was raised. It was confirmed to the EIA Working Group that this assessment includes both direct and indirect impacts to sensitive receptors.

11.4 Primary and tertiary mitigation

Primary measures

11.4.1 As described in ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6) a range of measures have been embedded into the Proposed Development design to avoid or reduce environmental effects. The primary mitigation measures specific to land quality and ground conditions, which form part of the design that has been assessed are:

1. Commitment to trenchless construction works where the Proposed Development crosses Main Rivers to reduce the potential for contaminated material to enter surface water via surface run-off. This is detailed within ES Appendix 3.1 Primary mitigation, Volume II (Document reference 6.2, DCO Volume 6) and secured through the Outline CEMP (Document reference 7.1, DCO Volume 7).
2. Undertaking Hydrogeological Impact Assessments for each element of the Proposed Development (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)). The Hydrogeological Impact Assessments have aided in identifying the mitigation measures required to be incorporated into the design of the Proposed Development.
3. Incorporation of ground gas protection measures into the design of the WRP site, as set out in the Design Principles Document, (Document reference 5.11, DCO Volume 5). The ground gas protection measures align with those required for a Characteristic Situation (CS) 3 [33]. See section 11.7 for a summary of encountered ground gas conditions.

Tertiary measures

11.4.2 Good construction practices are set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) and will manage the effects of construction. The measures which are protective of both on- and off-site land quality and ground conditions receptors are:

1. Measures to mitigate risks to human health during construction from potential exposure to contaminated materials.
2. Measures to protect and mitigate risks to controlled waters.
3. Measures to manage the re-use of excavated soils.
4. Measures relating to waste management, and management of wastewater.

11.4.3 Examples of specific measures set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) relevant to land quality and ground conditions include:

1. Preparation of plans describing measures to be adopted in the event of encountering expected and unexpected contamination in accordance with current guidance and legislation.
2. Appropriate storage of fuels and oils with processes in place to manage any leaks or spills from equipment.
3. Development of spill response plans and training of personnel on how to use spill kits.

4. Undertake all plant refuelling on hardstanding or within defined areas that utilise drip trays/plant nappies.
5. Storage of contaminated soils in demarcated areas with soils placed on impermeable surfaces to prevent contamination of the underlying ground.
6. Covering stockpiles to prevent windblown dust or ingress of rainwater, where practicable.
7. Implement controls for containing surface water run-off from contaminated stockpiles to prevent the uncontrolled discharge of contaminated effluent.
8. Reducing the surface areas of exposed landfill waste as far as practicable.
9. Providing temporary cover of exposed landfill areas promptly where possible and permanently covering exposed landfill areas as soon as is practicable.

11.4.4 A watching brief and discovery strategy will also be in place during the construction phase. Should visual and/or olfactory indicators of unforeseen contamination (including asbestos) be encountered, works will cease in that area and advice be sought from a suitably qualified geoenvironmental professional.

11.4.5 Outline Foundation Works Risk Assessments (FWRA) have been prepared and submitted with the DCO application (see Outline Foundation Works Risk Assessment – Proposed Water Recycling Plant and Trenchless Crossing to Budds Farm WTW Shaft Site, Outline Foundation Works Risk Assessment – Above Ground Plant and Trenchless Crossings and Outline Foundation Works Risk Assessment – Tunnels and Shafts (Document Reference 7.4, DCO Volume 7)). The Outline FWRAs (Document Reference 7.4, DCO Volume 7) are not intended to prescribe definitive foundation design but instead provide examples of foundation types that may be adopted. The commitment to undertake detailed FWRAs is secured within the Outline CEMP (Document reference 7.1, DCO Volume 7).

11.4.6 As secured in the Outline CEMP (Document reference 7.1, DCO Volume 7) and reported within the Outline FWRAs (Document Reference 7.4, DCO Volume 7), piled foundations will be cast in situ at the WRP site to ensure 'intimate contact' between the pile and the surrounding landfill waste in order to reduce the risk of creating pathways for contamination to migrate into the underlying Principal Aquifers and adjacent surface water features. For Above Ground Plant (AGP) example foundation types for buildings and tanks discussed within the Outline FWRA (Document Reference 7.4, DCO Volume 7) include shallow and cast in situ foundations. Foundations for tunnels and shafts could include, for example, pre-cast and cast elements to reduce potential risks of creating pathways for contamination to migrate into the underlying aquifers. The measures discussed above and within each of the Outline FWRAs (Document Reference 7.4, DCO Volume 7) demonstrate that technical solutions are possible with regard to mitigation measures that are protective of land quality and ground conditions receptors. However, the development of the Outline FWRAs (Document Reference 7.4, DCO Volume 7) follows an iterative process which is dependent on post-consent design and therefore the mitigation measures discussed are subject to change.

11.4.7 The proposed locations of trenchless crossings, and therefore where the Outline Foundation Works Risk Assessment – Above Ground Plant and Trenchless Crossings (Document reference 7.4, DCO Volume 7) would be applicable, are

provided within Appendix A of the Outline CEMP (Document reference 7.1, DCO Volume 7).

11.4.8 As secured within the Outline CEMP (Document reference 7.1, DCO Volume 7), the Contractor will adopt CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils on site, where applicable and appropriate. The Contractor will produce and adhere to a Materials Management Plan (MMP) as secured within the Outline CEMP (Document reference 7.1, DCO Volume 7).

11.4.9 A Hydrogeological Impact Assessment has been prepared and is submitted with the DCO application (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

11.4.10 In areas which are considered to represent a potentially unacceptable risk to land quality and ground conditions receptors, remediation strategies will be developed following the guidance provided within the appropriate contaminated land statutory guidance and, for example, the EA Land Contamination Risk Management Framework [21]. Further ground investigation, including monitoring should it be considered necessary, will be undertaken in areas considered to potentially pose an unacceptable risk to land quality and ground conditions receptors. The ground investigation will be interpreted and compared against relevant screening criteria, this will aid in the determination of whether an unacceptable risk is posed and informing whether a remediation strategy is required for that area of the Proposed Development as secured within LQGC10 of the Outline CEMP (Document reference 7.1, DCO Volume 7). See ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II) (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)for further details on which areas are considered to require further ground investigation.

11.4.11 ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) includes an outline remediation options appraisal and outline remediation strategy for the WRP site. The outline remediation strategy contains the following key elements to mitigate potential risks to land quality and ground conditions receptors:

1. Health and safety legislation (as discussed within the Outline CEMP (Document reference 7.1, DCO Volume 7)).
    a. This legislation includes regulatory measures to protect human health receptors from hazards including cover soils and landfill waste (asbestos, polycyclic aromatic hydrocarbons (PAHs) and landfill gases), Made Ground (asbestos and PAHs) and unforeseen ground conditions.
2. Outline CEMP (Document reference 7.1, DCO Volume 7).
    a. The Outline CEMP includes relevant measures to protect human health, controlled waters and ecologically sensitive sites from hazards including cover soils and landfill waste (asbestos, PAHs and landfill gases), unforeseen ground conditions, metals and ammonia. Measures include, but are not limited to:
        i Development and adherence to risk assessments and method statements.

ii Placement of contaminated soil stockpiles on impermeable surfaces.

iii Appropriate storage of fuels and oils with processes in place to manage any leaks or spills from equipment.

3. Watching brief and discovery strategy during ground works (unexpected ground conditions) (as discussed within the Outline CEMP (Document reference 7.1, DCO Volume 7)). Should visual and/or olfactory indicators of contamination (including asbestos) be encountered, works will cease in that area and advice will be sought from a suitably qualified geoenvironmental professional.
   a. To protect human health receptors from hazards related to unforeseen ground conditions.
4. Landfill gas protection measures (as discussed within the Design Principles Document (Document reference 5.11, DCO Volume 5)).
   a. To protect human health receptors and the built environment from hazards associated with landfill waste (landfill gases) and Made Ground (landfill gases). These hazards include asphyxiation and explosion as a result of the accumulation of landfill gases.
5. Selection of piling and shaft/tunnel construction methodology (as discussed within the Outline CEMP (Document reference 7.1, DCO Volume 7)).
   a. To protect controlled waters and ecologically sensitive sites from hazards including metals and ammonia.
   b. To prevent the creation of preferential pathways for ground gas migration.
6. Soil excavation, re-use and disposal protocol (as discussed within the Outline CEMP (Document reference 7.1, DCO Volume 7)).
   a. To protect human health, environmental and controlled water receptors from contaminated soils/wastes through the adoption of CL:AIRE Definition of Waste: Code of Practice.

11.4.12 ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) include risk reduction measures for the remaining elements of the Proposed Development outside of the WRP site. The risk reduction measures to mitigate potential risks to land quality and ground conditions receptors which will be included within the remediation strategy, as secured within the Outline CEMP (Document reference 7.1, DCO Volume 7), include:

1. Compliance with Health and Safety legislation
2. Watching brief and discovery strategy in place during groundworks
3. Ground gas risk management plan
4. Controlled waters monitoring plan
5. Soil excavation, re-use and disposal management measures
6. Selection of shaft/tunnel construction methodology (Foundations Works Risk Assessment)
7. Further post-consent ground investigation (including ground gas monitoring)

8. Stockpile management

11.4.13 The excavation and removal of the waste, or the temporary removal of the waste followed by the installation of a landfill liner, and the replacement of the waste within the WRP site is not considered a sustainable or economically viable means of remediation (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)). Either of these activities could result in the release of a significant volume of landfill leachate, landfill gases and potentially causing significant harm to the environment. Therefore, wholesale excavation of landfill waste within the WRP site is not considered appropriate. Details of volumes of waste materials generated during the construction of the Proposed Development are provided in ES Chapter 16 Resources and waste management, Volume I (Document reference 6.1, DCO Volume 6).

11.4.14 In addition to the above, a range of tertiary mitigation measures will be adopted to manage the effects on land quality and ground conditions receptors during the operation of the Proposed Development, as set out in the Operational Environmental Management Plan (Document reference 7.7, DCO Volume 7). This includes the development of task specific risk assessment and method statements by those conducting the works to manage any required excavation works, as well as the development of an Emergency Response Plan (or similar) to mitigate the potential impacts from an uncontrolled release of hazardous materials.

11.4.15 Decommissioning will be subject to the appropriate permits, consents and regulatory environment at the relevant time. Decommissioning activities are expected to follow good industry practice in place at the time, anticipated to be similar in nature to measures contained in the Outline CEMP (Document reference 7.1, DCO Volume 7).

11.5 Assessment methodology

Scope of assessment

11.5.1 Likely significant effects requiring assessment may be temporary or permanent, direct, indirect, secondary, cumulative, in-combination, beneficial or adverse and may occur during construction, operation and decommissioning. Potential likely significant effects on land quality and ground conditions receptors within the scope of the assessment are summarised in Table 11-6. The scope of the assessment has responded to feedback received as detailed in section 11.3.

11.5.2 The majority of the effects from decommissioning of the Proposed Development are considered to be no greater than those identified during the construction phase and are therefore assessed to be of the same significance as those assessed for construction. Refer to ES Chapter 3 Description of the Proposed Development, Volume I, (Document reference 6.1, DCO Volume 6) section 3.7 for additional information on decommissioning.

11.5.3 The only exception with regards to effects from decommissioning being no greater than those identified during construction are those associated with the decommissioning of the buried pipeline infrastructure. Potential impacts associated with this phase would have differing risks when compared to the

construction and operation phases, e.g. the pipeline potentially acting as a conduit for the migration of contaminants. This assessment is outlined in section 11.8.

11.5.4 Cumulative effects are those resulting from the interrelationship between the Proposed Development and other developments (inter-project). These are reported within ES Chapter 20 Cumulative and in-combination effects, Volume I (Document reference 6.1, DCO Volume 6).

11.5.5 In-combination effects are those that result from the interaction of individual effects combined together on a single receptor or resource at a single point in time. Where a receptor is affected by multiple topics and there is the potential for significant in-combination effects to occur, these aggregated effects are reported within ES Chapter 20 Cumulative and in-combination effects, Volume I (Document reference 6.1, DCO Volume 6).

11.5.6 Table 11-6 sets out the summary of the scope for the assessment in this chapter. All scoped out elements as agreed in the EIA Scoping Opinion are confirmed in ES Appendix 5.3 Response to EIA Scoping Opinion, Volume II (Document reference 6.2, DCO Volume 6).

Table 11-6 Summary of the scope for land quality and ground conditions assessment

Receptor	Construction	Operation**	Decommissioning
Effects on human health	Scoped in	Scoped in	Scoped in
Effects on groundwater	Scoped in	Scoped in	Scoped in
Effects on surface water quality and ecological habitats	Scoped in	Scoped in	Scoped in
Effects on geologically sensitive areas	Scoped out	Scoped out	Scoped out
Effects on the built environment*	Scoped in	Scoped in	Scoped in
Effects on agricultural land*	Scoped in	Scoped out	Scoped out

*Potential effects on the built environment and agricultural land were not previously included within the EIA Scoping Report or commented upon within the EIA Scoping Opinion. However, following submission of the EIA Scoping Report, it was identified that there is the potential for elements of the built environment to be impacted by the Proposed Development during the construction, operational and decommissioning phases of the Proposed Development (e.g. degradation of concrete from aggressive attack). It was also identified that there is the potential for areas of agricultural land to be impacted by the Proposed Development during construction as a result of contamination. As such, impacts associated with these phases of the Proposed Development have been scoped into the land quality and ground conditions assessment (see section 11.8). **Only operational effects within the WRP site have been scoped into the land quality and ground conditions assessment, all other operational effects for the remainder of the Proposed Development have been scoped out of assessment.

Study area

11.5.7 This section describes the spatial scope (the area which may be impacted) for the assessment as it applies to land quality and ground conditions.

11.5.8 The land quality and ground conditions study area has been defined on the basis of the distance over which impacts may occur and by the location of any receptors that may be affected by those potential impacts. The land quality and ground conditions study area is illustrated on ES Figure 11.1 Land quality and ground conditions study area, Volume III (Document reference 6.3, DCO Volume 6).

11.5.9 Table 11-7 summarises the buffer zones from the Order Limits which are included within the land quality and ground conditions study area.

Table 11-7 Land quality and ground conditions study area

Parameter	Buffer zone from the Order Limits
Source Protection Zones (SPZ)	Land within the Order Limits
Agricultural land	
PSCs not landfill related	50m
Trade directories (where applicable and not a registered address at a residential property)	
Groundwater potable abstractions (inclusive of private potable abstractions only)	
Discharge consents	
Pollution incidents	
Active consents (Integrated Pollution Prevention and Control and Local Authority Pollution Control)	
Control of Major Accident Hazards sites	
Scheduled monuments	250m
Infilled land and landfills	
Other waste sites (not licensed landfills, waste transfer stations and waste management)	
Ecological designations including SSSI, Ramsar, Special Area of Conservation (SAC), Special Protection Areas (SPAs) and Nitrate Vulnerable Zones	
Groundwater abstractions (both for non-potable and potable uses (exclusive of private potable abstractions described above))	500m

Assessment scenarios

11.5.10 ES Chapter 5 EIA approach and methodology, Volume I (Document reference 6.1, DCO Volume 6) provides an overview of the Proposed Development's approach to the temporal scope (the timescales over which impacts may occur) of the EIA. This section describes the temporal scope for the assessment as it applies to land quality and ground conditions.

11.5.11 The assessment of effects compares a scenario without the Proposed Development against one with the Proposed Development (inclusive of the construction, operation and decommissioning phases) over time. An assessment of the likely significant effects that may occur during construction, operation and decommissioning of the Proposed Development is provided in section 11.8.

11.5.12 Likely significant effects associated with the construction and decommissioning of the Proposed Development are effects that may commence at any point in the construction or decommissioning phases. Likely significant effects resulting from the physical presence of the Proposed Development which would continue through to operation are also considered as part of this assessment.

11.5.13 Likely significant effects associated with the operational phase may occur as a result of the operation and maintenance of the Proposed Development (see ES Chapter 5 EIA approach and methodology, Volume I (Document reference 6.1, DCO Volume 6)). Therefore, operational effects are considered to commence when the Proposed Development is fully operational. Operational effects may

occur at any time during the Proposed Development's lifetime (assumed to be a minimum of 100 years).

11.5.14 The future baseline includes committed developments that will be delivered prior to the commencement of construction of the Proposed Development (see section 11.7 for full details).

11.5.15 The temporal scope for this assessment differs from the scope set out in ES Chapter 5 EIA approach and methodology, Volume I (Document reference 6.1, DCO Volume 6), and are instead based on the topic specific guidance the CIRIA 552 'Contaminated Land Risk Assessment, A Guide to Good Practice' [25]. As such the temporal scope for this assessment is as follows:

1. Long-term – greater than 15 years
2. Medium-term – between two and 15 years
3. Short-term - between zero and six years

11.5.16 Where the temporal scope deviates from those outlined above, an explanation is included within section 11.8.

Baseline methodology

Desk study

11.5.17 Baseline data collection has been undertaken to obtain information across the study area. This section provides the approach to collecting baseline data.

11.5.18 The following data sources have been accessed to inform the baseline with respect to land quality and ground conditions (see Table 11-8). In addition to these data sources, the land quality and ground conditions assessment draws on environmental baseline data collated for other topics, specifically, baseline data relating to hydrology, hydrogeology and groundwater abstractions presented in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6).

Table 11-8 Data sources used to inform the land quality and ground conditions assessment

Source of data	Baseline data
Environmental Database Report (Groundsure) [34]	Historical maps, site sensitivity data, surface water features, trade directory and regulatory information (obtained 2022).
EA (2025)	Historical landfill sites, permitted waste sites, landfill site boundaries and groundwater abstractions (obtained April 2025).
British Geological Survey (BGS) (publications between 1987 and 2024)	Solid geology, superficial geology, borehole records, mineral extraction sites and radon gas risk (obtained April 2025).
NE (2024) [35]	Provisional Agricultural Land Classification dataset (obtained May 2025).
ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7	Superficial geology, solid geology, hydrogeology, contamination sources (including information held by local councils in relation to contaminated land

Source of data	Baseline data
and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)	sites/areas within their area). Dated between 2024 and 2025.
ES Appendix 12.1 Agricultural Land Quality Volume II (Document reference 6.2, DCO Volume 6)	Proposed Development specific agricultural land classification surveys undertaken in 2023 and 2024.
ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)	Superficial geology, solid geology and hydrogeology (obtained between 2022 and 2025).
Multi Agency Government Information for the Countryside (MAGIC) map application (Department for Environment, Food and Rural Affairs, 2024)	Aquifer designations and groundwater SPZs (obtained April 2025).
EA and Local Councils (EBC, EHDC, FBC, HBC, PCC, SDNPA, WCC)	Licensed and unlicensed potable and non-potable groundwater abstraction data (obtained 2024).

Ground investigations

11.5.19 Targeted ground investigations have allowed for the characterisation of current ground conditions within the Order Limits and has assisted in the identification of potentially unacceptable risks to land quality and ground conditions receptors. Due to the size and nature of the Proposed Development these investigations have been split into the following phases:

1. Phase 0: ten boreholes to depths of 60.00m below-ground level (bgl) within the area of the WRP site and Budds Farm Wastewater Treatment Works (WTW).
2. Phase 1: 19 boreholes to depths between 30.00 and 110.00m bgl and 15 machine excavated trial pits within key areas of tunnelling sections of the Pipeline.
3. Phase 2: 33 boreholes to a maximum depth of 30.00m bgl and four trial pits to a maximum depth of 4.00m bgl focusing on the linear part of the pipeline route (including locations where trenchless construction works would be undertaken beneath, for example, Main Rivers and transport infrastructure) and PSCs.
4. Phase 3A: 12 boreholes to a maximum depth of 55.70m bgl and two trial pits to a depth of 4.00m bgl within key areas of shafts and tunnels associated with the Pipeline.
5. Phase 3B and C: 49 boreholes to a maximum depth of 30.00m bgl and ten trial pits to a maximum depth of 4.00m bgl along the route of the Pipeline.

11.5.20 The results of the ground investigations have been used to inform the assessment.

11.5.21 Where available, information gathered as part of the ground investigations has been used in addition to those data sources identified in Table 11-8 to inform the baseline environment for land quality and ground conditions.

Assessment methodology

11.5.22 The approach to assessment is set out in ES Chapter 5 EIA approach and methodology, Volume I (Document reference 6.1, DCO Volume 6). This has informed the approach used in this land quality and ground conditions assessment.

11.5.23 The methodology for assessing the potential effects is based on the principle that environmental effects, in relation to land quality and ground conditions, of the Proposed Development are determined by identifying the potential receptors, assigning receptor value and the magnitude of impact the Proposed Development would have. This process allows for the identification of the likely significance of effect for each receptor. The assessment considers each component of the Proposed Development.

11.5.24 Where a location is described as 'off-site' in this assessment it is referring to a location beyond the Order Limits. For example, a receptor stated as 'off-site within 250m' means a receptor within 250m of the Order Limits.

Sensitivity of receptors

11.5.25 Receptor sensitivity is defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. Table 11-9 provides the criteria for appraisal of sensitivity for identified land quality and ground conditions receptors based on professional judgement with reference to the policy and guidance set out in section 11.2.

Table 11-9 Definition of sensitivity for a land quality and ground conditions receptor

Sensitivity	Definition
High – has very limited or no capacity to accommodate physical or chemical changes.	General • Receptor is internationally or nationally important/rare with limited potential for offsetting/compensation.
	Land quality – human health • Construction workers involved in below-ground construction works/groundbreaking activities. • Public and local residents/children (on and off-site within 50m). • Future end users (residential or allotment end use).
	Land quality – controlled waters and ecology • Groundwater SPZ 1. • Public water supplies/licensed surface water and groundwater abstractions for potable use (on and off-site within 500m). • Private water supplies for potable use (automatic 50m SPZ 1 applied around supply) (on and off-site within 50m). • Supports habitats or species that are highly sensitive to change in surface hydrology or water quality. • Surface and groundwater supporting internationally designated sites (e.g. Special Protection Area (SPA) or Ramsar sites).
	Built environment

Sensitivity	Definition
	• Sites of international importance, World Heritage Sites and Scheduled Monuments (on and/or off-site within 250m).
	Agricultural land • Land at Agricultural Land Classification (ALC) Grade 1, 2 or 3a* (agricultural land designated as Best and Most Versatile (BMV)).
Medium – has limited capacity to accommodate physical or chemical changes.	General • Receptor is regionally important/rare with limited potential for offsetting/compensation.
	Land quality – human health • Future end users (commercial/industrial end use/open space/farmers and workers on agricultural land). • Public and local residents/children (at distances >50m but <250m). • Commercial/industrial workers (off-site within 50m). • Construction workers (above-ground).
	Land quality – controlled waters and ecology • Groundwater SPZ 2 and SPZ 3. • Principal Aquifers. • Secondary A, B and Undifferentiated Aquifers with private potable groundwater abstractions. • Surface and groundwaters supporting nationally designated sites (e.g. SSSI).
	Built environment • Commercial or residential buildings (on and/or off-site within 250m).
	Agricultural land • Land at ALC Grade 3b (non-BMV land).
Low – has a moderate capacity to accommodate physical or chemical changes.	General • Receptor is locally important/rare.
	Land quality – human health • Future end users (transport end use such as car parks or highways). • Public and local residents/children (off-site >250m). • Commercial/industrial workers (off-site at distances >50m but <250m).
	Land quality – controlled waters and ecology • Secondary A, B and Undifferentiated Aquifers without groundwater abstractions. • Groundwater or surface waters supporting locally important sites (e.g. Local Nature Reserves).
	Built environment • Car parks, highways, transport infrastructure and utilities (on and/or off-site within 250m).
	Agricultural land

Sensitivity	Definition
	• Land at ALC Grade 4 (non-BMV land).
Negligible – is generally tolerant of changes.	General • Receptor is not considered to be particularly important/rare.
	Land quality – human health • Commercial/industrial workers (off-site >250m).
	Land quality – controlled waters and ecology • Unproductive strata. • Groundwater or surface waters that support or contribute to habitats that are not sensitive to changes in surface hydrology or water quality.
	Built environment • Locally important roads and footpaths.
	Agricultural land • Land at ALC Grade 5 (non-BMV land) and Urban land.
*ALC Grade 3 land can be subdivided into Grade 3a, which is considered good quality agricultural land, and Grade 3b which is considered to be of moderate quality. While ALC surveys have been undertaken for some areas within the Proposed Development, and identify 3a vs 3b land, in other areas Natural England's Provisional ALC dataset [35] is relied upon. The Natural England dataset does not subdivide Grade 3 land, as such all Grade 3 land is conservatively considered to be of high sensitivity.	

11.5.26 The sensitivity assessment considers how 'acceptable' changes to the availability or quality of a particular resource would be. This is dependent on the value of that resource which is assessed based on its strategic or geographic importance. Definitions of value are provided in Table 11-10.

Table 11-10 Definition of value levels for land quality and ground conditions

Value	Definition
High	Is an internationally or nationally important resource.
Medium	Is a regionally important resource.
Low	Is a locally important resource.
Negligible	Is of no significant resource value.

11.5.27 High value and high sensitivity are not necessarily linked within a particular impact. A receptor could be of high value but have low or a negligible sensitivity to an effect.

Magnitude of impact

11.5.28 For impacts related to human health and the built environment, magnitude reflects the likely increase or decrease in exposure risk for a receptor. For controlled waters and ecology, magnitude represents the likely impact that an activity would have on resource usability or value at the receptor. Magnitude is therefore affected by the distance and connectivity between the source and the receptor.

11.5.29 Potential effects may be adverse, beneficial or neutral. The magnitude of an impact is assessed qualitatively according to the criteria set out in Table 11-11. These are based on CIRIA 552 'Contaminated Land Risk Assessment, A Guide to Good

Practice' [24]. The following definitions apply to time periods used in the magnitude assessment:

1. Long-term – greater than 15 years
2. Medium-term – between two and 15 years
3. Short-term - between zero and six years

11.5.30 Where the temporal scope deviates from those outlined above, an explanation is included within section 11.8.

Table 11-11 Definition of magnitude of impacts for land quality and ground conditions

Magnitude	Definition
High – permanent or temporary long-term large-scale change affecting usability, risk or value over a wide area, or certain to affect regulatory compliance.	Land quality – human health • Permanent or major change to existing risk exposure (adverse/beneficial). • Unacceptable risks/severe harm to one or more receptors with a long-term or permanent effect (adverse). • Remediation and complete source removal (beneficial).
	Land quality – controlled waters and ecology • Permanent, long-term or wide scale effects on water quality or availability (adverse/beneficial). • Permanent loss or long-term derogation of a water supply source resulting in prosecution (adverse). • Permanent or long-term change in Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WER) water body status/potential or its ability to achieve WER objectives in the future (adverse/beneficial). • Permanent habitat creation or complete loss (adverse/beneficial). • Measurable habitat changes that are sustainable/recoverable over the long-term (adverse/beneficial).
	Built environment • Catastrophic damage to buildings or structures.
	Agricultural land • Permanent or major change to existing ALC Grade as a result of contamination.
Medium – reversible change affecting usability, value, or risk over the medium-term or local area possibly affecting regulatory compliance.	Land quality – human health • Medium-term or moderate change to existing risk of exposure (adverse/beneficial). • Unacceptable risks to one or more receptors with a medium-term effect (adverse).
	Land quality – controlled waters and ecology • Medium-term or local scale effects on water quality or availability (adverse/beneficial). • Medium-term derogation of a water supply source, possibly resulting in prosecution (adverse).

Magnitude	Definition
	• Observable habitat changes that are sustainable/recoverable over the medium-term (adverse/beneficial). • Temporary change in status/potential of a WER water body or its ability to meet objectives (adverse/beneficial).
	Built environment • Damage to buildings or structures.
	Agricultural land • Medium-term temporary or local scale effects on ALC Grade as a result of contamination.
Low – temporary change affecting usability, risk, or value over the short-term or within the study area. Measurable permanent change with minimal effect on usability, risk or value. No effect on regulatory compliance.	Land quality – human health • Short-term temporary or minor change to existing risk exposure (adverse/beneficial). • Unacceptable risks to one or more receptors with a short-term effect (adverse).
	Land quality – controlled waters and ecology • Short-term or very localised effects on water quality or availability (adverse/beneficial). • Short-term derogation of a water supply (adverse). • Measurable permanent effects on a water supply source that do not impact on its operations (adverse). • Observable habitat changes that are sustainable/recoverable over the short-term (adverse/beneficial). • No change in status/potential of a WER water body or its ability to meet objectives (neutral).
	Built environment • Easily repairable damage to buildings or structures.
	Agricultural land • Short-term temporary or very localised effects on ALC Grade as a result of contamination.
Negligible – minor permanent change; or temporary change affecting usability, risk or value that is indiscernible over the medium to long-term. Short-term temporary change with no effect on usability.	Land quality – human health • Negligible change to existing risk exposure. • Activity is unlikely to result in unacceptable risks to receptors (neutral).
	Land quality – controlled waters and ecology • Very minor or intermittent impact on local water quality or availability (adverse/beneficial). • Usability of a water supply source will be unaffected (neutral). • Very slight local changes that have no observable impact on dependent receptors (neutral). • No change in status/potential of a WER water body or its ability to meet objectives (neutral).
	Built environment

Magnitude	Definition
	• Very slight, non-structural damage or cosmetic harm to buildings or structures.
	Agricultural land • Very minor effect on ALC Grade as a result of contamination.

Significance of effect

11.5.31 The assessment of significance of an effect is informed by the sensitivity and value of the receptor and the magnitude of the impact (as described in ES Chapter 5 EIA approach and methodology, Volume I (Document reference 6.1, DCO Volume 6)). The determination of significance is guided by the use of a land quality and ground conditions significance of effect matrix as shown in Table 11-12. Definitions of each level of significance are provided in Table 11-13, these definitions are based on those within Highways England LA 104 guidance [23].

11.5.32 For the purpose of this assessment, any effect that is of major or moderate significance is considered to be significant in EIA terms, whether this be adverse or beneficial. Any effect that has a significance of minor or negligible is not significant.

Table 11-12 Land quality and ground conditions significance of effect matrix

		Adverse magnitude				Beneficial magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 11-13 Definition of effect significance

Significance	Definition
Major	Very large or large change in receptor condition, which is likely to be an important consideration at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Intermediate change in receptor condition, which is likely to be an important consideration at a local level.
Minor	Small change in receptor condition, which may be raised as a local issue but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore, no change in receptor condition.

11.6 Assumptions and limitations

11.6.1 This section provides a description of the assumptions and limitations to the land quality and ground conditions assessment. The results presented in the following sections are based on current design assumptions.

11.6.2 The assessment is based on both desk-based studies (see Table 11-8) and ground investigation reports (see section 11.7). In areas where no ground investigation data is available the assessment has adopted a precautionary approach, i.e. if a potential pollutant linkage has been identified as part of the desk-based study it is assumed to be present until further site-specific information is available to clarify whether the linkage exists.

11.6.3 The assessment presented in this chapter is limited by the finite data on which it is based. There is therefore a level of uncertainty associated with the extrapolation of site-specific data or non-site data to other locations within the Order Limits.

11.6.4 The land quality and ground conditions assessment is based on the assumption that the Pipeline between the WRP site and Otterbourne WSW and AGP could be located anywhere within their respective Limits of Deviation, as outlined in ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6). Therefore, the assessment is based on the worst case location (e.g. the location of PSCs in relation to identified receptors) of the construction working width and other works/permanent infrastructure within the Order Limits, taking into account the defined Limits of Deviation.

11.6.5 Whilst the DCO does not specify a maximum depth of the pipeline or AGP sites, the conclusions within this chapter still represent a worst case assessment on the basis the construction effects from the risks associated with the construction activities are assumed to occur irrespective of the depth of the works.

11.6.6 Due to the proposed operational lifespan of the Proposed Development, a minimum of 100 years, specific decommissioning details are not currently known and the decommissioning of the Proposed Development will be subject to a separate consenting process through which environmental impacts would be assessed and managed. With the exception of the buried pipeline infrastructure, the effects from decommissioning of the Proposed Development are considered to be no greater than those identified during the construction phase and are therefore assessed as being the same as construction effects.

11.7 Baseline conditions

11.7.1 To provide an assessment of the likely significant effects of the Proposed Development (in terms of land quality and ground conditions), it is necessary to identify and understand the baseline conditions in the study area. This provides a reference point against which potential changes in land quality and ground conditions can be assessed.

Current baseline

11.7.2 Baseline information for each of the principal components set out in ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6) is set out below.

Water Recycling Plant site

Preliminary potential source-pathway-receptor

11.7.3 Preliminary potential source-pathway-receptors identified within the Hampshire water transfer and water recycling project geotechnical and geo-environmental desk study (as presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)) are summarised within Table 11-14. The preliminary potential source-pathway-receptors considered within Table 11-14 have not considered those presented within the individual Proposed Development specific ground investigation reports as it utilises the desk-based information only to determine baseline conditions for the WRP site. The refined potential source-pathway-receptors that have been identified following Proposed Development specific ground investigations for the WRP site is presented within Table 11-43.

Table 11-14 Preliminary potential source-pathway-receptors present within the Water Recycling Plant site

Source	Receptor	Pathway	Proposed Development phase
• Harts Farm Way landfill • Made Ground • Former Sewage Works	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts, gases and vapours.	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration though groundwater and underground utilities	• Construction • Operation • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning

Geology

Published mapping

11.7.4 The WRP site is located within areas anticipated to contain localised Made Ground (land that is either artificial or disturbed natural materials) due to historical activities, this is reflected on BGS mapping.

11.7.5 Geological (BGS) mapping also indicates that the WRP site is underlain by superficial deposits. These include:

1. Raised Marine Deposits – located beneath the majority of the WRP site. The deposits comprise of sand and gravel.
2. River Terrace Deposits – located on the northern fringes of the WRP site. The deposits comprise of sand, silt and clay.

11.7.6 Bedrock geology of the Lewes Nodular Chalk Formation underlies the WRP site.

11.7.7 The superficial and bedrock geology of the WRP site is shown on sheet 1 of ES Figure 11.2 Superficial geology of the study area and ES Figure 11.3 Bedrock geology of the study area in Volume III respectively (Document reference 6.3, DCO Volume 6).

Previous ground investigation

11.7.8 Two previous phases of ground investigations have been conducted within an area of historical landfill (Harts Farm Way) located within the Order Limits. These have specifically been undertaken within the footprint of the WRP site and have informed this assessment. Due to the differing history and wastes deposited within the historical Harts Farm Way landfill, the area occupied by the historical landfill has been split into two areas for the purposes of this assessment. These areas are referred to as 'West Cell' and 'East Cell'. The previous phases of ground investigations are as follows:

1. Brockhampton West [36]
2. Geo-Environmental Assessment – Former Brockhampton West Landfill [37]

11.7.9 ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)contains additional information regarding previous ground investigations.

West Cell

11.7.10 A total of 27 exploratory holes were located within an area of the WRP site referred to as the 'West Cell'. Table 11-15 provides a summary of the ground conditions encountered within the West Cell, full details can be found in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents).

Table 11-15 Geology encountered during previous phases of ground investigation within the West Cell

Stratum	Depth to top – metres (m) bgl	Depth to base m bgl	Thickness m	Notes
Cover soils	Ground level	1.30 to 3.50. Typically, between 2.00 and 3.00	1.30 to 3.50	Encountered at all exploratory hole locations.
Landfill waste	1.30 to 3.50	8.20 to 11.50 (where full thickness proven)	4.70 to 9.00 (where full thickness proven)	Encountered at all exploratory hole locations.
Alluvium	8.20 to 10.70	11.10 to 13.00 (where full thickness proven)	0.40 to 3.50 (where full thickness proven)	Encountered at four locations only (RO101, RO107, CP02A and CP04).
River Terrace/Raised Marine Deposits	8.90 to 11.50	11.10 to 13.00 (where full thickness proven)	1.60 to 3.30 (where full thickness proven)	Encountered at four locations only (RO102, RO103, RO108 and CP01).
Lewes Nodular Chalk Formation	11.10 to 13.00	Proven to a maximum depth of 35.00 in CP01 and CP02A	Proven to a maximum thickness of 22.00 in CP01 and CP02A	Encountered at all exploratory holes where full thickness of superficial deposits were proven.

East Cell

11.7.11 A total of 30 exploratory holes were located within an area of the WRP site referred to as the 'East Cell'. Table 11-16 provides a summary of the ground conditions encountered within the East Cell, additional detail can be found in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents).

Table 11-16 Geology encountered during previous phases of ground investigation within the East Cell

Stratum	Depth to top m bgl	Depth to base m bgl	Thickness m	Notes
Cover soils	Ground level	0.90 to >4.00. Typically between 0.90 and 1.50.	0.90 to >4.00. Typically between 0.90 and 1.50.	Encountered at all exploratory hole locations except TP05.
Landfill waste	0.00 to 4.00	8.20 to 16.65 (where full thickness proven)	6.80 to 15.15 (where full thickness proven)	Encountered at all exploratory hole locations.
Alluvium/River Terrace/Raised Marine Deposits	8.20 to 10.70	10.50 to 14.00 (where full thickness proven)	0.90 to 5.80 (where full thickness proven)	Encountered at eight locations (RO104, RO105, RO109, CP03, CP06, DS101, DS102 and DS103).

Stratum	Depth to top m bgl	Depth to base m bgl	Thickness m	Notes
Lewes Nodular Chalk Formation	10.50 to 14.40	Proven to a maximum depth of 35.00 in CP03	Proven to a maximum thickness of 21.00 in CP03	Encountered at all exploratory holes where full thickness of superficial deposits were proven.

Proposed Development specific ground investigation (2023 to 2024)

11.7.12 Additional ground investigations were undertaken at the location of the WRP site as part of the Phase 0 ground investigation (as outlined in section 11.5). A summary of the ground conditions encountered is provided in Table 11-17 (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) for full details).

Table 11-17 Summary of Proposed Development specific ground investigations within the location of the Water Recycling Plant site [38]

Stratum	Depth to top m bgl (elevation m Ordnance Datum (OD))	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Cover soils	Ground level (+13.40 to +8.12	1.20 to 3.17 (+7.27 to +4.95)	1.20 to 3.17	Encountered at all locations.
Landfill waste	1.20 to 3.17 (+7.23 to +4.95)	8.75 to 17.00 (-0.63 to -6.73)	5.58 to 14.00	Encountered at all locations.
Raised Marine Deposits	8.75 to 9.00 (-0.57 to -0.63)	13.30 to 14.80 (-5.18 to -6.37)	4.55 to 5.80	Encountered at two locations (BHW001 and BHW002).
White Chalk Subgroup	13.30 to 17.00 (-5.18 to -6.73)	Proven to a maximum depth of 65.25 (-51.86) at BHRP01	Proven to a maximum thickness of 48.60 at BHRP01	Encountered at all locations.

Hydrogeology

Aquifer designations

11.7.13 The superficial River Terrace Deposits and Alluvium deposits are designated as a Secondary A Aquifer, with the Raised Marine Deposits designated as a Secondary Undifferentiated Aquifer. Due to the proximity of the WRP site to the coast, shallow groundwater within the superficial deposits may be brackish or saline in nature (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

11.7.14 The Lewes Nodular Chalk Formation is designated as a Principal Aquifer. These types of aquifers have high permeability, meaning they usually provide a high level

of water storage and transmission, supporting water supplies and river base flow on a strategic scale.

11.7.15 Although also in close proximity to the coast, the Principal Aquifer is not anticipated to be saline in nature due to the dominant flow paths being from the north of the Order Limits (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

Source Protection Zones

11.7.16 There are no SPZs located within the area of the WRP site (see sheet 1 of ES Figure 11.4 Source Protection Zones located within the study area, Volume III (Document reference 6.3, DCO Volume 6)).

Groundwater abstractions

11.7.17 Karstic springs associated with the chalk bedrock provide a potable water supply with three licensed groundwater abstractions located upgradient approximately 500m north of the WRP site. The licensed abstractions are located within the vicinity of the Pipelines between the WRP site and Bedhampton Springs, as such they are described in Table 11-29.

Previous ground investigations

11.7.18 During the previous phases of ground investigation, groundwater was encountered at eight locations within the 'West Cell' and seven locations within the 'East Cell' of the WRP site. A summary of groundwater strikes is provided in Table 11-18, additional details can be found in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents).

Table 11-18 Groundwater encountered during previous phases of ground investigations within the Water Recycling Plant site

Exploratory hole	Depth of strike during drilling mbgl (elevation m OD)	Rising to level during drilling mbgl – depth (elevation m OD)	Stratum within which the strike was recorded
West Cell			
RO102, TP104	1.00 (+9.04) to 1.80m bgl (+8.19)	No rise noted	Cover soils
RO103, CP04, CP05	5.90 (+3.66) to 7.60 (+3.66)	RO103: No rise noted CP04: 6.15 (+5.37) CP05: 5.50 (+4.06)	Landfill waste*
CP01	11.50 (-0.96)	9.70 (-0.84)	Landfill waste*/River Terrace Deposits
RO102	9.00 (+1.04)	No rise noted	River Terrace Deposits
CP02A	9.60 (+1.19)	8.40 (+2.39)	Alluvium
RO101	11.50 (-0.47)	No rise noted	Chalk
East Cell			

Exploratory hole	Depth of strike during drilling mbgl (elevation m OD)	Rising to level during drilling mbgl – depth (elevation m OD)	Stratum within which the strike was recorded
RO105, TP09, TP112, TP117, TP119, CP03, CP06	2.40 (+7.91) to 4.30 (+8.10)	RO105, TP112, TP117 and TP119: No rise noted CP06: 4.03 (+8.37) TP09: 3.70 (+4.47)	Landfill waste*
RO105	17.00 (-6.61)	No rise noted	Chalk

*water levels recorded within landfill waste may be representative of individual perched bodies of groundwater or landfill leachate.

11.7.19 Continuous groundwater monitoring was conducted during previous phases of ground investigation between March and May 2021. Four monitoring locations were installed into the landfill waste, two within River Terrace Deposits and three within the chalk. The results of the monitoring indicate that groundwater within the location of the WRP site is tidally influenced (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

Proposed Development specific ground investigation (2023 to 2024)

11.7.20 During the Proposed Development specific ground investigation, groundwater strikes were recorded at the locations highlighted in Table 11-19 with a summary of groundwater monitoring results provided in Table 11-20.

Table 11-19 Groundwater encountered during Proposed Development specific ground investigations within the Water Recycling Plant site [38]

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling (m bgl) – depth (elevation m OD)	Stratum within which the strike was recorded
BHRP01, BHRP02, BHW001, BHW002	7.20 (+0.92) to 13.60 (-0.20)	No rise noted	Landfill waste*

*Water levels recorded within landfill waste may be representative of individual perched bodies of groundwater or landfill leachate.

Table 11-20 Groundwater monitoring during Proposed Development specific ground investigations within the Water Recycling Plant site [38]

Exploratory hole	Response zone – depth mbgl (elevation m OD)	Groundwater level range – depth m bgl (elevation m OD)	Stratum
BHRP01	8.50 to 15.00 (+4.90 to -1.60)	10.26 to 10.77 (+3.14 to +2.63)	Landfill waste*
	27.50 to 34.00 (-14.10 to -20.60)	10.78 to 12.09 (+2.62 to +1.31)	
BHRP02	4.00 to 10.00 (+6.27 to +0.27)	7.13 to 7.78 (+3.14 to +2.49)	
	22.50 to 29.00 (-12.23 to -18.73)	7.19 to 9.32 (+3.08 to +0.95)	
BHW001	1.50 to 8.20 (+6.62 to -0.08)	5.80 to 6.62 (+2.32 to +1.50)	Made Ground

Exploratory hole	Response zone – depth mbgl (elevation m OD)	Groundwater level range – depth m bgl (elevation m OD)	Stratum
	14.50 to 21.50 (-6.38 to -13.38)	5.75 to 7.13 (+2.37 to +0.99)	
BHW002	1.50 to 8.10 (+6.93 to +0.33)	6.49 to 6.83 (+1.94 to +1.60)	Landfill waste*
	10.50 to 15.00 (-2.07 to -6.57)	6.34 to 7.30 (+2.09 to +1.13)	

*Water levels recorded within landfill waste may be representative of individual perched bodies of groundwater or landfill leachate.

11.7.21 Interpretation of water levels from across the area of the WRP site suggests that there may be an element of interconnectivity between individual areas of perched groundwater/landfill leachate or that a wider perched groundwater/leachate table is present in this area (see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

11.7.22 ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) also indicates that the groundwater levels recorded within both previous phases, as well as the Proposed Development specific ground investigation, suggest that groundwater bodies below the WRP site are tidally influenced.

Hydrology

Surface water features

11.7.23 The WRP site is located in an area adjacent to the Hermitage Stream, a tidally influenced Main River. A short Ordinary Watercourse (ditch/drain) follows the southern boundary of the WRP site which releases into the Hermitage Stream. See section 19.7 in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) for additional details.

11.7.24 The Hermitage Stream flows into the designated environmentally sensitive areas discussed in the 'Sensitive land uses' section below.

Sensitive land uses

11.7.25 No designated environmentally sensitive areas have been identified at the location of the WRP site. The following designated environmentally sensitive areas have been identified within 250m of the WRP site:

1. Chichester and Langstone Harbours Ramsar Site and SPA
2. Langstone Harbour SSSI and Groundwater Dependent Terrestrial Ecosystem
3. Solent Maritime SAC

11.7.26 Environmentally sensitive areas within the 250m buffer zone of the WRP site are shown on sheet 1 of ES Figure 11.5 Environmentally sensitive areas within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Built environment

11.7.27 The WRP site is bound to the south by Harts Farm Way and to the north and west by the A27 Havant Bypass and to the east by a public footpath (Route number 108/30/1). There are no commercial or residential properties located within the area of the WRP site.

11.7.28 Commercial properties are present within 250m of the WRP site, these buildings are separated from this area of the Order Limits by the Hermitage Stream.

Agricultural land

11.7.29 Land within the WRP site is designated as ALC Grade 1, based on the NE provisional ALC data (see ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6) for additional details). However, due to the historical use of the WRP site as a landfill and based on the geology encountered during previous and Proposed Development specific ground investigations, soils previously considered to represent ALC Grade 1 land are no longer present. This assumption has been confirmed during the Proposed Development ground investigations which identified the presence of non-agricultural land throughout the WRP site.

Potentially contaminative land uses

11.7.30 PSCs located within the area of the WRP site that represent the greatest risk to sensitive receptors are included in Table 11-21 (see also sheet 1 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6)). See Table 5.1 of ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) for additional details.

Table 11-21 Potentially contaminative land uses within the Water Recycling Plant site

Description	Potential contaminants of concern
Landfill waste within the former (now closed and restored) landfill that received domestic, commercial and industrial wastes between 1969 and 1987 before being restored to grassland (on-site and off-site potential source of contamination).	Landfill leachate containing elevated concentrations of inorganic compounds including ammoniacal nitrogen. The landfill waste mass could include a variety of materials, with potential contaminants of concern including asbestos, metals and metalloids, hydrocarbons (total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs), volatile and semi-volatile organic compounds (VOCs and SVOCs), poly- and per-fluoroalkyl substances (PFAS). Whilst there is potential for hydrocarbons present within the fill to migrate via the groundwater to the adjacent surface waters, there is no evidence to date that this is the case (e.g. hydrocarbon plumes have not been recorded) (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

Description	Potential contaminants of concern
	Landfill gases (methane, carbon dioxide, hydrogen sulphide, carbon monoxide, depleted oxygen concentrations).
Made Ground (restoration soils and soils imported to the 'West Cell' in the late 1990s as part of land raising works to create playing fields) (on-site potential source of contamination).	Asbestos, metals and metalloids, TPH and PAHs.
Former sewage works located approximately 50.00m north of the WRP site. Constructed by 1930, demolished by 1972. Comprised four filter beds and a row of tanks (off-site potential source of contamination).	Metals, TPH, PAHs, VOCs, SVOCs, pathogens, phenols, ammonia, asbestos, cyanide, PFAS and ground gas (from infilled former tanks).

11.7.31 Ground investigations (both previous phases and Proposed Development specific) within the location of the WRP site identified the following visual and olfactory evidence of contamination within the landfill waste:

1. Asbestos containing materials (ACM) at one location within the 'East Cell'.
2. A slight hydrocarbon sheen at one location within the 'East Cell'.
3. Occasional black organic staining at five locations within both the 'West Cell' and East Cell'.
4. Putrid, foul or rotten odours throughout the waste.
5. Solvent odours at four locations within the 'East Cell'.
6. Ashy or burnt odours at one location within the 'East Cell'.
7. Hydrocarbon odours at ten locations within both the 'West Cell' and East Cell'.
8. Organic odour at two locations within the 'East Cell'.

11.7.32 Geo-environmental samples were collected during the ground investigations (both previous phases and Proposed Development specific) undertaken in the area of the WRP site. The results of laboratory analysis on soil, soil-leachate, groundwater and surface water samples collected during the ground investigations have been reviewed against the latest screening criteria (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

Potential hazards to human health

11.7.33 In the cover soils, the identified human health hazards are limited to asbestos which was visually observed in one exploratory hole location (RO104, previous phase of ground investigation) and detected in two of the 33 soil samples analysed (TP03 and CP04, both samples obtained from previous ground investigations). The asbestos detected was recorded as both chrysotile and amosite. Quantification was only possible for one sample (CP04 at 0.5m bgl), a result of less than 0.1% was reported (see ES Appendix 11.2 Geotechnical and geo-

environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

11.7.34 Concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene were found to be marginally above the adopted generic assessment criteria (GAC) for a commercial/industrial end use. The exceedances were recorded within one cover soil sample only (collected during a previous phase of ground investigation within the 'East Cell' (TP09, 0.40m bgl)).

11.7.35 Within the landfill waste, the principal risks to human health are associated with the presence of asbestos. Asbestos was recorded within 14 of 50 samples of landfill waste tested as part of both previous phases and Proposed Development specific ground investigations. The asbestos detected was recorded as both chrysotile and amosite. Where quantification was undertaken, a maximum result of less than 0.1% was reported (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

11.7.36 Concentrations of dibenzo(a,h)anthracene were recorded in excess of the GAC for one landfill waste sample only (collected during the Proposed Development specific ground investigation from the 'East Cell' (BHW001, 2.10m bgl)). No additional exceedances of GAC protective of human health were identified within the samples analysed.

11.7.37 No exceedances of the GAC screening criteria were recorded within samples collected from natural soils.

11.7.38 It was noted in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)(that due to the presence of a large proportion of granular material within the cover soils of the 'West Cell', and materials of variable permeability within the cover soils of the 'East Cell', it is unlikely that they are functioning as a typical landfill cap allowing for landfill gases to escape the waste mass and vent to free air.

11.7.39 A ground gas risk assessment has been undertaken based on landfill gas spot and continuous monitoring results (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)). The assessment identified that the boreholes monitored typically exhibited CS2 conditions, with CS3 conditions recorded within four locations. A CS3 classification for the area of the WRP site is considered appropriate and suitably precautionary for the WRP site area (ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)). Ground gas results obtained from monitoring wells that were flooded were not included within the assessment to determine the CS classification [1] for the WRP site.

Potential hazards to controlled waters

11.7.40 Concentrations of metals (copper, iron, nickel, lead, zinc and mercury) and ammoniacal nitrogen were identified as being in excess of their respective environmental quality standard (EQS) for saltwater within groundwater samples collected from shallow superficial deposits and chalk (collected from both previous

phases and Proposed Development specific ground investigation boreholes). Surface water samples collected from the Hermitage Stream at upstream, midstream and downstream locations relative to the WRP site as part of previous phases of ground investigation recorded elevated concentrations of copper, zinc and ammoniacal nitrogen.

11.7.41 Concentrations of ammonia were elevated within the landfill waste and groundwater recovered from superficial deposits and chalk (collected from both previous phases and Proposed Development specific ground investigation boreholes). Surface water samples collected from the Hermitage Stream indicated that it is also impacted by ammonia. There are a number of historical 'dilute and disperse' landfills, including Harts Farm Way landfill, located within the area of and surrounding the WRP site that may be a potential source for the ammonia identified within the stream.

11.7.42 Elevated concentrations of PAHs have been identified within the groundwater samples collected from within the historical landfill (collected from previous ground investigation boreholes). Groundwater samples collected from within the River Terrace Deposits/Raised Marine Deposits recorded elevated concentrations of PAHs within two of the 12 samples analysed (DS101 and DS103, both collected from previous ground investigation boreholes). One out of 38 groundwater samples collected from within the chalk recorded a marginally elevated concentration of PAHs (RO106, collected from previous ground investigation boreholes).

11.7.43 Concentrations of VOCs and SVOCs above the laboratory limit of detection were identified within the groundwater samples collected from the landfill waste (eight samples), Raised Marine Deposits (one sample) and chalk (three samples), all of which were collected from previous ground investigation boreholes.

11.7.44 As discussed previously, the cover soils within the 'West Cell' and 'East Cell' contain a large proportion of granular material/material of variable permeability. As such, there is the potential for precipitation to infiltrate into the waste mass and migrate into underlying groundwater bodies.

11.7.45 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents).

Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Preliminary potential source-pathway-receptor

11.7.46 Preliminary potential source-pathway-receptors identified within the Hampshire water transfer and water recycling project geotechnical and geo-environmental desk study (as presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents) are summarised within Table 11-22. The preliminary potential source-pathway-receptors considered within Table 11-22 have not considered those presented within the individual Proposed Development specific ground investigation reports

as it utilises the desk-based information only to determine baseline conditions for the Pipelines. The refined potential source-pathway-receptors that have been identified following Proposed Development specific ground investigations for the Pipelines is presented within Table 11-44.

Table 11-22 Preliminary potential source-pathway-receptors present along the route of the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Source	Receptor	Pathway	Proposed Development phase
• WTW – Budds Farm with lagoons (sewage sludge) • Landfill - Land south of Budds Farm WTW • Infilled Land – watercourse and marshland	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Operation • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning

Geology

Published mapping

11.7.47 The Pipelines between Budds Farm WTW and the WRP site, which also includes the Budds Farm WTW pumping station, are located within areas anticipated to contain localised Made Ground due to historical activities, this is reflected on BGS mapping.

11.7.48 Geological (BGS) mapping indicates that the Pipelines are underlain by superficial deposits. These include:

1. Beach and Tidal Flat Deposits – located within the central part of the Pipelines. The deposits comprise clay, silt, sand and gravel.

2. Alluvium – located within the south-eastern part of the Pipelines. The deposits comprise clay, silt, sand and gravels.
3. River Terrace Deposits – located in the eastern part of Budds Farm WTW. The deposits comprise sand, silt and clay.
4. Raised Marine Deposits – located within the north-western part of the Pipelines. The deposits comprise sand and gravels.

11.7.49 Bedrock geology of the Lewes Nodular Chalk Formation underlies the route of the Pipelines.

11.7.50 The superficial and bedrock geology of the Pipelines are shown on sheet 1 of ES Figure 11.2 Superficial geology of the study area and ES Figure 11.3 Bedrock geology of the study area in Volume III respectively (Document reference 6.3, DCO Volume 6).

Previous ground investigation

11.7.51 No information in relation to previous phases of ground investigation has been provided for this section of the Proposed Development.

Proposed Development specific ground investigation (2023 to 2024)

11.7.52 There is a degree of crossover between the most southern part of the WRP site and the most northern part of the Pipelines. To avoid duplication, refer to the 'Water Recycling Plant site' section with reference to exploratory holes BHW001 and BHW002.

11.7.53 An additional seven exploratory holes are located within the area of the Pipelines which relate to the Proposed Development specific ground investigation. The exploratory holes relevant to this area of the Order Limits include:

1. BHW003 – BHW005
2. WSW001 – WSW004

11.7.54 Table 11-23 provides an overview of the geology encountered during the Phase 0 Proposed Development specific ground investigation (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 1 of 18 documents)).

Table 11-23 Geology encountered during Proposed Development specific ground investigation for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Topsoil	Ground level (+9.76)	0.02 (+9.56)	0.02	Encountered within BHW003.
Made Ground	Ground level to 2.50 (+9.56 to +3.15)	1.60 to 5.00 (where full thickness proven) (+1.55 to +1.53)	1.60 to 5.00 (where full thickness proven)	Encountered at all exploratory hole locations.

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Landfill waste	1.87 to 2.20 (+3.32 to +7.56)	7.50 to 11.40 (-2.31 to -1.64)	5.63 to 9.20	Encountered within BHW003 and BHW004.
Alluvium	1.60 to 7.50 (+1.55 to -2.31)	3.70 to 8.25 (where full thickness proven) (-0.55 to -3.06)	0.75 to 5.02 (where full thickness proven)	Encountered within BHW004, BHW005, WSW002 and WSW003.
River Terrace Deposits	3.70 (-0.55)	Proven to a maximum depth of 4.45 in WSW003 (-1.30)	Proven to a maximum thickness of 0.75 in WSW003	Encountered within WSW003.
Raised Marine Deposits	11.40 (-1.64)	Proven to a maximum depth of 12.13 in BHW003 (-2.37)	Proven to a maximum thickness of 0.73 in BHW003	Encountered within BHW003.
Chalk	7.20 to 12.13 (-3.78 to -2.37)	Proven to a maximum depth of 45.80 in BHW005 (-42.38)	Proven to a maximum thickness of 38.60 in BHW005	Encountered within BHW003 – BHW005.

Hydrogeology

Aquifer designations

11.7.55 The superficial Alluvium and River Terrace Deposits are designated as Secondary A Aquifers, with the Beach and Tidal Deposits and Raised Marine Deposits designated as Secondary Undifferentiated Aquifers. Due to the proximity of the Pipelines to the coast, shallow groundwater within the superficial deposits may be brackish or saline in nature (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

11.7.56 The Lewes Nodular Chalk Formation is designated as a Principal Aquifer. Although also in proximity to the coast, the Principal Aquifer is not anticipated to be saline in nature due to the dominant flow paths being from the north of the Order Limits (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

Source Protection Zones

11.7.57 There are no SPZs located within the area of the Pipelines (see sheet 1 of ES Figure 11.4 Source Protection Zones located within the study area, Volume III (Document reference 6.3, DCO Volume 6)).

Groundwater abstractions

11.7.58 Licenced groundwater abstractions included within Table 11-29 are also applicable to the study area of the Pipelines.

11.7.59 Information received from HBC in relation to domestic potable abstractions within their administrative area indicates that there is no available data for the area of the Pipelines (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

Previous ground investigations

11.7.60 No information in relation to previous phases of ground investigation has been provided for this section of the Proposed Development.

Proposed Development specific ground investigation (2023 to 2024)

11.7.61 During the Phase 0 Proposed Development specific ground investigation, groundwater was encountered at five locations within the area of the Pipelines. A summary of groundwater strikes is provided in Table 11-24 with a summary of groundwater monitoring results provided in Table 11-25 (for additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 1 of 18 documents)).

Table 11-24 Groundwater encountered during Proposed Development specific ground investigations for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling m bgl – depth (elevation m OD)	Stratum within which the strike was recorded
WSW002	5.80 (+0.73)	5.00 (+1.53)	Alluvium
WSW003	3.10 (+0.05)	2.00 (+1.15m)	Alluvium
BHW003	29.90 (-20.14)	No rise noted	Chalk
BHW004	24.90 (-19.71)	No rise noted	Chalk
BHW005	26.40 (-22.98)	No rise noted	Chalk

Table 11-25 Groundwater monitoring summary during Proposed Development specific ground investigations for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Exploratory hole	Response zone – depth m bgl (elevation m OD)	Groundwater level range – depth m bgl (elevation m OD)	Stratum
BHW003	18.50 to 21.50 (-8.74 to -11.74)	8.25 to 18.20 (+1.51 to -8.44)	Chalk
	23.50 to 30.00 (-13.74 to -20.24)	7.51 to 9.10 (+2.25 to +0.66)	
BHW004	11.70 to 16.70 (-6.51 to -11.51)	3.83 to 5.12 (+1.36 to +0.07)	
	20.00 to 25.00 (-14.81 to -19.81)	3.10 to 5.27 (+2.09 to -0.08)	
BHW005	10.00 to 15.50l (-6.58 to -12.08)	1.93 to 2.36 (+1.49 to +1.06)	

Exploratory hole	Response zone – depth m bgl (elevation m OD)	Groundwater level range – depth m bgl (elevation m OD)	Stratum
	21.00 to 26.50 (-17.58 to -23.08)	1.12 to 2.58 (+2.30 to +0.84)	
WSW001	0.80 to 4.45 (+6.27 to -2.62)	Dry	Made Ground
WSW002	5.20 to 6.45 (+1.33 to +0.08)	4.37 to 4.68 (+2.16 to +1.85)	Alluvium
WSW003	1.80 to 3.50 (+1.35 to -0.70)	0.85 to 1.55 (+2.30 to +1.60)	Alluvium

Hydrology

Surface water features

11.7.62 This part of the Pipeline crosses the Hermitage Stream which, as described previously, is a tidally influenced Main River that drains into designated environmentally sensitive sites. The Pipelines also cross Brockhampton Stream, a Main River which is a tributary of the Hermitage Stream. See section 19.7 in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) for additional details.

Sensitive land uses

11.7.63 Other than those already identified as being in proximity to the WRP site, no additional designated environmentally sensitive sites were identified within the area of the Pipelines (see sheet 1 of ES Figure 11.5 Environmentally sensitive areas within the study area, Volume III (Document reference 6.3, DCO Volume 6)).

Built environment

11.7.64 The Pipelines cross Harts Farm Way as well as the Solent Way footpath and the Wayfarer's Walk footpath before connecting to the existing Budds Farm WTW. An area of public open space and multiple commercial buildings are present within 250m, located to the north and east of the Pipelines and Budds Farm WTW.

Agricultural land

11.7.65 Land within the area of the Pipelines is predominantly mapped as Urban, with a small area of ALC Grade 1 land present in the north-west part of Budds Farm WTW, however Proposed Development specific ground investigation have determined that there is no ALC Grade 1 land within the area of the Pipelines (see ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.2, DCO Volume 6) for additional details).

11.7.66 As discussed within the 'Water Recycling Plant site' above, soils corresponding to ALC Grade 1 land are no longer present as mapped on the NE provisional ALC dataset [35].

Potentially contaminative land uses

11.7.67 Potential sources of contamination within the area of the Pipelines that represent the greatest risk to sensitive receptors are included in Table 11-26 (see also sheet 1 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6)).

Table 11-26 Potentially contaminative land uses along the route of the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Description	Potential contaminants of concern	Exploratory holes advanced to determine presence or absence of source/contaminants of concern
WTW – Budds Farm with lagoons (sewage sludge)	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs, polychlorinated biphenyls (PCBs), pesticides, herbicides, PFAS and pathogens. Landfill gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide)	BHW003, BHW005, WSW001 – WSW004
Landfill - Land south of Budds Farm WTW		
Infilled Land – Watercourse and marshland		BHW004

11.7.68 Ground investigations within the location of the Pipelines identified the following visual and olfactory evidence of contamination:

1. Strong hydrocarbon odour within Made Ground of WSW001 at 3.00 to 3.70m bgl (+4.07 to +3.37m OD).

11.7.69 Slight to strong organic odours were recorded within the Made Ground and Alluvium at three exploratory hole locations (BHW004, BHW005 and WSW003).

11.7.70 Geo-environmental samples were collected during the ground investigation undertaken within the area of the Pipelines. The results of laboratory analysis on soil and groundwater samples collected during the ground investigation have been reviewed against the latest screening criteria (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 1 of 18 documents)).

Potential hazards to human health

11.7.71 No exceedances of the GAC screening criteria were recorded within the five soil samples collected from within the area of the Pipelines. In addition, no asbestos was identified within the samples screened.

11.7.72 Notable concentrations of total cyanide were recorded within a sample of Made Ground collected from WSW002 (0.50m bgl).

11.7.73 Ground gas monitoring was undertaken at six locations (BHW003 – BHW005 and WSW001 – WSW003) as part of the Phase 0 ground investigation (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 1 of 18 documents)). The interpretative report noted that during the monitoring period WSW003 had less than 1.00m between the top of the standpipe and water level on three occasions thereby reducing the volume of ground gas available for analysis. The

interpretative report also noted that BHW005 had a minimum depth of 1.12m on one occasion reducing the reliability of the recorded ground gas concentrations for analysis.

11.7.74 Each of the exploratory holes recorded exceedances of gas thresholds for carbon dioxide. Five of the exploratory holes also recorded exceedances of gas thresholds for VOCs.

Potential hazards to controlled waters

11.7.75 A total of five groundwater samples were collected from within the area of the Pipelines. The results were compared against saltwater EQS GAC. Concentrations of nickel and TPH (C_8 – C_{40}) were identified as being in excess of their respective GAC values within groundwater collected from within the Landfill waste of BHW003. An exceedance of the GAC for mercury was reported within a groundwater sample collected from within the Made Ground of BHW004.

11.7.76 Exceedances of GAC values for metals (cadmium, copper, lead, nickel and zinc), TPH (C_8 – C_{40}), anthracene, fluoranthene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene and ammoniacal nitrogen (as NH_3) were identified within groundwater samples collected from within Alluvium deposits in BHW005, WSW002 and WSW003.

11.7.77 No soil leachate analysis was undertaken for soil samples collected from within the area of the Pipelines.

Pipelines between the Water Recycling Plant site and Bedhampton Springs

Preliminary potential source-pathway-receptor

11.7.78 Preliminary potential source-pathway-receptors identified within the Hampshire water transfer and water recycling project geotechnical and geo-environmental desk study (as presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)) are summarised within Table 11-27. The preliminary potential source-pathway-receptors considered within Table 11-27 have not considered those presented within the individual Proposed Development specific ground investigation reports as it utilises the desk-based information only to determine baseline conditions for the Pipelines. The refined potential source-pathway-receptors that have been identified following Proposed Development specific ground investigations for the Pipelines is presented in Table 11-45.

Table 11-27 Preliminary potential source-pathway-receptors present along the route of the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Source	Receptor	Pathway	Proposed Development phase
• Bedhampton Waterworks • Railway	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts, gases and vapours	• Construction • Operation • Decommissioning

Source	Receptor	Pathway	Proposed Development phase
• Infilled land – Pond, watercourse and drain	• Groundwater	• Leaching through unsaturated and saturated soil	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Operation • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning

Geology

Published mapping

11.7.79 The Pipelines between the WRP site and Bedhampton Springs are located within areas anticipated to contain localised Made Ground due to historical activities.

11.7.80 Geological (BGS) mapping indicates that the Pipelines are underlain by superficial deposits. These include:

1. Raised Marine Deposits – located at the southern end of the Pipelines. The deposits comprise sand and gravels.
2. River Terrace Deposits – located within the central part of the Pipelines. The deposits comprise sand, silt and clay.
3. Alluvium – located within the north-eastern part of the Pipelines. The deposits comprise clay, silt, sand and gravels.

11.7.81 Bedrock geology of the Lewes Nodular Chalk Formation underlies the route of the Pipelines.

11.7.82 The superficial and bedrock geology of the Pipelines are shown on sheet 1 of ES Figure 11.2 Superficial geology of the study area and ES Figure 11.3 Bedrock geology of the study area in Volume III respectively (Document reference 6.3, DCO Volume 6).

Previous ground investigation

11.7.83 There is a degree of crossover between the most southern part of the Pipelines and the WRP site. To avoid duplication, refer to the 'Water Recycling Plant site' section with reference to CPT106, CPT109, TP111, TP116 and RO104 (ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

11.7.84 There are no additional boreholes located within the area of the Pipelines.

Proposed Development specific ground investigation (2023 to 2024)

11.7.85 As with previous phases of ground investigation, there is a degree of crossover with the Proposed Development specific ground investigation (Phase 0) undertaken within the WRP site. To avoid duplication, refer to the 'Water Recycling Plant site' section with reference to BHRP01.

11.7.86 A total of four exploratory holes were located within the site of the Pipelines as part of the Phase 3A ground investigation (ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)).

11.7.87 A summary of the ground conditions encountered is provided in Table 11-28.

Table 11-28 Summary of the Proposed Development specific ground investigations for the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Bedhampton Tunnel Shafts - TPP05-DS, BHP02, BHP05 and BHP06				
Topsoil	Ground level (+3.91)	0.23 (+3.68)	0.23	Encountered at one location (BHP06)
Made Ground	Ground level to 0.23 (+4.23 to +3.91)	0.70 to 0.80 (+3.53 to +3.11)	0.57 to 0.70	Encountered at two locations (BHP06 and TPP05-DS - open undeveloped farmland)
Alluvium	0.60 to 0.70 (+3.29 to +3.53)	4.30 to 5.20* (-0.01 to -0.97*)	3.70 to 4.50*	Encountered at two locations (TPP05-DS and BHP05).
Head Deposits	0.80 (+3.11)	1.50 (+2.41)	0.70	Encountered at one location (BHP06)
River Terrace Deposits	0.25 to 1.50 (+2.41 to +5.11)	3.40 to 6.20 (+1.96 to -2.29)	3.15 to 4.70	Encountered at two locations (BHP02 and BHP06)
White Chalk Subgroup	3.40 to 6.20 (+1.96 to -2.29)	Proven to a maximum depth of 35.20 (-31.29) at BHP06	Proven to a maximum thickness of 29.00 at BHP06	Encountered at three locations (BHP02, BHP05 and BHP06)

*Base of borehole

Hydrogeology

Aquifer designations

11.7.88 The superficial River Terrace Deposits and Alluvium deposits are designated as Secondary A Aquifers, with the Raised Marine Deposits designated as a Secondary Undifferentiated Aquifer. Due to the proximity of the Pipelines to the coast, shallow groundwater within the superficial deposits may be brackish or saline in nature (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

11.7.89 The Lewes Nodular Chalk Formation is designated as a Principal Aquifer. Although also in close proximity to the coast, the Principal Aquifer is not anticipated to be saline in nature due to the dominant flow paths being from the north of the Order Limits (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

Source Protection Zones

11.7.90 The north-eastern part of the Pipelines crosses over, below or through a SPZ 1 (located to the north of Brockhampton and south of Bedhampton). The location of the SPZ is shown on sheet 1 of ES Figure 11.4 Source Protection Zones located within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Groundwater abstractions

11.7.91 As mentioned previously, karstic springs associated with the chalk bedrock provide a potable water supply. Details of the abstractions are provided within Table 11-29. The locations of these abstractions are provided on sheet 1 of ES Figure 11.4 Source Protection Zones located within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Table 11-29 Licenced groundwater abstractions

Licence holder	Licence no.	Use	Point name
Portsmouth Water	11/42/36.2/1	Public Water Supply	Bedhampton PS Spring No 1
Portsmouth Water	11/42/36.2/1	Public Water Supply	Bedhampton PS Spring No 2
Portsmouth Water	11/42/36.2/1	Public Water Supply	Havant PS

11.7.92 Information received from HBC in relation to domestic potable abstractions within their administrative area indicates that there are no available data for the area of the Pipelines. (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

Previous ground investigations

11.7.93 Groundwater monitoring was undertaken at one location within the area of the Pipelines, a summary of groundwater monitoring is provided in Table 11-30, with additional information provided in ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6).

Table 11-30 Groundwater monitoring summary for the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Exploratory hole	Response zone m bgl – depth (elevation m OD)	Groundwater level range – depth m bgl (elevation m OD)	Stratum
RO104	1.50 (+9.38) – 10.00 (+0.88)	8.78 (+1.11) – 9.92 (+2.25)	Landfill waste
	16.00 (-5.12) – 22.00 (-11.12)	8.42 (+1.43) – 8.61 (+1.62)	Chalk

11.7.94 Interpretation of water levels within RO104, specifically the monitoring well installed within the landfill waste, suggests that at this location the groundwater is not tidally influenced (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)).

Proposed Development specific ground investigation (2023 to 2024)

11.7.95 During the Proposed Development specific ground investigation, groundwater strikes were recorded at the locations highlighted in Table 11-31 (additional detail provided in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)).

Table 11-31 Groundwater encountered during Proposed Development specific ground investigations for the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
BHP05	4.70 (-0.41)	3.56 (+0.73)	Chalk
BHP06	1.20 (+2.71)	1.17 (+2.74)	Head Deposits

11.7.96 Groundwater monitoring was undertaken at three locations within the area of the Pipelines; a summary of groundwater monitoring is provided in Table 11-32 (additional detail is provided in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)).

Table 11-32 Groundwater monitoring summary for the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Exploratory hole	Response zone m bgl – depth (elevation m OD)	Groundwater level range – depth m bgl (elevation m OD)	Stratum
BHP02	1.20 to 3.00 (+4.16 to +2.36)	0.74 to 2.26 (+4.62 to +3.10)	River Terrace Deposits
	6.00 to 11.60 (-0.64 to -6.24)	1.24 to 2.68 (+4.12 to +2.68)	Chalk
BHP05	5.00 to 10.60 (-0.71 to -6.31)	0.56 to 1.60 (+3.73 to +2.69)	Chalk
BHP06	7.00 to 12.60 (-3.09 to -8.69)	Artesian groundwater – ground level (+3.91)	Chalk

Hydrology

Surface water features

11.7.97 The Pipelines cross tributary sections of Main Rivers and are bounded to the east by the Hermitage Stream. See section 19.7 in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) for additional details.

Sensitive land uses

11.7.98 No designated environmentally sensitive areas were identified within the location of the Pipelines. The following designated environmentally sensitive areas have been identified within 250m of the Pipelines:

1. Chichester and Langstone Harbours Ramsar Site and SPA
2. Langstone Harbour SSSI and Groundwater Dependent Terrestrial Ecosystem
3. Solent Maritime SAC

11.7.99 Environmentally sensitive areas within the 250m buffer of the Pipelines are shown on sheet 1 of ES Figure 11.5 Environmentally sensitive areas within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Built environment

11.7.100 The route of the Pipelines crosses the A27 Havant Bypass, public footpaths (Route numbers 108/30/1, 108/30/2 and the Wayfarer's Walk) and areas of public open space. A waterworks is located within the north-eastern area of the Pipelines.

11.7.101 These features are also present within 250m of the Pipelines. In addition to the features already described, a railway, Church of St Thomas and residential properties are located within 250m of the Pipelines.

Agricultural land

11.7.102 Land within the area of the Pipelines is predominantly mapped as ALC Grade 1 land within NEs Provisional ALC dataset with an area of urban land present within the north-eastern area of the Pipelines. However, Proposed Development specific ground investigations have identified the presence of non-agricultural land (4.9ha) within the area of the Pipelines (see ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6) for additional details).

11.7.103 An area of grassland at Mill Lane, Bedhampton to the north of the A27 and the WRP site was previously surveyed by the Ministry of Agriculture, Fisheries and Food (MAFF) (see ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6). The survey identified the presence of ALC Grade 3a land, of which 0.7ha is located within the area of the Pipelines.

Potentially contaminative land uses

11.7.104 PSCs located along the route of the Pipelines that represent the greatest risk to sensitive receptors are included in Table 11-33 (see also sheet 1 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6)). See ES Appendix 11.2 Geotechnical and geo-

environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 2 and 12 to 14 of 18 documents).

Table 11-33 Potentially contaminative land uses along the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Description	Potential contaminants of concern
Bedhampton Waterworks	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs, PCBs, pesticides, herbicides, pathogens and PFAS. Potential for methane, carbon dioxide, carbon monoxide, hydrogen sulphide gas.
Railway	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs and PCBs.
Infilled land – Pond, watercourse and drain	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, benzene, toluene, ethylbenzene (BTEX) and phenols. Potential for methane, carbon dioxide, carbon monoxide, hydrogen sulphide gas.

Potential hazards to human health

11.7.105 A total of 17 No. soil samples were collected as part of the Proposed Development specific ground investigation (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)). The samples consisted of six samples of Made Ground and 11 No. from natural ground (Alluvium, River Terrace Deposits and Chalk).

11.7.106 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use. Asbestos was also not identified within the soil samples screened.

11.7.107 There were no notable concentrations that were considered to be elevated compared to other chemical results recorded.

11.7.108 Ground gas monitoring was undertaken at three locations (BHP02, BHP05 and BHP06) as part of the Phase 3A ground investigation (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)). An exceedance of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide was recorded within BHP02. A ground gas risk assessment was not undertaken for this exploratory hole as the monitoring conducted was to assess the risk to construction workers and not ground gas ingress into buildings.

11.7.109 Presently it is not proposed that buildings are constructed along this section of the Pipelines, therefore ground gas risk has not been considered to these structures. If this changes, then a ground gas assessment will be completed to consider potential risks to this receptor.

Potential hazards to controlled waters

11.7.110 A total of six groundwater samples were collected from three locations as part of the Phase 3A ground investigation. The results were compared against EQS,

Drinking Water Standards (DWS) and the withdrawn Water Supply (Water Quality) Regulations (1989) (WQS) (for TPH thresholds due to the absence of a value within The Water Supply (Water Quality) Regulations 2016 (as amended)) GAC. The interpretative report notes that all borehole locations exceeded the 10µg/l withdrawn WQS for petroleum hydrocarbons. Concentrations of copper and zinc were recorded as being in excess of their respective GAC within the Head Deposits of BHP06. Exceedances of manganese and nickel were identified within groundwater collected from within the River Terrace Deposits of BHP06.

11.7.111 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents).

Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Preliminary potential source-pathway-receptor

11.7.112 Preliminary potential source-pathway-receptors identified within the Hampshire water transfer and water recycling project geotechnical and geo-environmental desk study (as presented within ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)) are summarised within Table 11-34. The preliminary potential source-pathway-receptors considered within Table 11-34 have not considered those presented within the individual Proposed Development specific ground investigation reports as it utilises the desk-based information only to determine baseline conditions for the Pipelines. The refined potential source-pathway-receptors that have been identified following Proposed Development specific ground investigations for the Pipelines is presented in Table 11-46.

Table 11-34 Preliminary potential source-pathway-receptors present along the route of the Pipelines between the Water Recycling Plant site and Otterbourne Water Supply Works

Source	Receptor	Pathway	Proposed Development phase
Section D – ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)			
• Harts Farm Way Landfill • Marsh land • Made Ground • Pits (unspecified and chalk) • Military land • Water works (including reservoir, filter beds, filter tanks and unknown tanks (likely to be for filtration purposes)) • Waste facility	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff and migration through groundwater and underground utilities	• Construction • Operation • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning
Section E - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)			
• Pits (unspecified and chalk) • Water works (including reservoir)	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning

Source	Receptor	Pathway	Proposed Development phase
• Kilns • Made Ground/infilled ground • Parchow Groundworks Landfill			
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment (including Break Pressure Tank (BPT)/Intermediate Pumping Station (IPS)-E)	• Gas migration/accumulation	• Construction • Operation • Decommissioning
Section F - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 4 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)			
• Crockerhill Former Brickworks • Albany Farm Historical Landfill • Infilled ground • Pits (unspecified, chalk, gravel and clay)	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through	• Construction • Decommissioning

Source	Receptor	Pathway	Proposed Development phase
		groundwater and underground utilities	
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment (including IPS-F)	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning
Section G - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 5 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)			
• Wickham WTW • Infilled ground • Pits (various) • Motorhome repair garage/garage (vehicle maintenance)	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning

Source	Receptor	Pathway	Proposed Development phase
	• Built environment (including IPS-G)	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning
Section H - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 6 and 15 to 18 of 18 documents)			
• Shirrell Heath Sand Pit Landfill • Infilled land • Pits (sand) • Potential former pig farm	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/ accumulation	• Construction • Operation • Decommissioning
Section J - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 7 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)			

Source	Receptor	Pathway	Proposed Development phase
• Industrial Estate - Woodmans Farm • Ash House Farm Landfill • Rossgarth Landfill • Pit – Sand	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning
Section K - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 8 and 15 to 18 of 18 documents)			
• Infilled land – pond, channels • Worked ground	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation

Source	Receptor	Pathway	Proposed Development phase
			• Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment (including BPT-K)	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning
Section L - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 9 and 15 to 18 of 18 documents)			
• Crowd Hill Landfill • Infilled land	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching through unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of	• Construction • Operation

Source	Receptor	Pathway	Proposed Development phase
		soils/dusts, gases, and vapours by animals	• Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning
Section M – ES Appendix 11.2 Geo-technical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 10 and 15 to 18 of 18 documents)			
• Open agricultural field • Otterbourne WSW • Bugle Farm Landfill • Made Ground	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dusts, gases and vapours	• Construction • Operation • Decommissioning
	• Groundwater	• Leaching though unsaturated and saturated soils	• Construction • Operation • Decommissioning
	• Surface water	• Surface water runoff from stockpiles and migration through groundwater and underground utilities	• Construction • Decommissioning
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals	• Construction • Operation • Decommissioning
	• Built environment	• Direct contact • Gas migration/accumulation	• Construction • Operation • Decommissioning

Geology

Published mapping

11.7.113 The Pipeline between the WRP site and Otterbourne WSW is located within areas anticipated to contain localised Made Ground due to historical activities, this is reflected on BGS mapping.

11.7.114 Geological (BGS) mapping indicates that the Pipeline between the WRP site and Otterbourne WSW is underlain by superficial deposits. These include:

1. Head Deposits – located throughout the route of the Pipeline between the WRP site and Otterbourne WSW. These deposits comprise clay, silt, sand and gravel.
2. River Terrace Deposits – located throughout the route of the Pipeline between the WRP site and Otterbourne WSW. The deposits comprise sand, silt and clay.
3. Alluvium – located throughout the route of the Pipeline between the WRP site and Otterbourne WSW. The deposits comprise clay, silt, sand and gravels.
4. Raised Marine Deposits – located towards the eastern end of the Pipeline between the WRP site and Otterbourne WSW where it would connect to the WRP site. The deposits comprise sand and gravels.
5. Clay with Flints Formation – located in the area surrounding the Otterbourne WSW. The deposits comprise clay, silt, sand and gravel.

11.7.115 Geological (BGS) mapping indicates that the Pipeline between the WRP site and Otterbourne WSW is underlain by the following solid geology:

1. London Clay Formation – comprising clay, silt and sand
2. Lambeth Group – comprising clay, silt and sand
3. Lewes Nodular Chalk – comprising of chalk
4. Spetisbury Chalk Formation – comprising of chalk
5. Newhaven Chalk Formation – comprising of chalk
6. Portsdown Chalk Formation – comprising of chalk
7. Tarrant Chalk Member – comprising of chalk
8. Whitecliff Sand Member – comprising of sand, silt and clay
9. Wittering Formation – comprising of sand, silt and clay
10. Culver Chalk Formation – comprising of chalk
11. Earnley Sand Formation – comprising of sand, silt and clay

11.7.116 The superficial and bedrock geology of the Pipeline between the WRP site and Otterbourne WSW is shown on sheets 1 to 4 of ES Figure 11.2 Superficial geology of the study area and ES Figure 11.3 Bedrock geology of the study area in Volume III respectively (Document reference 6.3, DCO Volume 6).

Previous ground investigation

11.7.117 Due to the length of the Pipeline between the WRP site and Otterbourne WSW, the route between the WRP site and Otterbourne WSW has been divided into sections. These sections are labelled Sections D to M, are illustrated on sheets 1

to 4 of ES Figure 11.1 Land quality and ground conditions study area, Volume III (Document reference 6.3, DCO Volume 6).

11.7.118 A review of previous ground investigations within Sections D to M of the Pipeline between the WRP site and Otterbourne WSW is included in ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)). A summary of the ground conditions encountered during previous ground investigations is provided in Table 11-35, figures illustrating the locations of the boreholes are included within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents).

Table 11-35 Geology encountered during previous phases of ground investigation along the route of Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Stratum	Depth to top m bgl	Depth to base m bgl	Thickness m	Notes
Section D: The Water Recycling Plant site to Portsdown Hill – two exploratory holes on-site (SU60NE7 and SU60NE88), two exploratory holes within 160m (SU60NE90 – 100m north and SU60NE93 – 160m north)				
Topsoil	Ground level	0.30 to 0.38	0.30 to 0.38	Encountered at all exploratory hole locations.
Head Deposits	0.30 to 0.38	1.07 to 4.30	0.69 to 4.00	Encountered in SU60NE7 and SU60NE88.
White Chalk Subgroup (Chalk)	0.38 to 4.30	Proven to a maximum depth of 6.00 in SU60NE7	Proven to a maximum thickness of 1.70 in SU60NE7	Encountered at all exploratory hole locations.
Section E: Portsdown Hill to Boarhunt – one exploratory hole within 250m (SU60NW140 – 250m north)				
Reading Formation (clay, silt and sands)	Ground level	38.50	38.50	N/A
White Chalk Subgroup	38.50	Proven to a maximum depth of 50.00	Proven to a maximum thickness of 11.50	
Section F: Boarhunt to Crockerhill – two exploratory hole locations within 270m (SU50NE203 – 110m north-east and SU50NE204 – 270m north-east)				
Topsoil	Ground level	0.15 to 0.20	0.15 to 0.20	Encountered at all exploratory hole locations.
Head Deposits	0.15	2.80	2.65	Encountered within SU50NE203.
River Terrace Deposits	0.20	4.20	4.00	Encountered within SU50NE204.
White Chalk Subgroup	2.80 to 4.20	Proven to a maximum depth of 7.95 in SU50NE204	Proven to a maximum thickness of 4.65 in SU50NE203	Encountered at all exploratory hole locations.
Section G: Crockerhill to Wickham – one exploratory hole location 370m south-west (SU50NE251)				
Topsoil	Ground level	0.20	0.20	N/A
River Terrace Deposits	0.20	Proven to a maximum depth of 1.60	Proven to a maximum thickness of 1.40	

Stratum	Depth to top m bgl	Depth to base m bgl	Thickness m	Notes
Section H: Wickham to Shedfield – one exploratory hole location 40m north (SU51SE152)				
Topsoil	Ground level	1.00	1.00	N/A
Head Deposits	1.00	3.00	2.00	
London Clay Formation	3.00	75.00	72.00	
Reading Formation	75.00	104.00	29.00	
White Chalk Subgroup	104.00	Proven to a maximum depth of 210.00	Proven to a maximum thickness of 106.00	
Section J: Shedfield to the River Hamble – no exploratory holes within 500m				
Section K: The River Hamble to Lower Upham – one exploratory hole location 110m south-west (SU51NW29)				
Topsoil	Ground level	1.50	1.50	N/A
London Clay Formation	1.50	32.00	30.50	
Reading Formation	32.00	35.00	2.00	
White Chalk Subgroup	35.00	Proven to a maximum depth of 105.00	Proven to a maximum thickness of 70.00	
Section L: Lower Upham to Brambridge – two exploratory hole locations within 150m (SU51NW41 – 65m south-west and SU42SE58 – 150m south-west)				
Topsoil	Ground level	0.00	0.00	Encountered at all exploratory hole locations.
London Clay Formation	0.00	24.80 to 31.00	24.80 to 31.00	
Reading Formation	24.80 to 31.00	36.00 to 55.20	0.20 to 5.00	
White Chalk Subgroup	36.00 to 55.20	Proven to a maximum depth of 83.40 in SU42SE58	Proven to a maximum thickness of 41.30 in SU51NW41	
Section M: Brambridge to Otterbourne Water Supply Works – four exploratory hole locations within 300m (SU42SE29 – 120m north-east, SU42SE184 – 180m north-east, SU42SE30 – 190m north-east and BH-E – 300m east)				
Topsoil	Ground level	0.20 to 0.35	0.20 to 0.35	Encountered within SU42SE29, SU42SE30 and BH-E.

Stratum	Depth to top m bgl	Depth to base m bgl	Thickness m	Notes
Made Ground	Ground level to 0.30	Proven to a maximum depth of 2.00 within BH-E	Proven to a maximum thickness of 1.70 within BH-E	Encountered within SU42SE184 and BH-E.
Alluvium	0.35	1.10	0.75	Encountered within SU42SE30.
Head Deposits	2.00	4.00	2.00	Encountered within BH-E.
River Terrace Deposits	0.20 to 4.00	2.10 to 7.00	1.90 to 3.10	Encountered within SU42SE29, SU42SE30 and BH-E.
London Clay Formation	2.10 to 4.20	Proven to a maximum depth of 10.00	Proven to a maximum thickness of 5.80	Encountered within SU42SE29 and SU42SE30.
White Chalk Subgroup	0.50 to 7.00	Proven to a maximum depth of 20.00 within BH-E	Proven to a maximum thickness of 13.00 within BH-E	Encountered within SU42SE184 and BH-E.

Proposed Development specific ground investigation (2023 to 2024)

11.7.119 Proposed Development specific ground investigations were undertaken along Sections E to M (noting there is no Section I along the route of the Pipeline). The ground investigations were undertaken as Phase 2 and Phase 3B/3C, a summary of the ground conditions encountered is provided in Table 11-36.

11.7.120 Additional ground investigations were also conducted at the locations of the proposed tunnels and shafts to confirm ground conditions at greater depths than those reached as part of the Phase 2 and Phase 3B/3C ground investigations. A summary of the ground conditions encountered at locations within the Pipeline route is included in Table 11-37.

Table 11-36 Geology encountered during Proposed Development specific ground investigation (Phase 2 and Phase 3B/3C) along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Section E: Portsdown Hill to Boarhunt - 3E3100DS, 2E3000RC, 2E3001RC, 2E3002RC, 3E7501IT, 3E7502IT, 3E7503IT, 3E7504IT, 3E7505IT, 3E7506IT, 3E7507IT, 3E7508IT, 3E3101TP, 3E3102TP, 3E3103HP, 3E3104HP, 3E3105HP, 3E3106TP, 3E3107HP, 3E3019DS, 3E3020DS, 3E3021DS, 3E3022HP, 3E3023TP, 3E3108TP, 3E3109HP, 3E3110DS, 3E3111HP, 3E3028HP, 3E3119HP, 3E3112TP, 3E3113HP, 3E3114DS, 3E3115DS, 3E3034HP, 3E3035DS, 3E3036DS and 3E3038HP.				
Topsoil	Ground level (+49.67 to +92.27)	0.20 to 0.60 (+92.01 to +66.04)	0.20 to 0.60	Encountered at all locations with the exception of 3E3034HP, 3E3108TP and 3E3115DS.
Made Ground	Ground level to 0.30 (+61.56 to +63.24)	>4.00* to >6.45* (+59.54* to +55.11*)	3.70* to 6.45*	Encountered at two locations, both within historical chalk pits (3E3023TP and 3E3115DS).
Head Deposits	Ground level to 0.60 (+52.34 to +65.54)	0.55 to >1.60* (+51.24 to +64.94)	0.15 to >1.35	Encountered at 15 locations (3E3019DS, 3E3021DS, 3E3022HP, 3E3034HP, 3E3036DS, 3E3102TP, 3E3103HP, 3E3104HP, 3E3105HP, 3E3106TP, 3E3107HP, 3E3110DS, 3E3111HP, 3E3113HP, 3E3115DS and 3E3119HP).
Lambeth Group	0.60 to 0.80 (+52.82 to +48.47)	>1.20* to >4.00* (+64.16* to +48.47*)	>0.60* to >2.40*	Encountered at four locations (3E3102TP, 3E3103HP, 3E3104HP and 3E3105HP).
White Chalk Subgroup	0.20 to 1.00 (+91.81 to +55.96)	Proven to a maximum depth of 30.85 (+60.72) in 2E3000RC	Proven to a maximum thickness of 30.65 in 2E3000RC	Encountered at all locations with the exception of 3E3022HP, 3E3023TP, 3E3034HP, 3E3102TP, 3E3103HP, 3E3104HP and 3E3105HP.
Section F: Boarhunt to Crockerhill - 2F3500DS, 2F3501DS, 2F3502SA, 2F3503SA, 2F3504DS, 2F3505DS, 2F3512RC, 2F3513DS, 2F3514DS, 2F3515DS, 2F3537DS, 3F3517DS, 3F3519HP, 3F3521HP, 3F3523DR, 3F3524DR, 3F3601HP, 3F3602HP, 3F7509IT, 3F7510IT, 3F7512IT, 3F7513IT, 3W8553DS, 3W8554DS, 3W8556DS, 3W8558SA, 3W8559TP, 3W8563TP and 3W8567SA				
Topsoil	Ground level (+8.52 to +67.40)	0.15 to 0.35 (+31.28 to +37.05)	0.15 to 0.35	Encountered at all locations with the exception of 2F3500DS, 3F3523DR, 3F7513IT, 3W8553DS and 3W8554DS.
Made Ground	Ground level to 0.30 (+56.12 to +36.99)	0.28 to 3.50 (+19.24 to +33.49)	0.28 to 3.20	Encountered at four locations (2F3500DS (historical sand pit), 3F3517DS (open undeveloped farmland), 3F3523DR (open undeveloped farmland) and 3W8558SA (former brickworks)).

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Alluvium	0.20 to 1.50 (+54.62 to +43.65)	0.60 to 3.50 (+5.02 to +43.25)	0.40 to 3.20	Encountered at four locations (2F3500DS, 2F3501DS, 2F3503SA and 2F3537DS).
Head Deposits	Ground level to 0.35 (+22.86 to +21.16)	0.35 to 6.25 (+13.27 to +31.08)	0.10 to 5.97	Encountered at all locations with the exception of 2F3500DS, 2F3501DS, 2F3503SA, 2F3505DS, 2F3537DS, 3F3517DS, 3W8556DS, 3W8558SA and 3W8567SA.
London Clay Formation	2.40 to 3.10 (+33.29 to +47.74)	4.00 to 8.00 (+42.14 to +32.39)	0.90 to 5.60	Encountered at two locations (3W8559TP and 3W8567SA).
Lambeth Group	0.35 to 3.50 (+67.05 to +33.49)	5.45 to 6.70 (+61.95 to +30.29)	3.20 to 5.10	Encountered at two locations (3W8556DS and 3W8558SA)
White Chalk Subgroup	0.30 to 6.70 (+23.17 to +30.29)	Proven to a maximum depth of 30.20 (-10.68 to -8.69) in 3F3523DR and 3F3524DR	Proven to a maximum thickness of 28.65 in 3F3524DR	Encountered at all locations with the exception of 3F3521HP, 3F3601HP, 3F3602HP, 3F7509IT, 3F7510IT, 3W8556DS, 3W8559TP, 3W8563TP and 3W8567SA.
Section G - Crockerhill to Wickham - 3W8560HP, 3W8526HP, 3W8527HP, 3W8528HP, 3W8529SA, 3W8530SA, 3W8531HP, 3W8532HP, 3W8535SA, 3W8536SA, 3W8538HP, 3W8539DS, 3W8534DS, 3G4022DS, 3G4037DS, 3G4038DS, 3G7525IT, 3G7530IT, 3G4105SA, 3G4106SA, 3G4023HP, 3G4024HP, 3G4102SA, 2G4000SA, 2G4001SA, 2G4002DS, 2G4003DS and 2G4004DS				
Topsoil	Ground level (+14.33 to +62.81)	0.05 to 0.50 (+19.24 to +49.20)	0.05 to 0.50	Encountered at all locations with the exception of 2G4002DS, 2G4003DS, 2G4004DS, 3G4022DS, 3G4037DS, 3G4038DS, 3G4105SA, 3W8531HP, 3W8534DS, 3W8536SA and 3W8539DS.
Made Ground	Ground level to 0.05 (+19.24 to +53.14)	0.30 to 2.20 (+18.99 to +50.94)	0.25 to 2.20	Encountered at nine locations (2G4000SA (open undeveloped farmland), 2G4002DS (historical gravel pit), 2G4003DS (historical gravel pit), 2G4004DS (historical gravel pit), 3G4037DS (former garage), 3G4038DS (former garage), 3W8534DS (historical gravel pit), 3W8536SA (WTW) and 3W8539DS (historical gravel pit)).
Alluvium	0.25 (+14.80)	0.70 (+13.63)	0.45	Encountered at one location (2G4001SA).
Head Deposits	Ground level to 0.40 (+35.44 to +45.82)	0.65 to 2.50 (+19.42 to +45.57)	0.25 to 2.20	Encountered at all locations with the exception of 2G4004DS, 3G4023HP, 3G4024DS, 3G7525IT,

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
				3G7530IT, 3W8529SA, 3W8530SA, 3W8534DS, 3W8536SA, 3W8538HP, 3W8539DS and 3W8560HP.
River Terrace Deposits	Ground level to 2.20 (+55.07 to +50.94)	0.45 to 5.60 (+51.29 to +19.96)	0.15 to 5.30	Encountered at 13 locations (2G4004DS, 3G4022DS, 3G4024DS, 3H4600SA, 3G4105SA, 3G4106SA, 3G7525IT, 3G7530IT, 3W8526HP, 3W8534DS, 3W8536SA, 3W8538HP and 3W8539DS).
Earnley Sand Formation	0.30 to 5.60 (+54.55 to +46.96)	1.20 to 27.80 (+53.65 to +23.94)	0.65 to 25.30	Encountered at ten locations (2G4002DS, 2G4003DS, 2G4004DS, 3G4023HP, 3G4024DS, 3G4037DS, 3G4038DS, 3G4105SA, 3G4106SA and 3W8534DS).
Wittering Formation	0.20 to 27.80 (+23.94 to 29.90)	3.00* to 30.45* (+42.45* to +21.29*)	2.65* to 8.30	Encountered at ten locations (2G4002DS, 2G4003DS, 2G4004DS, 3G4102SA, 3H4600SA, 3G4105SA, 3G4106SA, 3W8529SA, 3W8530SA, and 3W8535SA).
London Clay Formation	0.25 to 13.10 (+62.56 to +42.10)	1.20* to 20.45* (+61.60* to +34.75*)	0.40 to 16.85*	Encountered at ten locations (2G4001SA, 3G4102SA, 3H4600SA, 3W8528HP, 3W8529SA, 3W8530SA, 3W8532HP, 3W8535SA, 3W8536SA, and 3W8560HP).
Lambeth Group	2.50 to 10.90 (+16.79 to +4.43)	Proven to a maximum depth of 20.00 (-0.71 to -5.67) at 2G4000SA and 2G4001SA	Proven to a maximum thickness of 17.50 at 2G4000SA	Encountered at two locations (2G4000SA and 2G4001SA).
Section H: Wickham to Shedfield - 3H4600SA, 3H4602HP, 3H4507HP, 3H4511HP, 3H4603HP, 3H4513HP, 3H4514HP, 3H4515HP, 2H4500DR, 2H4501DR, 2H4502DS, 2H4503DS, 3H4606HP and 3H4517SA				
Topsoil	Ground level (+66.16 to +43.12)	0.15 to 0.42 (+59.88 to +65.74)	0.15 to 0.42	Encountered at all locations with the exception of 3H4517SA and 3H4606HP.
Made Ground	Ground level (+54.62 to +58.79)	0.25 to 0.40 (+54.37 to +58.39)	0.25 to 0.40	Encountered at two locations (3H4517SA (adjacent to historical sand pit/worked ground) and 3H4606HP (open undeveloped farmland)).
River Terrace Deposits	0.25 to 0.40 (+54.43 to +53.81)	0.95 to 4.00 (+53.73 to +51.20)	0.70 to 3.65	Encountered at three locations (3H4600SA, 3G4102SA and 3H4602HP).
Head Deposits	0.15 to 0.40 (+59.88 to +42.72)	0.80 to 3.95 (+60.53 to +56.08)	0.55 to 3.80	Encountered at four locations (2H4500DR, 2H4503DS, 3H4513HP and 3H4514HP).

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Wittering Formation	0.25 to 4.00 (+60.70 to +51.20)	1.10 to 13.10 (+53.58 to +42.10)	0.15 to 7.10	Encountered at five locations (3H4507HP, 3H4511HP, 3H4600SA, 3G4102SA and 3H4602HP).
London Clay Formation	0.20 to 13.10 (+42.10 to +50.36)	Proven to a maximum depth of 20.45 (+34.75) at 3G4102SA.	Proven to a maximum thickness of 19.80 at 3J5002SA.	Encountered at all locations with the exception of 3H4507HP, 3H4511HP, 3H4513HP, 3H4514HP and 3H4602HP.
Section J: Shedfield to the River Hamble - 3J5002SA, 3J5003HP, 3J5004DS, 3J5007DS, 3J5012HP, 3J5101HP, 3J5102HP, 3J5013HP, 3J5014TP, 3J5015SA, 3J5016TP, 3J5017HP, 3J5027DS, 3J5028DS, 3J5029HP, 3J5023HP, 3J5024HP, 3J5025HP and 3J5026HP.				
Topsoil	Ground level (+25.34 to +55.27)	0.20 to 0.35 (+50.37 to +24.99)	0.20 to 0.35	Encountered at all locations with the exception of 3J5007DS, 3J5014TP, 3J5015SA, 3J5016TP and 3J5026HP.
Made Ground	Ground level to 0.35 (+54.62 to +25.34)	0.40 to 6.00 (+24.94 to +42.33)	0.40 to 6.00	Encountered at six locations (3J5004DS (Rossgarth Landfill), 3J5007DS (Rossgarth Landfill), 3J5014TP (Ash House Farm Landfill), 3J5015SA (Ash House Farm Landfill), 3J5016TP (Ash House Farm Landfill) and 3J5026HP (open undeveloped farmland)).
Head Deposits	0.30 to 3.60 (+53.72 to +35.79)	0.90 to 6.45* (+50.10 to +32.94*)	0.55 to 3.00*	Encountered at four locations (3J5003HP, 3J5004DS, 3J5007DS and 3J5028DS).
Wittering Formation	0.30 to 0.35 (+53.05 to +54.97)	1.20* to 4.50* (+52.20* to +50.77*)	0.85* to 4.20*	Encountered at two locations (3J5017HP and 3J5027DS).
London Clay Formation	0.20 to 6.00 (+50.37 to +42.33)	Proven to maximum depth of 20.00 (+30.57) at 3J5002SA.	Proven to maximum thickness of 19.80 at 3J5002SA.	Encountered at all locations with the exception of 3J5004DS, 3J5007DS, 3J5017HP and 3J5027DS).
Section K: The River Hamble to Lower Upham - 2K5500SR, 2K5501SR, 2K5502DS, 2K5503DS, 2K5534DS, 2K5535DS, 3K5511DS, 3K5513HP, 3K5515HP, 3K5525DR, 3K5527DR, 3K5529HP, 3K5530HP, 3K5531DS, 3K5604HP, 3K5606SA, 3K5607HP, 3K5608HP, 3K5609HP, 3K5610HP, 3K7541IT, 3K7542IT, 3K7543IT, 3K7544IT, 3K7545IT and 3K7546IT				
Topsoil	Ground level (+17.75 to +72.71)	0.12 to 0.35 (+17.63 to +51.68)	0.12 to 0.30	Encountered at all locations with the exception of 2K5500SR and 3K5511DS.

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Made Ground	Ground level to 0.20 (+36.00 to +66.18	0.55 to 1.60 (+65.83 to +34.40)	0.35 to 1.60	Encountered at four locations (2K5500SR (65m west of areas of infilled land), 2K5502DS (infilled land – pond), 3K5511DS (unspecified worked ground) and 3K7542IT (open undeveloped farmland)).
Alluvium	0.15 to 0.60 (+67.12 to +43.23)	0.70 to 3.00 (+43.11 to 69.19)	0.10 to 2.80	Encountered at 11 locations (2K5502DS, 2K5503DS, 2K5534DS, 2K5535DS, 3K5525DR, 3K5527DR, 3K5606SA, 3K7542IT, 3K7543IT, 3K7545IT and 3K7546IT)
Head Deposits	0.12 to 0.35 (+17.03 to +51.68)	0.70 to 2.00 (+55.32 to +15.75)	0.40 to 1.88	Encountered at eight locations (2K5501SR, 3K5515HP, 3K5529HP, 3K5607HP, 3K5608HP, 3K5610HP, 3K7541IT and 3K7544IT).
River Terrace Deposits	0.70 (+22.46)	4.90 (+18.26)	4.20	Encountered at one location (2K5500SR).
London Clay Formation	0.15 to 4.90 (+18.46 to +44.66)	Proven to a maximum depth of 30.50 (+41.69) in 3K5525DR	Proven to a maximum thickness of 27.50 in 3K5525DR	Encountered at all locations with the exception of 2K5502DS, 2K5503DS, 2K5534DS, 2K5535DS, 3K5529HP and 3K5608HP)
Section L: Lower Upham to Brambridge - 3L6013HP, 3L6100HP, 3L6015HP, 3L6101DS, 3L6102HP, 3L6017HP, 3L6103HP, 3L6104HP, 3L6105HP, 3L6023HP, 3L6024HP, 3L6106DS, 3L6107DS, 3L6027HP, 3L6028HP, 3L6029HP, 2L6000TP, 2L6001TP, 2L6002SA, 2L6003SA, 2L6004TP, 2L6005SA, 2L6006TP, 2L6007DR, 2L6008DR, 2L6009DR, 2L6010DR, 3L6044HP, 3L6045HP, 3L6046HP, 2L6011SR and 2L6012SR.				
Topsoil	Ground level (+20.66 to +56.94)	0.10 to 0.50 (+46.68 to +20.85)	0.10 to 0.50	Encountered at all locations with the exception of 3L6027HP, 3L6045HP, 3L6046HP, 3L6106DS, 3L6107DS, 2L6000TP, 2L6002SA, 2L6004TP, 2L6005SA, 2L6006TP and 2L6009DR.
Made Ground	Ground level (+23.12 to +44.65)	0.15 to 1.00 (+44.50 to +34.54)	0.15 to 1.00	Encountered at 11 locations (3L6027HP (open undeveloped farmland), 3L6045HP (open undeveloped farmland), 3L6046HP (open undeveloped farmland), 3L6106DS (Crowd Hill Landfill), 3L6107DS (Crowd Hill Landfill), 2L6000TP (Crowd Hill Landfill), 2L6002SA (Crowd Hill Landfill), 2L6004TP (Crowd Hill Landfill),

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
				2L6005SA (Crowd Hill Landfill), 2L6006TP (Crowd Hill Landfill) and 2L6009DR (open undeveloped farmland)).
Alluvium	0.20 to 0.40 (+24.82 to +23.18)	1.80 to 3.90 (+23.22 to +19.68)	1.50 to 3.50	Encountered at four locations (2L6007DR, 2L6008DR, 2L6009DR and 2L6010DR).
River Terrace Deposits	0.15 to 0.50 (+20.51 to +20.85)	1.20 to 2.40 (+36.21 to +18.26)	0.77 to 2.25	Encountered at three locations (3L6046HP, 2L6011SR and 2L6012SR).
Head Deposits	0.30 to 1.80 (+23.22 to +37.28)	1.40 to 2.75 (+22.27 to +28.94)	0.95 to 1.50	Encountered at four locations (2L6004TP, 2L6005SA, 2L6006TP and 2L6008DR).
London Clay Formation	0.10 to 3.90 (+48.68 to +19.68)	Proven to a maximum depth of 20.00 (+3.12) at 2L6009DR.	Proven to a maximum thickness of 17.45 at 2L6009DR.	Encountered at all locations with the exception of 3L6046HP and 3L6107DS.
Possible Harwich Formation	12.40 to 15.80 (+8.95 to +9.22)	14.40 to 18.65 (+6.95 to +6.37)	0.25 to 2.85	Encountered at three locations (2L6008DR, 2L6011SR and 2L6012SR).
Lambeth Group	0.35 to 18.65 (+35.65 to +6.37)	Proven to a maximum depth of 20.10 (+4.92) at 2L6008DR.	Proven to a maximum thickness of 5.60 at 2L6010DR.	Encountered at eight locations (3L6101DS, 3L6106DS, 3L6107DS, 2L6007DR, 2L6008DR, 2L6010DR, 2L6011SR, and 2L6012SR).
Section M: Brambridge to Otterbourne Water Supply Works - BH504, TP507, TP508, TP509, 2M6507SA, 2M6508SA, 3M6517HP and 3M6601HP				
Topsoil	Ground level (+24.01 to +26.15)	0.25 to 0.35 (+23.76 to +25.51)	0.25 to 0.35	Encountered at all locations with the exception of TP509 and 3M6517HP.
Made Ground	Ground level (+23.75 to +22.70)	0.36 to 0.48 (+23.39 to +22.22)	0.36 to 0.48	Encountered at two locations (TP509 and 3M6517HP - both open undeveloped farmland).
Alluvium	0.30 to 0.48 (+22.95 to +22.22)	0.65 to 2.55 (+22.05 to +20.70)	0.17 to 2.25	Encountered at two locations (3M6517HP and 2M6508SA).
Head Deposits	0.65 (+22.05)	1.20 (+21.50)	0.55	Encountered at one location (3M6517HP).

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
River Terrace Deposits	0.25 to 2.55 (+25.51 to +20.70)	1.00 to 5.70 (+22.75 to +20.45)	0.64 to 5.40	Encountered at all locations with the exception of 3M6517HP and 3M6601HP.
London Clay Formation	1.00 to 2.89 (+22.75 to +21.12)	4.00* to 30.80 (+19.75* to -6.79)	2.60* to 27.91	Encountered at four locations (BH504, TP507, TP508 and TP509).
Lambeth Group	0.25 to 30.80 (-6.79 to +25.02)	1.20* to 40.30 (+24.05* to -16.29)	0.95* to 9.50	Encountered at three locations (BH504, 3M6601HP and 2M6507SA).
White Chalk Subgroup	4.50 to 40.30 (+18.75 to -16.29)	Proven to a maximum depth of 50.50 (-24.75) in BH504	Proven to a maximum thickness of 15.95 in 2M6508SA	Encountered at three locations (BH504, 2M6507SA and 2M6508SA).

*Base of borehole

Table 11-37 Geology encountered during Proposed Development specific ground investigation (Phase 1 and Phase 3A) within the shafts located along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Portsdown Hill Shaft (located in Section D) – BH301				
Topsoil	Ground level (+64.34)	0.16 (+64.18)	0.16	N/A
Head Deposits	0.16 (+64.18)	0.75 (+63.74)	0.59	N/A
White Chalk Subgroup	0.75 (+63.74)	Proven to a maximum depth of 100.30 (-35.96)	Proven to a maximum thickness of 99.70	N/A
Purbrook Shaft (located in Section D) – TP304, TP305, TP306 and BH303-D				
Topsoil	Ground level (+69.63 to +69.17)	0.12 to 0.50 (+69.51 to +68.67)	0.12 to 0.50	Encountered at two locations (TP304 and BH303-D)
Head Deposits	Ground level to 0.5 (+68.67 to +69.63)	0.20 to 2.90 (+66.27 to +69.43)	0.20 to 2.40	Encountered at three locations (TP305, TP306 and BH303-D)

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
White Chalk Subgroup	0.12 to 2.90 (+66.27 to 69.51)	Proven to a maximum depth of 115.00 (-45.83)	Proven to a maximum thickness of 112.10	Encountered at all locations
Highbridge Shaft (located in Section L) – TP501, TP502, TP503 and BH501				
Topsoil	Ground level (+20.97 to +21.04)	0.20 to 0.40 (+20.77 to +20.54)	0.20 to 0.40	Encountered at three locations (TP502, TP503 and BH501)
Made Ground	Ground level (+21.06)	0.25 (+20.81)	0.25	Encountered at one location (TP501 - open undeveloped farmland)
River Terrace Deposits	0.20 to 0.40 (+20.77 to +20.54)	1.40** to 3.50 (+19.57* to +17.44)	1.35** to 3.10	Encountered at four locations (TP501, TP502, TP503 and BH501)
London Clay Formation	3.50 (+17.44)	42.05 (-21.11)	38.55	Encountered at one location (BH501)
White Chalk Subgroup	42.05 (-21.11)	Proven to a maximum depth of 45.15 (-24.21)	Proven to a maximum thickness of 3.10	Encountered at one location (BH501)
Otterbourne Shafts (located in Section M) –TP504, TP505, TP506, BH502, BH503 and BH506				
Topsoil	Ground level (+20.47 to +17.09)	0.20 to 0.40 (+20.27 to +16.79)	0.20 to 0.40	Encountered at all locations
Made Ground	0.20 (+20.27)	0.70 (+19.77)	0.50	Encountered at one location (TP505 - open undeveloped farmland)
Alluvium	0.20 (+20.09 to 20.26)	1.20 to 2.10 (+19.09 to 18.36)	1.00 to 1.90	Encountered at two locations (TP504 and BH503)
Head Deposits	0.40 (+22.27)	1.00 (+21.67)	0.60	Encountered at one location (BH506).
River Terrace Deposits	0.30 to 1.20 (+16.79 to +19.09)	1.50 to 4.25 (+18.87 to +12.84)	0.30 to 3.95	Encountered at five locations (TP504, TP505, TP506, BH502 and BH506)
London Clay Formation	1.50 to 4.25 (+18.97 to +12.84)	4.00** to 29.75 (+16.47* to elevation not recorded)	2.50** to 27.15	Encountered at all locations

Stratum	Depth to top m bgl (elevation m OD)	Depth to base m bgl (elevation m OD)	Thickness m	Notes
Lambeth Group	28.55 to 29.75 (-8.09 to -7.08)	43.75 to 44.50 (-21.08 to -23.59)	14.00 to 15.95	Encountered at two locations (BH503 and BH506)
White Chalk Subgroup	43.75 to 44.50 (elevation not recorded to -23.59)	Proven to a maximum depth of 55.70 at BH506 (-33.03)	Proven to a maximum thickness of 11.95 at BH506	Encountered at two locations (BH503 and BH506)

*To avoid duplication, only those exploratory holes not discussed in Table 11-36 have been included in Table 11-37.
**Base of exploratory hole.

Hydrogeology

Aquifer designations

11.7.121 The superficial Alluvium and River Terrace Deposits are designated as Secondary A Aquifers, with the Head Deposits, Clay with Flints Formation and Raised Marine Deposits designated as unproductive strata. As with other locations within the Order Limits, due to the proximity of Section D of the Pipeline between the WRP site and Otterbourne WSW to the coast, shallow groundwater within the superficial deposits may be brackish or saline in nature (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

11.7.122 Bedrock geology of the Culver Chalk Formation, Portsdown Chalk Formation, Spetisbury Chalk Member, Tarrant Chalk Member, Newhaven Chalk Formation and Lewes Nodular Chalk Formation are designated as Principal Aquifers. The Earnley Sand Formation, Wittering Formation, Whitecliff Sand Member and Lambeth Group are designated as Secondary A Aquifers. The London Clay Formation is designated as unproductive strata.

11.7.123 Although part of the Pipeline between the WRP site and Otterbourne WSW is located in proximity to the coast before heading inland, the Principal Aquifers associated with the bedrock are not anticipated to be saline in nature due to the dominant flow paths being from the north of the Order Limits (see ES Appendix 19.3 Hydrogeological Impact Assessment, Volume II (Document reference 6.2, DCO Volume 6)).

Source Protection Zones

11.7.124 The route of the Pipeline between the WRP site and Otterbourne WSW crosses over, below or through one SPZ 1, two SPZ 1C, two SPZ 2, three SPZ 2C and two SPZ 3. The locations of the SPZs in relation to the Pipeline between the WRP site and Otterbourne WSW are shown on sheets 1 to 4 of ES Figure 11.4 Source Protection Zones located within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Groundwater abstractions

11.7.125 Table 11-38 provides details of potable groundwater abstractions located within 500m of the Pipeline between the WRP site and Otterbourne WSW with additional information provided within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents). The locations of these abstractions are provided on sheets 1 to 4 of ES Figure 11.4 Source Protection Zones located within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Table 11-38 Licenced potable groundwater abstractions

Licence holder	Distance and direction from Order Limits	Use
Section K: The River Hamble to Lower Upham		
Portsmouth Water	600m south-west	Potable
Section M: Brambridge to Otterbourne Water Supply Works		
Southern Water	180m south-west	Potable and top up water
	220m east	Potable and top up water
	270m west	Potable and top up water

Previous ground investigations

11.7.126 During previous phases of ground investigation groundwater strikes were recorded at the locations highlighted in Table 11-39.

Table 11-39 Groundwater encountered during previous phases of ground investigations along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
Section D: The Water Recycling Plant site to Portsdown Hill			
SU60NE7	5.32 (+0.58)	No rise noted	White Chalk Subgroup.
Section E: Portsdown Hill to Boarhunt			
SU60NW140	38.50 (-1.00)	No rise noted	Boundary of Reading Formation and White Chalk Subgroup.
Section F: Boarhunt to Crockerhill			
SU50NE203	6.00 (+1.13)	4.80(+2.33)	White Chalk Subgroup.
SU50NE204	5.50 (+2.10)	5.35 (+2.25)	
Section H: Wickham to Shedfield			
SU51SE152	25.00 (+27.69)	No rise noted	White Chalk Subgroup.
Section K: The River Hamble to Lower Upham			
SU51NW29*	11.00* (+34.00*)	No rise noted	White Chalk Subgroup.
Section L: Lower Upham to Brambridge			
SU51NW41	10.50 (+39.50)	No rise noted	London Clay Formation
SU42SE58	24.00 (+12.60)		Reading Formation

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
Section M: Brambridge to Otterbourne Water Supply Works			
SU42SE29	10.00 (+18.50)	No rise noted	London Clay Formation
BH-E	5.30 (+16.88)	No rise noted	River Terrace Deposits.

*Weak artesian pressure was encountered at 80.00 – 90.00 m bgl. Casing was grouted to 75.50 m as a precaution. 11.00 m bgl is the resting groundwater level.

Proposed Development specific ground investigation (2023 to 2024)

11.7.127 During the Proposed Development specific ground investigation groundwater strikes were recorded at the locations highlighted in Table 11-40 (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)).

Table 11-40 Groundwater encountered during Proposed Development specific ground investigation along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
Purbrook Shaft and Tunnel (located in Section D)			
BH202	10.50 (+3.48)	No rise noted	White Chalk Subgroup
BH303-D	42.80 (+26.37)	No rise noted	White Chalk Subgroup
Portsdown Hill Shaft (located in Section D)			
Not encountered.			
Section E: Portsdown Hill to Boarhunt			
Not encountered.			
Section F: Boarhunt to Crockerhill			
2F3503SA	3.43 (+5.09)	No rise noted	Alluvium
3W8556DS	Seepage at 1.20 (+66.20)	N/A	Lambeth Group
2F3502SA	Damp at 6.00 (+3.12)	No rise noted	Chalk
3W8554DS	Damp at 6.45 (+16.41)	No rise noted	Chalk
Section G: Crockerhill to Wickham			
2G4002DS	1.10 (+44.32)	0.80 (+33.62)	Earnley Sand Formation
2G4003DS	1.10 (+45.12	0.80 (+45.42)	Earnley Sand Formation
2G4004DS	1.10 (+44.35)	No rise noted	Earnley Sand Formation
3G4024DS	Seepage at 1.10 (+54.72)	No rise noted	River Terrace Deposits
3G4037DS	Seepage at 6.00 (+46.96)	No rise noted	Earnley Sand Formation
3G4105SA	0.50 (+51.24)	No rise noted	River Terrace Deposits
	10.55 (+41.19)	8.36 (+43.19)	Earnley Sand Formation

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
3W8529SA	6.00 (+24.10)	2.57 (+27.53)	Wittering Formation
	8.80 (+21.30)	4.11 (+25.99)	Wittering Formation
3W8535SA	4.50 (+17.42)	1.95 (+19.97)	Wittering Formation
3W8536SA	17.00 (+6.65)	9.52 (+14.13)	London Clay Formation
Section H: Wickham to Shedfield			
2H4503DS	3.10 (+56.93)	No rise noted	Head Deposits
3H4600SA	3.00 (+51.21)	No rise noted	Wittering Formation
2H4501DR	Seepage at 0.60 (+65.56)	N/A	London Clay Formation
3H4517SA	11.20 (+43.42)	No rise noted	London Clay Formation
Section J: Shedfield to the River Hamble			
3J5004DS	1.20 (+39.63)	No rise noted	Made Ground
3J5014TP	Seepage at 2.80 (+44.40)	N/A	Made Ground
3J5016TP	Seepage at 3.60 (+43.17	N/A	Made Ground
3J5028DS	Slight seepage at 1.00 (+53.02)	N/A	Head Deposits
3J5027DS	1.20 (+54.07)	No rise noted	Wittering Formation
3J5002SA	17.70 (+32.86)	No rise noted	London Clay Formation
Section K: The River Hamble to Lower Upham			
2K5502DS	0.70 (+43.13)	0.50 (+43.33)	Made Ground/Alluvium
2K5503DS	0.90 (+42.83)	0.80 (+42.93)	Alluvium
2K5535DS	0.70 (+43.28)	0.50 (+43.49)	
3K5608HP	0.90 (+51.13)	No rise noted	Head Deposits

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
3K5515HP	0.70 (+55.32)	No rise noted	Head Deposits/London Clay Formation
3K5513HP	1.20 (+47.99)	No rise noted	London Clay Formation
3K5529HP	1.20 (+50.98)	No rise noted	London Clay Formation
2K5500SR	6.10 (+17.05)	6.30 (+16.86)	London Clay Formation
Section L: Lower Upham to Brambridge			
3L6024HP 3L6024HP-A	0.20 (+36.76)	No rise noted	Topsoil
2L6008DR	1.00 (+24.02)	No rise noted	Alluvium
2L6009DR	0.60 (+22.52)	Dropping to 0.64 (+22.56)	Alluvium
2L6010DR	0.58 (+23.00)	No rise noted	Alluvium
2L6012SR	1.20 (+19.46)	Rising to 1.09 (+19.57)	River Terrace Deposits
2L6006TP	Slow seepage at 2.40 (+27.94)	N/A	London Clay Formation
3L6100HP	0.60 (+56.34) and 1.20 (+55.74)	No rise noted	London Clay Formation
3L6103HP	1.10 (+42.19)	No rise noted	London Clay Formation
Highbridge Shaft (located in Section L)			
BH501	21.75 (-0.81)	21.80 (-0.86)	Lambeth Group
Section M - Brambridge to Otterbourne Water Supply Works			
BH504	2.70 (+21.31)	No rise noted	River Terrace Deposits
2M6507SA	3.00 (+23.15)	1.89 (+24.26)	River Terrace Deposits, Lambeth Group and White Chalk Subgroup
	14.00 (+12.15)	13.17 (+12.98)	
	15.00 (+11.15)	3.34 (+22.81)	

Exploratory hole	Depth of strike during drilling m bgl (elevation m OD)	Rising to level during drilling – depth m bgl (elevation m OD)	Stratum within which the strike was recorded
2M6508SA	2.80 (+20.45)	1.70 (+21.55)	River Terrace Deposits
	6.00 (+17.25)	4.97 (+18.28)	White Chalk Subgroup
Otterbourne Shafts and Tunnel (located in Section M)			
BH502	0.40 (+16.69)	Remained at 0.40 (+16.69)	River Terrace Deposits
BH503	1.00 (+19.46)	0.75 (+19.71)	River Terrace Deposits
BH504	Seepage at 2.7 (+21.31)	N/A	River Terrace Deposits
BH505	0.60 and 14.00 (+16.41 and +3.01)	0.32 and 1.70 (+16.69 and +15.31)	River Terrace Deposits
BH506	Slow seepage at 0.60 (+22.07)	N/A	Head Deposits
BH507-D	10.00 (+9.49)	3.07 (+16.42)	London Clay Formation
TP504	Very slow seepage at 1.20 (+19.09)	N/A	Alluvium
TP505	Very slow seepage at 1.30 (+19.17)	N/A	River Terrace Deposits
TP506	Slow seepage at 1.35 (+19.12)	N/A	River Terrace Deposits

Hydrology

Surface water features

11.7.128 There are numerous surface water features located within the footprint of the Pipeline between the WRP site and Otterbourne WSW. The Main Rivers include:

1. Hermitage Stream
2. Potwell Tributary
3. Wallington River
4. River Meon
5. River Hamble
6. Horton Heath Stream
7. Bow Lake
8. River Itchen

11.7.129 For additional details on the Main Rivers located within the footprint of the Pipeline between the WRP site and Otterbourne WSW see section 19.7 in ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6).

Sensitive land uses

11.7.130 Sections of the River Itchen SSSI and SAC bisect the route of the Pipeline between the WRP site and Otterbourne WSW. Several designated environmentally sensitive areas have been identified within the 250m buffer of the Pipeline between the WRP site and Otterbourne WSW:

1. Chichester and Langstone Harbours Ramsar site and SPA
2. Langstone Harbour SSSI and Groundwater Dependent Terrestrial Ecosystem
3. Solent Maritime SAC
4. Portsdown SSSI
5. Hook Heath Meadows SSSI
6. Botley Wood and Everett's and Mushes Copses SSSI

11.7.131 Environmentally sensitive areas within the 250m buffer of the Pipeline between the WRP site and Otterbourne WSW are shown on sheets 1-4 of ES Figure 11.5 Environmentally sensitive areas within the study area, Volume III (Document reference 6.3, DCO Volume 6).

Built environment

11.7.132 The route of the Pipeline between the WRP site and Otterbourne WSW crosses multiple residential and commercial areas, highways, railway lines, public footpaths (The Solent Way footpath, Wayfarer's Walk footpath and 33 numbered routes), public open spaces, a waterworks (with a covered reservoir), Trullingham Equestrian Centre, Wickham Park Golf Club and other leisure facilities. The Pipeline also passes beneath Peacock Preschool at a minimum depth of 11.00m bgl.

11.7.133 These features are also present within 250m of the Pipeline between the WRP site and Otterbourne WSW. In addition to the features already described, Portsmouth Golf Course, preschools and primary schools, multiple places of worship, reservoirs, allotments, community and family centres are located within 250m of the Pipeline between the WRP site and Otterbourne WSW. There are also four scheduled monuments located within 250m of Sections D, L and M of the Pipeline between the WRP site and Otterbourne WSW, these include:

1. Bevis's Grave long barrow and early medieval cemetery, 100m west of Belmont Castle – Section D of the Pipeline between the WRP site and Otterbourne WSW.
2. Fort Purbrook, including covered-way to the east – Section D of the Pipeline between the WRP site and Otterbourne WSW.
3. Park Pale at Marwell Manor, south of Fisher's Pond – Section L of the Pipeline between the WRP site and Otterbourne WSW.
4. Moated site at Otterbourne Manor – Section M of the Pipeline between the WRP site and Otterbourne WSW.

Agricultural land

11.7.134 Overall, the NE Provisional ALC dataset indicates that the route of the Pipeline between the WRP site and Otterbourne WSW is dominated by both ALC Grade 3 or Grade 4 (see ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6) for additional details) with the following Provisional ALC Grades present within each section of the Pipeline between the WRP site and Otterbourne WSW:

1. Section D – ALC Grade 1 is present at the eastern edge of Section D (located adjacent to the WRP site) with Grade 3 and Urban land present along the remainder of the section in approximately equal proportions.
2. Section E – ALC Grade 3 is the predominant ALC Grade within Section E. An area of ALC Grade 2 land is present at the western end of the section.
3. Section F – ALC Grade 2 is the predominant ALC Grade within Section F. An area of ALC Grade 2 is present at the northern end of the section.
4. Section G – ALC Grade 3 is present throughout Section G.
5. Section H – ALC Grade 2 is the predominant ALC Grade within Section H. An area of ALC Grade 3 is present at the southern end of the section.
6. Section J – ALC Grades 2, 3 and 4 are present in approximately equal proportions in Section J.
7. Section K – ALC Grades 3 and 4 are the predominant ALC Grade present within the section. An area of ALC Grade 1 is present at the southern end of the section.
8. Section L – ALC Grade 4 is the predominant ALC Grade within Section L with areas of ALC Grade 3 land also present along the route of Section L.
9. Section M – ALC Grade 3 is the predominant ALC Grade within Section M with an area of ALC Grade 4 land also present within the south-eastern area of the section.

11.7.135 It is noted that the route of the Pipeline between the WRP site and Otterbourne WSW crosses areas of agricultural land outside of those developed areas discussed within the 'Built environment' section above.

11.7.136 A review of Proposed Development specific ground investigation data has been undertaken in the context of ALC guidelines in areas where temporary infrastructure and short-term use of agricultural land has been undertaken (see ES Appendix 12.1 Agricultural Land Quality (Document Reference 6.2, Volume 6). For areas of the Proposed Development that would require longer-term use, detailed surveys have been undertaken (e.g. in areas of AGP).

11.7.137 Proposed Development specific ground investigations identified the following ALC Grades within the areas of temporary infrastructure/short-term use of agricultural land along the route of the Pipeline between the WRP site and Otterbourne WSW:

1. Section D – ALC Grade 2 (6.4ha), Grade 3a (1.0ha) and non-agricultural land (35.9ha).
2. Section E – ALC Grade 1 (5.8ha), Grade 2 (23.9ha) Grade 3a (17.2ha), Grade 3b (6.3ha) and non-agricultural land (2.3ha).
3. Section F – ALC Grade 2 (9.0ha), Grade 3b (18.2ha) and Grade 4 (0.1ha).
4. Section G – ALC Grade 1 (1.4ha), Grade 2 (1.5ha), Grade 3a (7.7ha), Grade 3b (4.1ha), Grade 4 (1.3ha) and non-agricultural land (29.4ha).
5. Section H – ALC Grade 2 (4.8ha), Grade 3a (3.2ha), Grade 3b (7.3ha) and non-agricultural land (1.0ha).
6. Section J – ALC Grade 1 (2.3ha), Grade 3a (13.7ha), Grade 3b (13.1ha) and non-agricultural land (0.8ha).
7. Section K – ALC Grade 3b (24.9ha), Grade 4 (11.8ha) and non-agricultural land (2.2ha).
8. Section L – ALC Grade 3a (1.9ha), Grade 4 (40.3ha) and non-agricultural land (2.7ha).
9. Section M – ALC Grade 3a (8.0ha), Grade 3b (2.6ha) and non-agricultural land (9.7ha).

11.7.138 In the areas where AGP will be located, the following ALC Grades have been identified:

1. BPT/IPS-E – ALC Grade 2 and 3a
2. IPS-F – ALC Grade 3a and 3b
3. IPS-G – ALC Grade 3a
4. BPT-K – ALC Grade 4

Potentially contaminative land uses

11.7.139 The interpretative reports (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 to 5 and 7 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)) highlighted that there are PSCs along the route of the Pipeline between the WRP site and Otterbourne WSW that represent moderate/low and

higher potential risks to the Proposed Development within and outside of the Order Limits. A summary of the PSCs identified are included within Table 11-41.

Table 11-41 Potentially contaminative land uses along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Description	Potential contaminants of concern	Exploratory holes advanced to determine presence or absence of source/contaminants of concern
Section D (see also sheets 1 and 2 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents))		
Water works	Potential carbon dioxide, reduced oxygen concentration and chlorine gas	BH301
Agricultural field (based on findings of Proposed Development specific ground investigation)	Potential methane, carbon dioxide, carbon monoxide, hydrogen sulphide and chlorine gas	BH303-D, TP304, TP305 and TP306
Section E (see also sheets 1 and 2 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents))		
Pits (unspecified and chalk), water works (including reservoir) and kilns – potential for Made Ground/infill of unknown material and ground gas generation (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, benzene, toluene, ethylbenzene, and xylene (BTEX) and phenols. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	2E3000RC, 2E3002RC, 3E3020DS, 3E3021DS, 3E3036DS, 3E3102TP, 3E3106TP, 3E3110DS, 3E3114DS, 3E3115DS, 3E3035DS, 3E3023TP, 3E3108TP, 3E3019DS and 3E3112TP.
Parchow Groundworks (off-site potential source of contamination).	Petroleum hydrocarbons, VOCs, metals, PAHs and asbestos	2E3001RC and 3E3101TP.

Description	Potential contaminants of concern	Exploratory holes advanced to determine presence or absence of source/contaminants of concern
Landfill (on-site potential source of contamination).	Petroleum hydrocarbons, metals, inorganics (sulphate, sulphide, cyanide, etc) and asbestos. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	3E3100DS.
Section F (see also sheet 2 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 4 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents))		
Crockerhill Former Brickworks (on-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs and PCBs. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	3W8558SA.
Albany Farm Historical Landfill (off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs, PCBs, pesticides, herbicides and PFAS. Landfill gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide).	2F3504DS and 2F3505DS.
Potentially Infilled Ground – Pits (sand, chalk and clay) (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, BTEX and phenols. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	2F3500DS, 2F3501DS, 3W8553DS, 3W8554DS, 3W8559TP, 3W8563TP and 3W8567SA.
Section G (see also sheets 2 and 3 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 5 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents))		
WTW (off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, phenols, PCBs, PFAS and pathogens.	3W8536SA.

Description	Potential contaminants of concern	Exploratory holes advanced to determine presence or absence of source/contaminants of concern
	Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	
Potentially infilled ground (gravel pits) (off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, BTEX and phenols. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	2G4002DS, 2G4003DS and 2G4004DS.
Pits – various (off-site potential source of contamination).		3W8534DS and 3W8539DS.
Garage (on-site potential source of contamination).	Metals, asbestos, petroleum hydrocarbons, PAHs, VOCs and phenols.	3G4038DS.
Section H (see also sheet 3 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 6 and 15 to 18 of 18 documents))		
Shirrell Heath Sand Pit Landfill – potential for Made Ground/infill of unknown material and ground gas generation (off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs, PCBs, pesticides, herbicides and PFAS. Landfill ground gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide).	2H4502DS, 2H4503DS and 3H4606HP
Potential former pig farm (on-site potential source of contamination).	Metals, parasites, pathogens and pesticides/herbicides.	3H4507HP
Section J (see also sheet 3 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 7 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents))		

Description	Potential contaminants of concern	Exploratory holes advanced to determine presence or absence of source/contaminants of concern
Industrial Estate - Woodmans Farm (off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAH, VOC, total phenols, pesticides and herbicides.	3J5028DS
Ash House Farm Landfill (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAH, VOC, SVOC, PCB, pesticides, herbicides and PFAS. Landfill gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide).	3J5014TP, 3J5015SA and 3J5016TP
Pit – Sand (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAH, BTEX and total phenols. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	3J5002SA
Rossgarth Landfill (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAH, VOC, SVOC, PCB, pesticides, herbicides and PFAS. Landfill gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide).	3J5004DS and 3J5007DS
Section K (see also sheets 3 and 4 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 8 and 15 to 18 of 18 documents))		
Infilled land – pond, channels (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, BTEX and phenols. Potential methane, carbon dioxide, carbon monoxide and hydrogen sulphide gas.	2K5500SR, 2K55001SR, 2K5502DS, 2K5503DS, 2K5534DS and 2K5535DS.
Worked ground (on-site and off-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, BTEX and phenols.	3K5511DS

Description	Potential contaminants of concern	Exploratory holes advanced to determine presence or absence of source/contaminants of concern
Section L (see also sheet 4 of ES Figure 11.6 Potential sources of contamination within the study area, Volume III (Document reference 6.3, DCO Volume 6) and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 9 and 15 to 18 of 18 documents))		
Crowd Hill Landfill (two locations) and BGS Made Ground (on-site potential source of contamination).	Metals, inorganics, asbestos, petroleum hydrocarbons, PAHs, VOCs, SVOCs, PCBs, pesticides, herbicides and PFAS. Landfill ground gas (methane, carbon dioxide, carbon monoxide and hydrogen sulphide).	2L6002SA, 2L6003SA, 2L6005SA, 2L6000TP, 2L6001TP, 2L6004TP, 2L600TP, 3L6106DS and 3L6107DS.
Section M (see also ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 10 and 15 to 18 of 18 documents))		
No PSCs were identified within Section M.		

11.7.140 The Proposed Development specific ground investigations identified visual and olfactory evidence of contamination, which is summarised in Table 11-42 (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)).

Table 11-42 Visual and olfactory evidence of contamination encountered during the Proposed Development specific ground investigation along the route of the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Exploratory hole	Visual/olfactory contamination
Section D: Portsdown Hill and Purbrook Shafts	
The Proposed Development specific ground investigation within Section D did not encounter any visual or olfactory evidence of contamination.	
Section E: Portsdown Hill to Boarhunt	
3E3023TP	Slight hydrocarbon odour within the Made Ground at depths between 0.70 and 1.00m bgl. The borehole was located within an area of potentially infilled land (chalk pit).
3E3115DS	Slight organic odour within the Made Ground at depths between 3.50 and 3.80m bgl. The borehole was located within an area of potentially infilled land (chalk pit)
Section F: Boarhunt to Crockerhill	
The Proposed Development specific ground investigation within Section F did not encounter any visual or olfactory evidence of contamination.	
Section G: Crockerhill to Wickham	
3W8539DS	Slight hydrocarbon odour within the Made Ground at depths between 0.75 and 0.85m bgl. The borehole was located within an area of potentially infilled land (pit).
Section H: Wickham to Shedfield	
The Proposed Development specific ground investigation within Section H did not encounter any visual or olfactory evidence of contamination.	
Section J: Shedfield to the River Hamble	
3J5004DS	Strong organic odour within topsoil at depths between ground level and 0.05m bgl, with black friable material with an organic odour encountered within the Made Ground at depths between 0.60 and 0.70m bgl. The borehole was located within the Rossgarth Landfill.

Exploratory hole	Visual/olfactory contamination
3J5014TP	Moderate organic odour within the Made Ground at a depth of 2.50m bgl. The borehole was located within Ash House Farm Landfill.
3J5016TP	Visual contamination within the Made Ground of ash and clinker at depths between 1.40 and 3.30m bgl. A moderate malodour was also recorded at these depths. The borehole was located within Ash House Farm Landfill.
Section K: The River Hamble to Lower Upham	
The Proposed Development specific ground investigation within Section K did not encounter any visual or olfactory evidence of contamination.	
Section L: Lower Upham to Brambridge	
2L6002SA	Possible ACM and possible asbestos fragments between ground level and 0.20m bgl within Made Ground.
Section M: Brambridge to Otterbourne Water Supply Works (Otterbourne Shafts)	
BH502	Slight hydrocarbon odour at 0.30 to 0.55m bgl within River Terrace Deposits.

Potential hazards to human health

Section E: Portsdown Hill to Boarhunt

11.7.141 A total of nine soil samples were collected as part of the Phase 2 ground investigation (three topsoil and six chalk) and 53 No. soil samples as part of the Phase 3B/3C ground investigation (19 No. topsoil, five Made Ground and 29 No. natural ground (Head Deposits, Chalk and Lambeth Group)), see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents).

11.7.142 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use. Asbestos was also not identified within the soil samples screened.

11.7.143 Notable concentrations of TPH C_{10} to C_{40} which does not have a GAC value were identified within a topsoil sample collected from 3E3102TP at a depth of 0.10m bgl.

11.7.144 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents)). A total of ten and six ground gas monitoring rounds were completed at Phase 2 and Phase 3B/3C locations respectively.

11.7.145 The Phase 2 exploratory holes 2E3000RC and 2E3002RC were placed within the BPT/IPS-E area. The results, and subsequent ground gas risk assessment, for these exploratory holes indicated that the BPT/IPS-E is located within a CS1 area.

11.7.146 Three Phase 3B/3C exploratory holes (3E3019DS, 3E3035DS and 3E3115DS), located on or within 20m of infilled land/pits, recorded exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide. A ground gas risk assessment was not undertaken for these exploratory holes because the monitoring was conducted to assess the risk to construction workers and not ground gas ingress into buildings. Presently, there are no buildings proposed to be constructed within Section E outside of the BPT/IPS-E discussed above, as such a ground gas risk assessment has not been undertaken at these three exploratory hole locations. Should it be determined that additional buildings will be located within Section E, then a ground gas assessment will be completed to consider potential risks to this receptor.

Section F: Boarhunt to Crockerhill

11.7.147 A total of 75 No. soil samples were collected from within Section F of the Pipeline as part of the Proposed Development specific ground investigation. The samples comprised of 13 No. samples of topsoil, six Made Ground and 56 No. natural ground (Alluvium, Head Deposits, Chalk, Lambeth Group and London Clay Formation). Of the samples collected, 72 No. were subject to laboratory analysis (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 4 of 18 documents)).

11.7.148 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use. Asbestos was also not identified within the soil samples screened.

11.7.149 There were no notable concentrations that were considered to be elevated compared to other chemical results recorded.

11.7.150 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 4 of 18 documents)). The interpretative report noted that during the monitoring period one Phase 2 borehole (2F3503SA) was flooded on one occasion, with a Phase 3B/3C borehole (3W567SA) flooded on three occasions. It was also noted that boreholes 2F3502SA and 2F3503SA had less than 1.50m between the top of the slotted standpipe and water level on one occasion. As such, the results were assessed as indicative within the interpretative report. The interpretative report states that the data from these exploratory holes should be considered during the preconstruction phase as temporary deep excavations are planned as reception shafts for trenchless construction works.

11.7.151 A ground gas risk assessment was undertaken to determine the risks to the building structures associated with IPS-F. The assessment concluded that the area where the IPS-F would be located is a CS1 and therefore no gas protection measures are required (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 4 of 18 documents)).

11.7.152 Six Phase 2 and six Phase 3B/3C exploratory holes recorded exceedances of workplace exposure of short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide. The exceedances were recorded in areas of PSCs and trenchless construction sites for the Proposed Development.

Section G: Crockerhill to Wickham

11.7.153 A total of 72 No. soil samples were collected from within Section G of the Pipeline as part of the Proposed Development specific ground investigation. The samples comprised of two samples of topsoil, eight Made Ground and 62 No. natural ground samples (River Terrace Deposits and clays from the Wittering and Earnley Formations and Lambeth Group), see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 5 of 18 documents).

11.7.154 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use. Asbestos was identified within the Made Ground of 3G4038DS (0.10m bgl) at a concentration of 0.009% weight by weight (w/w).

11.7.155 Notable concentrations of sulphate (19,000 mg/kg) were recorded within 2G4003DS (Wittering Formation, 3.70m bgl). The interpretative report notes that the concentration recorded is a potential outlier as all other samples recorded concentrations between 81 and 927 mg/kg. The report suggests that this concentration may possibly be natural.

11.7.156 Notable concentrations of TPH C_{10} to C_{40} were recorded within the Made Ground of 3G4037DS (600mg/kg, 0.50m bgl) and 3W8539DS (1,350mg/kg, 0.80m bgl) and within the River Terrace Deposits of 3G4105SA (1,920mg/kg, 1.00m bgl). The interpretative report notes that the concentrations recorded within these soil samples are potential outliers as concentrations from other samples generally ranged from 24 to 144 mg/kg. The report also notes that these results may indicate further hydrocarbon contamination within the vicinity of these locations.

11.7.157 The interpretative report highlights that due to the variable nature of infilled ground, elevated chemical concentrations can occur randomly and may not indicate a specific point source of contamination; however, they may assist in identifying concentrations which pose a health and safety risk.

11.7.158 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 5 of 18 documents)). The interpretative report noted that during the monitoring period seven of the Phase 3B/3C boreholes were flooded, as such the results were assessed as indicative within the interpretative report. The report noted that boreholes 3G4105SA and 3G4106SA should be considered at the preconstruction phase due to the proposed IPS-G site. In addition, ground gas data recorded at locations of proposed trenchless construction works should also be considered due to temporary deep excavations planned at reception shafts for trenchless construction works within the Proposed Development.

11.7.159 The ground gas risk assessment characterised the area of the proposed IPS-G site as a CS3. However, the interpretative report states that due to a lack of a credible ground gas source, gas protection measures were not considered necessary.

11.7.160 One Phase 2 and 12 No. Phase 3B/3C exploratory holes recorded exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide. The exceedances were recorded in areas of PSCs and trenchless construction sites for the Proposed Development.

11.7.161 An exceedance of the workplace exposure long-term limit threshold value for carbon monoxide was recorded within Phase 3B/3C exploratory hole 3G4105SA (IPS-G location) with an exceedance of the long-term limit threshold value for hydrogen sulphide recorded within Phase 3B/3C exploratory hole 3G4038DS (located within a former garage).

Section H: Wickham to Shedfield

11.7.162 A total of 35 No. soil samples were collected from within Section H of the Pipeline as part of the Proposed Development specific ground investigation. The samples comprised of seven samples of topsoil, two Made Ground and 26 No. natural ground samples (Head Deposits, River Terrace Deposits, Wittering Formation, London Clay Formation and Whitecliff Sand Member), see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 6 of 18 documents).

11.7.163 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use. In addition, no asbestos was recorded within the samples

screened. However, asbestos screening was requested for three soil samples collected as part of the Phase 2 ground investigation works but the results had not been received.

11.7.164 Notable concentrations of cresols were recorded within 3H4507HP (Wittering Formation, 1.00m bgl). The report notes that this is not typically expected within natural soils.

11.7.165 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 6 of 18 documents)). The interpretative report noted that during the monitoring period, one Phase 2 and two Phase 3B/3C boreholes were fully flooded with one Phase 2 borehole having less than 1m depth between the top of the slotted standpipe and the water level. As such, the results were assessed as indicative within the interpretative report. The interpretative report states that although no permanent structures are planned within the vicinity of these exploratory holes, the data should be considered during the preconstruction phase as temporary deep excavations are planned as launch or reception shafts for trenchless construction works within the Proposed Development.

11.7.166 Three Phase 2 exploratory holes (2H4501DR, 2H4502DS and 2H4503DS) and two Phase 3B/3C exploratory holes (3H4517SA and 3H4600SA) recorded exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide. The exceedances were recorded in areas of PSCs and trenchless construction sites for the Proposed Development. A ground gas risk assessment was not undertaken for these exploratory holes because the monitoring was conducted to assess the risk to construction workers and not ground gas ingress into buildings. Presently, there are no buildings proposed to be constructed within Section H, as such a ground gas risk assessment has not been undertaken. Should it be determined that buildings will be located within Section H, then a ground gas assessment will be completed to consider potential risks to this receptor.

Section J: Shedfield to the River Hamble

11.7.167 A total of 47 No. soils samples were collected from within Section J during the Phase 3B/3C ground investigation (nine samples of topsoil, 15 No. Made Ground and 23 No. natural ground (Head Deposits, Wittering Formation and London Clay Formation)), see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 7 of 18 documents).

11.7.168 Of the soil samples analysed, lead was recorded at a concentration in excess of the GAC value for a commercial end use within a soil sample of Made Ground collected from 3J5016TP.

11.7.169 The interpretative report notes that of the 26 No. soil samples scheduled for asbestos screening, results were only obtained for five samples (topsoil, Whitecliff Sand Member and London Clay Formation). Within the samples screened, no asbestos was detected. Two soil samples collected from 3J5014TP could not be screened due to insufficient sample volume, with the remaining 19 No. samples

(which included all Made Ground samples) not undergoing screening due to laboratory error.

11.7.170 Notable concentrations of cadmium, copper and TPH (C_{10} – C_{40}) were reported within Made Ground soil samples of 3J5014TP collected from Rossgarth and Ash House Farm landfills. Notable concentrations of trimethylphenol and 1,2,4-trimethylbenzene were reported in natural ground samples (topsoil and Whitecliff Sand Formation) collected from 3J5004DS and 3J5016TP, also located within the Rossgarth and Ash House Farm landfills. The interpretative report noted that the concentrations of trimethylphenol and 1,2,4-trimethylbenzene were not expected in natural soils.

11.7.171 The interpretative report highlights that due to the variable nature of the Made Ground, elevated chemical concentrations can occur randomly and may not indicate a specific point source of contamination, however they may assist in identifying concentrations which pose a health and safety risk.

11.7.172 Ground gas monitoring was undertaken on seven occasions as part of the Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 7 of 18 documents)). The interpretative report noted that during the monitoring period, the response zones for 3J5004DS and 3J5007DS were fully flooded during all monitoring rounds, with 3J5028DS flooded on four occasions. Within 3J5002SA and 3J5028DS, there was less than 1.00m between the top of the slotted standpipe and water level on three and two occasions respectively.

11.7.173 The interpretative report states that although no permanent structures are planned within the vicinity of these exploratory holes, the data should be considered during the preconstruction phase as temporary deep excavations are planned for a reception shaft.

11.7.174 Four Phase 3B/3C exploratory holes (3J5004DS, 3J5007DS, 3J5015SA and 3J5028DS) recorded exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide and, with the exception of 3J5028DS, methane. An exceedance of the threshold values for carbon monoxide (long-term limit) and hydrogen sulphide (short-term and long-term limit) was recorded within 3J5002SA. The exceedances were recorded in areas of PSCs and trenchless construction sites for the Proposed Development.

Section K: The River Hamble to Lower Upham

11.7.175 A total of six soil samples were collected as part of the Phase 2 ground investigation (one topsoil, one Made Ground, four natural ground (River Terrace Deposits, Head Deposits and London Clay Formation)). A further 36 No. soil samples were collected from within Section K during the Phase 3B/3C ground investigation (eight samples of topsoil, three Made Ground and 25 No. natural ground (Head Deposits, Alluvium and London Clay Formation)), see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 8 of 18 documents).

11.7.176 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use within of the Phase 2 soil samples (2K5500SR, 2K5501SR)

or within any of the Phase 3B/3C soil samples. A further four soil samples collected as part of the Phase 2 ground investigation were scheduled for analysis, however, the results had not been received.

11.7.177 Asbestos cement (chrysotile) was identified within the Made Ground of 2K5500SR (0.50m bgl) at a concentration of 0.1475% w/w. Asbestos was not identified within any other soil samples screened.

11.7.178 Notable concentrations of lead and mineral oil (>C_{10} – C_{40}) were reported within the River Terrace Deposits of 2K5500SR (4.50m bgl). Within 3K5515DS, notable concentrations of TPH >C_{10} – C_{40} were identified within a sample of topsoil (0.20m bgl). Copper was reported at a notable concentration within a sample of Alluvium (0.50m bgl) collected from 3K5606SA.

11.7.179 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 8 of 18 documents)). The interpretative report noted that during the monitoring period, Phase 2 exploratory holes and 3K5606SA were flooded, as such the results were assessed as indicative within the interpretative report. The interpretative report states that although no permanent structures are planned within the vicinity of these exploratory holes, the data should be considered during the preconstruction phase as temporary deep excavations are planned for a reception shaft within the Proposed Development.

11.7.180 The Phase 3B/3C exploratory hole 3K5525DR was placed within the area of the proposed BPT-K. The results, and subsequent ground gas risk assessment, for this exploratory hole indicated that the proposed BPT-K would require gas protection measures as it is located within a CS3 area. However, the report notes that additional gas flow monitoring should be considered at this location due to inconsistent gas flow readings.

11.7.181 Two Phase 2 and two Phase 3B/3C exploratory holes (2K5500SR, 2K55001SR, 3K5525DR and 3K5606SA) recorded exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide. An exceedance of the short-term limit threshold value for hydrogen sulphide was recorded within Phase 2 exploratory hole 2K5501SR. The exceedances were recorded in areas of PSCs and trenchless construction sites for the Proposed Development.

Section L: Lower Upham to Brambridge

11.7.182 A total of 81 No. soil samples were collected from within Section L of the Pipeline as part of the Proposed Development specific ground investigation. The samples comprised of 11 No. samples of topsoil, 16 No. Made Ground and 54 No. natural ground samples (Head Deposits, River Terrace Deposits, Alluvium, London Clay Formation and Lambeth Group), see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 9 of 18 documents).

11.7.183 Of the soil samples analysed, there were no exceedances of the GAC values for a commercial end use. Asbestos was identified within 2L6005SA (0.05 – 1.00 m bgl) as insulation boarding and free fibres (amosite and chrysotile) at concentrations of

1.21 and 0.50% w/w. No additional samples were identified as containing asbestos.

11.7.184 A notable concentration of total PAH (249 mg/kg) was recorded within 2L6002SA at a depth of 0.10 to 0.20m bgl. The interpretative report notes that the concentrations of individual PAHs were below their respective GACs, and that the cumulative concentration was considered to be elevated when compared to other locations.

11.7.185 Notable concentrations of iron were reported within samples collected from eight locations at depths between 0.10 and 6.00m bgl. The concentrations recorded ranged from 23,400 to 47,600 mg/kg. The interpretative report notes iron is recorded at high concentrations from a range of depths, and that although it is possible to be reflective of the natural geology, samples of Made Ground also included notable concentrations.

11.7.186 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 9 of 18 documents)). The interpretative report noted that during the monitoring period three Phase 2 boreholes were flooded and a further two boreholes suffered a pump flow failure which was attributed to high groundwater levels. As such, the results were assessed as indicative within the interpretative report. The interpretative report states that the ground gas data should be considered at the preconstruction phase in terms of risks to groundworkers, specifically those working within the temporary deep excavations associated with the planned reception shafts for trenchless construction works within the Proposed Development.

11.7.187 Eight Phase 2 and one Phase 3B/3C exploratory hole recorded exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas thresholds for carbon dioxide. The exceedances were recorded in areas of PSCs and trenchless construction sites for the Proposed Development. A ground gas risk assessment was not undertaken for these exploratory holes. Presently, there are no buildings proposed to be constructed within Section L, as such a ground gas risk assessment has not been undertaken. Should it be determined that buildings will be located within Section L, then a ground gas assessment will be completed to consider potential risks to this receptor.

Section M: Brambridge to Otterbourne Water Supply Works

11.7.188 A total of 11 No. soil samples were collected from within Section M of the Pipeline as part of the Proposed Development specific ground investigation. The samples comprised of one sample of topsoil, one Made Ground and nine natural ground samples (Head Deposits, Alluvium, River Terrace Deposits, Lambeth Group and Chalk), see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 10 of 18 documents).

11.7.189 There were no recorded exceedances of the GAC values for a commercial end use or asbestos identified in the samples screened. There were also no notable concentrations reported within the ES Appendix 11.2 Geotechnical and geo-

environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 10 of 18 documents)).

11.7.190 Ground gas monitoring was undertaken as part of the Phase 2 and Phase 3B/3C ground investigations (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 10 of 18 documents)). The interpretative report noted that during the monitoring period two Phase 2 exploratory holes were flooded. Within the remaining exploratory holes, the interpretative report notes that generally, gas concentrations were low; however, some low concentrations of oxygen and elevated concentrations of carbon dioxide were encountered.

11.7.191 Exceedances of workplace exposure short-term (15-minute reference period) and long-term limits (8-hour reference period) gas threshold values for carbon dioxide were recorded within 2M6507SA and 2M6508SA. The exceedances were recorded within an area where trenchless construction works would be undertaken for the Proposed Development. No additional ground gas risk assessments were undertaken.

Potential hazards to controlled waters

Section E: Portsdown Hill to Boarhunt

11.7.192 The interpretative report noted that 17 No. soil leachate samples were requested for analysis; however, one sample was misplaced, and so results were only available for 16 No. of the samples (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents)). The results received were compared against the DWS guidance [39] and the withdrawn WQS for petroleum hydrocarbons.

11.7.193 Concentrations of nitrate (as NO_3) and TPH (C_8 – C_{40}) aromatic and aliphatic were identified as being in excess of their respective GAC within topsoil samples. Within samples of Made Ground, exceedances of ammonium (NH_4), nitrate (NO_3), nitrite (NO_2), sulphate, iron, manganese and TPH (C_8 – C_{40}, C_{21} – C_{35}) aromatic were recorded. Exceedances for TPH (C_{21} – C_{35}) aromatic and TPH (C_6 – C_{40}) aromatic and aliphatic were identified in samples of Head Deposits and Chalk.

11.7.194 There were no groundwater samples collected during the Proposed Development specific ground investigation for Section E of the Pipeline.

11.7.195 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents).

Section F: Boarhunt to Crockerhill

11.7.196 The interpretative report noted that 14 No. soil leachate samples were requested for analysis as part of the Phase 2 ground investigation; however, only the results for one sample had been reported. The results relate to a sample of Head Deposits collected from 2F3503SA (0.50m bgl). A further ten samples were requested for analysis as part of the Phase 3B/3C ground investigation.

11.7.197 The results received were compared against EQS, UK DWS and the withdrawn WQS GAC. Concentrations of total ammonia (N) were compared against the Water Framework Directive (WFD) criteria.

11.7.198 Concentrations of TPH aromatic and aliphatic (C_8 – C_{40}) and phenol were identified as being in excess of their respective GAC values within Made Ground samples. Within samples of Alluvium, exceedances were identified for TPH (C_6 – C_{40}), phenol, copper and chromium VI. TPH (C_8 – C_{40}) aromatic and aliphatic and TPH (C_{21} – C_{35}, C_{35} – C_{44}) aromatic were identified at concentrations in excess of their respective GAC values within Head Deposits samples. Lambeth Group and Chalk samples identified exceedances for TPH (C_8 – C_{40}) aromatic and aliphatic with additional exceedances of TPH aromatic (total, C_{21} – C_{35}), phenol and sulphate (SO_4) recorded within Lambeth Group samples.

11.7.199 Soil leachate results from exploratory hole 3W8558SA (1.30m bgl) recorded a concentration of naphthalene (43.20µg/l) which was considered to be an outlier when compared to the other samples analysed. The interpretative report notes that the source of naphthalene at this location was unconfirmed.

11.7.200 A total of seven groundwater samples were collected from four locations as part of the Phase 2 and Phase 3B/3C ground investigation within Section F. The results were compared against DWS, withdrawn WQS, EQS and WFD.

11.7.201 Concentrations of TPH (C_{10} – C_{40}), TPH aliphatic (C_8 – C_{40}, C_{21} – C_{35}), TPH aromatic (C_{10} – C_{40}), chloride, sulphate (SO_4), selenium and zinc were identified as being in excess of their respective GAC values.

Section G: Crockerhill to Wickham

11.7.202 The interpretative report noted that analysis of 12 No. soil leachate samples was requested as part of the Phase 2 ground investigation, however only the results for one sample had been received. The results relate to a sample of Wittering Formation clay collected from 2G4003DS (3.70m bgl). A further ten samples were requested for analysis as part of the Phase 3B/3C ground investigation.

11.7.203 The results received were compared against the EQS, DWS and the withdrawn WQS. Concentrations of total ammonia (N) and nitrogen were compared against the WFD criteria.

11.7.204 Concentrations of ammonium (NH_4), total ammonia (N), copper and TPH (C_8 – C_{40}) aromatic and aliphatic were identified as being in excess of their respective GAC values within samples of River Terrace Deposits. Within Wittering Formation samples, exceedances for metals (chromium VI, copper, cadmium, nickel, selenium and zinc), ammonium (NH_4), total ammonia (N) and TPH (C_6 – C_{40}) were identified. Exceedances for ammonium (NH_4), total ammonia (N), metals (chromium VI, copper and lead) and TPH (C_6 – C_{40}) were identified within Earnley Sand Formation samples. Chromium VI was identified in excess of its GAC within a sample of London Clay Formation.

11.7.205 A total of 27 No. groundwater samples were collected from nine locations as part of the Phase 2 and Phase 3B/3C ground investigations within Section G. The results were compared against EQS, DWS, withdrawn WQS and WFD GAC. Concentrations of metals (cadmium, copper, chromium III, lead, nickel and zinc), TPH (C_8 – C_{40}) aromatic and aliphatic, fluoranthene, benzo(a)pyrene,

benzo(b)fluoranthene, anthracene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, ammonium (NH_4) and total ammonia (N) were identified as being in excess of their respective GAC values for the groundwater samples collected from the River Terrace Deposits and Earnley Sand Formation.

11.7.206 Groundwater samples collected from the Wittering Formation and Whitecliff Sand Member recorded concentrations of metals (cadmium, chromium III, copper, iron, manganese, nickel and zinc), anthracene, fluoranthene, TPH (C_6 – C_{40}) and cyanide identified as being in excess of their respective GAC values for the groundwater samples.

11.7.207 Exceedances of GAC for E.Coli were also recorded, as was the presence of faecal coliforms, faecal streptococci and total coliforms (which do not have GACs) within a groundwater sample collected from the Whitecliff Sand Member (11.50 – 17.00m bgl) of 3W8536SA.

11.7.208 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 5 of 18 documents).

Section H: Wickham to Shedfield

11.7.209 The interpretative report noted that six soil leachate samples were requested for analysis as part of the Phase 2 ground investigation; however, none were reported by the analytical laboratory. One sample collected as part of the Phase 3B/3C ground investigation from 3H4600SA (Wittering Formation, 3.30m bgl) was sent for soil leachate analysis. The results were compared against DWS, WFD and the withdrawn WQS GAC.

11.7.210 An exceedance of the withdrawn WQS GAC for TPH (C_6 – C_{40}) was recorded within the soil leachate sample.

11.7.211 A total of 14 No. groundwater samples were collected from five locations as part of the Phase 2 and Phase 3B/3C ground investigation within Section H. The results were compared against DWS, WFD and withdrawn WQS GAC.

11.7.212 Concentrations of metals (iron, lead, manganese and nickel), TPH (C_6 – C_{40}), gasoline range organics (GRO) (C_6 – C_{10}), ammonium (NH_4) and nitrite (NO_2) were identified as being in excess of their respective GAC values.

11.7.213 Notable concentrations of perfluorooctanoic acid (0.012 µg/l) were reported in a groundwater sample collected from 2H4503DS during the September 2023 monitoring round. The interpretative report notes that the concentration appeared to be elevated when compared to other chemical results recorded during previous groundwater sampling rounds which were below the limit of detection. No additional sampling was undertaken within this exploratory hole post September 2023.

11.7.214 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 6 of 18 documents).

Section J: Shedfield to the River Hamble

11.7.215 The interpretative report noted that 13 No. soil leachate samples were requested for analysis as part of the Phase 3B/3C ground investigation; however, only ten were reported by the analytical laboratory. This was due to insufficient sample volume within the remaining three samples. The results were compared against EQS, DWS and the withdrawn WQS GAC. Concentrations of total ammonia and nitrogen were compared against WFD GAC.

11.7.216 Concentrations of metals (boron, iron, manganese and nickel), TPH aromatic (C_8 – C_{40}, C_{12} – C_{16}, C_{16} – C_{21}, C_{21} – C_{35}, C_{35} – C_{44}), TPH aliphatic (C_8 – C_{40}, C_{10} – C_{12}, C_{12} – C_{16}, C_{16} – C_{21}, C_{21} – C_{35}), TPH (C_{35} – C_{44}), ammonium (NH_4), sulphate (SO_4) and benzo(a)pyrene were identified as being in excess of their respective GAC values in Made Ground samples.

11.7.217 Samples collected from the Whitecliff Sand Member recorded concentrations of ammonium (NH_4) and TPH aromatic (C_8 – C_{40}, C_{21} – C_{35}) in excess of their respective GAC values.

11.7.218 A total of 15 No. groundwater samples were collected as part of the Phase 3B/3C ground investigations within Section J. The results were compared against EQS, DWS, withdrawn WQS and WFD GAC. Concentrations of metals (arsenic, iron, lead, manganese and nickel), TPH aliphatic (C_8 – C_{40}, C_{10} – C_{12}, C_{16} – C_{21}, C_{21} – C_{35}, C_{35} – C_{44}), TPH aromatic (C_8 – C_{40}, C_{16} – C_{21}, C_{21} – C_{35}, C_{35} – C_{44}), ammonium (NH_4), nitrite (NO_2), benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, benzo(g,h,i)perylene and benzo(a)pyrene were recorded om excess of their respective GAC values.

11.7.219 Perfluorooctane sulfonate concentrations above 0.10µg/l (Tier 3 threshold) were recorded within soil leachate samples collected from the Made Ground of 3J5014TP and 3J5015SA. Exceedances of the Tier 3 threshold [39] were also recorded within groundwater samples collected from 3J5015SA (three samples collected on separate occasions) which had a response zone located within Made Ground.

Section K: The River Hamble to Lower Upham

11.7.220 The interpretative report noted that analysis of six soil leachate samples was requested; the analysis results for one sample had been received. The results relate to a sample of London Clay collected from borehole 2K5501SR (6.00m bgl). The results received were compared against the DWS and withdrawn WQS GAC.

11.7.221 Concentrations of ammonia (NH_4) and total ammonia (N) were identified as being in excess of their respective GAC for the soil leachate sample analysed.

11.7.222 A total of 13 No. groundwater samples were collected as part of the Phase 2 and Phase 3B/3C ground investigations within Section K. The results were compared against EQS, DWS and withdrawn WQS GAC. Concentrations of metals (arsenic, chromium VI, nickel, mercury, sodium and zinc), fluoranthene, benzo(g,h,i)perylene, total ammonia (N), ammonium (NH_4), phenol, sulphate, TPH (C_6 – C_{40}, C_8 – C_{40}, C_{10} – C_{40}), GRO (C_6 – C_{40}) and chloride were identified as being in excess of their respective GAC values for the groundwater samples analysed.

11.7.223 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 8 of 18 documents).

Section L: Lower Upham to Brambridge

11.7.224 The interpretative report noted that 15 No. soil leachate samples were requested as part of the Phase 2 ground investigation for analysis; the analysis results for two samples had been received. An additional five soil leachate samples were requested as part of the Phase 3B/3C ground investigation. The results received were compared against EQS, DWS and the withdrawn WQS GAC. Concentrations of total ammonia were compared against WFD GAC.

11.7.225 Concentrations of copper were identified as being in excess of the GAC value for a sample of topsoil. Within the Made Ground samples exceedances of GAC values were identified for copper, iron and TPH (C_6 – C_{40}) aromatic. Selenium concentrations and total ammonia (N) and TPH (C_6 – C_{40}) concentrations were identified in exceedance of their respective GAC values in samples of London Clay Formation and Lambeth Group respectively.

11.7.226 A total of 23 No. groundwater samples were collected from nine locations as part of the Phase 2 and Phase 3B/3C ground investigations within Section L. The results were compared against EQS, DWS, withdrawn WQS and WFD GAC. Concentrations of TPHs (C_6 – C_{40}), chloride, sulphate, total ammonia (N), ammonium (NH_4), nitrate (NO_2), metals (manganese, selenium, sodium, boron, zinc, copper, cadmium, chromium VI, lead and nickel), indeno(1,2,3-c,d)pyrene and fluoranthene were identified as being in excess of their respective GAC values for the groundwater samples analysed.

11.7.227 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 9 of 18 documents).

Section M: Brambridge to Otterbourne Water Supply Works

11.7.228 The interpretative report noted that three soil leachate samples were requested for analysis as part of the Phase 2 ground investigation; however, only the results for one sample had been reported at the time of writing. The sample was collected from within the Alluvium of 2M6508SA (1.00m bgl). The results were compared to DWS and the withdrawn WQS GAC.

11.7.229 An exceedance of the withdrawn WQS for TPH and EQS for cadmium and copper was reported within the soil leachate sample analysed.

11.7.230 A total of eight groundwater samples were collected from two locations as part of the Phase 2 ground investigation (2M6507SA and 2M6508SA) within Section M. The results were compared against EQS, DWS, withdrawn WQS and WFD GAC.

11.7.231 Concentrations of TPH, chromium VI, zinc, anthracene, fluoranthene and benzo(g,h,i)perylene were identified as being in excess of their respective GAC values within two of the groundwater samples analysed.

11.7.232 No groundwater samples were collected as part of the Phase 3B/3C ground investigation within Section M.

11.7.233 For additional details see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 10 of 18 documents)(.

Above Ground Plant

11.7.234 The AGP would be located along the route of the pipelines within the Order Limits of the Proposed Development, therefore, the baseline sub-sections previously discussed are inclusive of the proposed AGP. An additional discussion of the baseline environment for the AGP has not been repeated here to avoid duplication.

Future baseline

11.7.235 A review of the potential future baseline for land quality and ground conditions has been carried out, the results of which are discussed within this section. The future baseline includes committed developments that will be delivered prior to the commencement of the construction of the Proposed Development.

11.7.236 Sections of the Order Limits are located within areas identified as containing mineral resources (see section 16.7 of ES Chapter 16 Resources and waste management, Volume I (Document reference 6.1, DCO Volume 6)). Should extraction of these materials take place in the future, the baseline conditions for those areas would be altered. The potential changes not only relate to the geology of the area, but also the hydrogeology and hydrology conditions. Removal of superficial deposits has the potential to impact on groundwater flow patterns, for example by removing more permeable strata, and discharges into surface water bodies. The removal of deposits also has the potential to expose pre-existing contamination which then may be mobilised. However, there are currently no applications in place for mineral extraction within the land quality and ground conditions study area and therefore none are considered as part the future baseline for this chapter.

11.7.237 Climate change is causing more extreme weather in the UK, resulting in wetter winters and drier summers. This change in climate conditions has the potential to mobilise pre-existing contamination through, for example, increased rates of infiltration due to heavier rainfalls, increased surface run-off due to heavy rainfall following a period of drought/dry weather, dust generation through drier summers and the creation of fissures (either via drier summers or periods of cold weather) within soils allowing infiltration into deeper layers where contamination may be present [40]. Increased infiltration as a result of excavation of surface layers is discussed within section 11.8 inclusive of any changes to rainfall rates that may occur as a result of climate change.

11.7.238 It should also be noted that natural degradation/attenuation of contaminants over time may result in a general improvement in ground conditions.

11.7.239 There is also the potential for groundwater levels to rise as a result of increased rainfall. A rise in groundwater levels into the unsaturated zone has the potential to mobilise pre-existing contaminants resulting in potential migration and adversely impacting controlled waters.

11.7.240 Climate change has the potential to impact on the hydrology of surface drainage networks, with higher winter flows, lower summer flows and a greater number of storm related flood flows. The risk of flooding would also be amplified as a result

of the predicted increase in rainfall which may result in an increase in peak river flows and an increase in the magnitude of surface water flooding. Changes to surface run-off as a result of construction works discussed within section 11.8 is inclusive of any changes associated with climate change.

11.7.241 An increase in population, increasing urbanisation and improvement in living standards may lead to a reduction in land available for agriculture (see ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6) for an assessment of impacts to agricultural land from the Proposed Development). For land that is retained for agricultural use, pressures for more productive practices may increase to feed the increased population. As such, there may be an increase in the use of agricultural chemicals and industrial fertiliser to ensure continued high crop yields at a high quality.

11.7.242 Although there is the potential for increased usage of agrichemicals to maintain crop yields, ongoing measures, such as the regulation of agricultural chemicals and catchment wide initiatives, as part of the implementation of the WER are likely to improve the baseline environment by reducing the existing pressures on groundwater bodies. Also, as with the degradation of contaminants in soils, the baseline for groundwater quality is likely to improve over time through the natural breakdown of chemicals that may currently be present within the baseline environment.

11.7.243 Increasing demand from population growth may also drive the expansion of urban areas into new areas, including previously developed land (i.e. brownfield land). This expansion could result in an increase in the number of potential receptors to pre-existing sources of contamination. The expansion could also result in the introduction of new sources of contamination (e.g. fuel spills) and new pathways (e.g. piled foundations). Those developments that have been committed to, for example residential development, have the potential to result in additional human health and built environment receptors within the land quality and ground conditions study area. These receptors have been included within the assessment of likely significant effects provided in section 11.8.

11.8 Assessment of likely significant effects

11.8.1 This section presents the assessment of likely significant effects on land quality and ground conditions resulting from the construction, operation and decommissioning of the Proposed Development. The likely significant effects of the Proposed Development are identified taking into account primary and tertiary mitigation. Following assessment, the need for secondary mitigation is considered in section 11.9 and residual effects are explained in section 11.10.

Construction effects

Water Recycling Plant site

Proposed construction methodology

11.8.2 Construction of the WRP site would require a cut and fill operation. This would create a level surface for a piling mat from which the foundations of the WRP site would be piled. Reinforced concrete slabs would be laid onto the piled foundations.

Piled foundations would be cast in situ to reduce the risk associated with landfill leachate, and continuous flight auger piles would be used to reduce the potential for the creation of contamination pathways, these are both recognised appropriate methodologies for former landfill sites (see section 11.4 and Outline CEMP (Document reference 7.1, DCO Volume 7) for additional details). Ground gas protection measures would be implemented at enclosed structures and pressure relief systems would be implemented at areas of hardstanding.

11.8.3 Construction of the WRP site would consist of a main process building, three pumping stations, kiosks for control equipment, administration buildings and parking facilities. Several large holding tanks and chemical storage units would also be constructed above-ground. These would either be pre-cast concrete tanks or glass fused to steel construction.

11.8.4 A temporary construction compound would be located at the WRP site. This would enable the construction of the WRP site and tunnel shafts associated with the various pipelines.

Summary of contaminant linkages requiring risk management

11.8.5 Following the completion of Proposed Development specific ground investigations, a refined source-pathway-receptor model has been developed and presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents). A summary of the refined model is provided in Table 11-43.

11.8.6 Although the Order Limits have been refined following the completion of Proposed Development specific ground investigations, the assessments presented below include areas where no risks have been identified in light of the potential for unforeseen contamination to be present.

Table 11-43 Refined source-pathway-receptor model for the Water Recycling Plant site

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
• Cover soils and landfill waste • Unforeseen ground conditions • Made Ground	• Human health	• Direct dermal contact, ingestion and inhalation of soil/dust • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Development of remediation strategies for areas deemed to represent a potentially inacceptable risk to land quality and ground conditions receptors • Foundation Works Risk Assessment • Measures included within the Design Principles Document (Document reference 5.11, DCO Volume 5): • Incorporation of ground gas protection measures into the design of the WRP site
	• Groundwater	• Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils. • Migration via anthropogenic routes		
	• Surface water	• Runoff or discharges to surface water via existing drainage network • Deposition of wind-blown dust • Recharge of surface water via contaminated groundwater		
	• Ecological sensitive sites			
	• Built environment	• Direct contact – sulphate attack on concrete, hydrocarbon corrosion/permeation of plastic pipes		

Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts

11.8.7 The earthworks and piled foundations required for the WRP site, as well as the movement and storage of soils, have the potential to mobilise existing ground contamination. This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

11.8.8 As mentioned in section 11.7, two previous phases and one Proposed Development specific phase of ground investigations have been undertaken within the area of the WRP site. Analysis of soil samples collected during each of the phases of ground investigation identified the presence of amosite and chrysotile asbestos in both cover soil and landfill waste samples (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)). Marginal exceedances of the GAC for PAH, specifically benzo(a)pyrene and dibenzo(a,h)anthracene, were recorded in one cover soil sample. An exceedance of the GAC for dibenzo(a,h)anthracene was recorded within one landfill waste sample.

11.8.9 In addition to the contamination identified within soil samples, groundwater samples collected from within both the superficial deposits and chalk bedrock recorded exceedances of EQS values for several metals (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)). Exceedances for ammonia and PAH were also recorded within groundwater samples collected from within the landfill waste, superficial deposits and chalk.

11.8.10 The presence of these contaminants could represent a risk to construction workers, landowners, land users and neighbouring land users if exposed during construction activities. Construction activities, particularly earthworks, could disturb and expose construction workers, landowners, land users and neighbouring land users to contamination associated with the historical landfill. Construction activities could create pollutant linkages through ingestion, inhalation and direct dermal contact pathways (see Table 11-43).

11.8.11 In the event of exposing soils and storage of construction waste (including excavated soils), dust could be generated during dry and windy conditions. Under these conditions, and in the absence of appropriate mitigation measures, construction workers, landowners, land users and neighbouring land users could be temporarily exposed to contamination via the inhalation of potentially contaminated dusts.

11.8.12 Additionally, earthworks and piling activities have the potential to change or create new preferential pathways allowing for any ground gases to migrate and accumulate in confined spaces. The potential risk from ground gas could represent a risk to the health of construction workers through asphyxiation and explosion should they be required to enter confined spaces during the construction phase.

Sensitivity of receptor

11.8.13 The sensitivity of construction workers, landowners, land users and neighbouring land users is considered to be high.

Magnitude of impact

11.8.14 During the construction phase of the WRP site, excavation and movement of materials would be required. On a conservative basis, the impacts associated with the construction of the WRP site could be present across the whole construction footprint for the duration of the works. Potential impacts are, however, considered to be of short-term duration (occurring only during the works). Therefore, the magnitude of impact is considered to be low.

11.8.15 In relation to risks associated with the migration of ground gas, the impacts could, on a conservative basis, be present across the whole construction footprint of the WRP site for the duration of the works. This could therefore represent both acute and chronic health risks. Prior to the implementation of mitigation measures, the magnitude of impact in relation to ground gas is therefore considered to be high.

11.8.16 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4, which includes adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), incorporating ground gas protection measures within buildings (see Design Principles Document (Document reference 5.11, DCO Volume 5)) and undertaking remediation within the WRP site (see Table 11-5), the magnitude of impact is considered to be negligible for both risks associated with the excavation and movement of materials and ground gas.

Significance of effect

11.8.17 With the implementation of primary and tertiary mitigation measures, as described in section 11.4 and Table 11-43, the significance of effect on human health receptors during the construction of the WRP site is considered minor adverse which is not significant.

Impact 2: Direct and indirect impacts on groundwater quality and groundwater resources

11.8.18 As mentioned previously in section 11.7, groundwater samples collected from within the landfill waste recorded concentrations of ammonia and PAH in excess of their respective EQS. Exceedances for both ammonia and PAH were also recorded within groundwater samples collected from superficial deposits and chalk bedrock. Additionally, metals were recorded above their respective EQS within groundwater samples collected from superficial deposits and chalk bedrock.

11.8.19 There is the possibility that ammonium as NH_4 within the landfill leachate is presently undergoing oxidation transformation to nitrate (NO_2^-) and then nitrate (NO_3^+). This would result in an increased nitrate concentration within the landfill leachate and a reduction in ammonium concentrations. This transformation occurs within the landfill leachate when oxygen is introduced.

11.8.20 Piling and other earthwork activities associated with the construction of the WRP site have, in the absence of appropriate mitigation measures, the potential to result in direct impacts to the underlying Principal Aquifer of the Lewes Nodular Chalk Formation. Piled foundations have the potential to create a preferential pathway between the historical landfill and the Principal Aquifer. This potential preferential

pathway could allow contaminants to migrate from the overlying landfill impacting upon groundwater quality.

11.8.21 Direct impacts to the Secondary A and Secondary Undifferentiated Aquifers within the superficial deposits could also occur due to piling and the intrusive nature of earthworks in the absence of appropriate mitigation measures. The significance of disturbance would be dependent on the depth of the aquifer units in relation to the proposed depths of piling and earthworks, with superficial aquifers present at the surface at greater risk of direct impacts.

11.8.22 During construction, surface layers would be excavated which would allow for increased infiltration of rainwater and surface run-off to the subsurface. This could, in the absence of appropriate mitigation measures, potentially mobilise residual contamination already present in the overlying unsaturated strata which could potentially migrate into the underlying superficial aquifers. Due to the location of the WRP site, avoidance of areas of residual contamination would not be possible.

11.8.23 Should groundwater within the aquifers underlying the WRP site be impacted by the mobilisation of pre-existing sources of contamination, e.g. landfill leachate, or through the introduction of new sources of contamination there is the potential for impacted groundwater to be released into Hermitage Stream. This in turn has the potential to impact on sensitive ecological receptors (see Impact 3).

11.8.24 If required, dewatering of perched water or groundwater within excavations could also affect groundwater flow and water quality resulting in impacts to the base flow of local watercourses and waterbodies.

11.8.25 In addition, there is the potential for the introduction of new sources of contamination through, for example, the accidental release of lubricants, fuels, and oils from construction machinery. This can occur as a result of spillages, leakage, or storage. These can enter into the ground and subsequently into groundwater affecting the quality of the resource.

Sensitivity of receptor

11.8.26 Due to the potential for groundwater within the superficial aquifers to discharge into surface water features that support ecologically important sites, the sensitivity of the Secondary A and Secondary Undifferentiated Aquifers is considered to be high.

11.8.27 Although regional potable groundwater abstractions are located outside of the footprint of the WRP site, the groundwater is abstracted from the Principal Aquifer associated with the chalk bedrock. As such, the sensitivity of the Principal Aquifer is considered to be high.

Magnitude of impact

11.8.28 Direct and indirect effects on superficial aquifers associated with excavation works (and any other associated construction activities, e.g. accidental spillages), changes to infiltration rates, surface water run-off (including run-off from the historical Harts Farm Way landfill) and dewatering that may occur at the WRP site during the construction phase are predicted to be of local spatial extent within each aquifer unit. Should any such direct or indirect effects occur, the magnitude of

impact for each aquifer is considered to be medium as there is the potential for impacts to affect the local area.

11.8.29 Piling activities have the potential to create a preferential pathway between the historical landfill and the Secondary A, Secondary Undifferentiated and Principal Aquifers. Should a pathway be created, the magnitude of impact for each of the aquifers is considered to be high in the absence of appropriate mitigation measures as there is the potential for large scale, long-term impacts on groundwater quality.

11.8.30 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4, which includes adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) undertaking hydrogeological risk assessments, remediation within the WRP site (see Table 11-5) and adoption of a detailed CEMP, the magnitude of impacts on groundwater quality and groundwater resources are reduced to negligible.

11.8.31 During construction of the cut off walls and shafts, there is the possibility that oxygen may be introduced into the landfill mass and existing leachate. Continuous flight augering or similar pilling methodologies would result in a solid pile. There is the potential for oxygen to be introduced during the mechanism of piling into the landfill mass in areas where leachate may exist. However, the potential for the introduction of oxygen into the landfill mass/leachate would be temporary in nature and of short-term duration. Therefore, the potential magnitude of impact, in the absence of appropriate mitigation measures, is considered to be low.

11.8.32 Mitigation measures to reduce the potential for the introduction of oxygen into the landfill mass/leachate include the use of a piling mechanism which would not result in the long-term introduction of oxygen and a monitoring programme of adjacent watercourses is proposed during the construction phase. Therefore, the magnitude of impact is reduced to negligible.

Significance of effect

11.8.33 With the implementation of primary and tertiary mitigation measures, as described in section 11.4 and Table 11-43, the significance of effect associated with the construction of the WRP site on groundwater quality and groundwater resources is considered minor adverse which is not significant.

Impact 3: Impacts on surface water quality and the ecological habitats they support from contamination

11.8.34 There are no Main Rivers located within the footprint of the WRP site. However, there is a drainage channel which follows the south-western edge of the WRP site which drains into the Hermitage Stream. The Hermitage Stream is located to the east of the WRP site.

11.8.35 As discussed in section 11.7 (and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents)), exceedances of metals, ammoniacal nitrogen, ammonia and PAH have been recorded within groundwater samples collected from within the landfill waste, superficial deposits and chalk bedrock.

11.8.36 The earthworks and piled foundations required to enable the construction of the WRP site have the potential to disturb pre-existing and/or introduce new sources contamination which could, in the absence of appropriate mitigation measures, migrate and be released into surface water via the following pathways:

1. Mobilisation and migration of soil contaminants or dissolved phase contaminants in groundwater by construction activities with subsequent release into surface waters.
2. Surface water run-off from contaminated Made Ground soils brought to the surface during construction.
3. Run-off from storage of potentially contaminated soils.
4. Migration of soil or groundwater contaminants into surface water drains during construction activities which then enter surface water.
5. Accidental spillage whilst handling, storing or treating contaminated water, fuel or other chemicals used during construction.
6. Alteration of the hydraulic regime of the local area as a result of the construction works.

11.8.37 As a worst case scenario, full infiltration of the landfill mass within the WRP site has been assumed; therefore, creating the potential for more leachate to enter Langstone Harbour and Hermitage Stream.

Sensitivity of receptor

11.8.38 Any migration and discharge of contamination into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats that they support. Although the area of the WRP site is not located within a designated environmentally sensitive area, three designated sites are located within 250m (Chichester and Langstone Harbours Ramsar Site and SPA, Langstone Harbour SSSI and Solent Maritime SAC). The Hermitage Stream discharges into the three designated sites. Therefore, the sensitivity of surface water receptors is considered to be high.

Magnitude of impact

11.8.39 Information presented in ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) indicates that the historical Harts Farm Way landfill within the WRP site was operational up until the 1980s. Surface water samples collected during the ground investigations, as discussed in section 11.7, indicate that surface water features continue to be impacted by on and off-site historical ‘dilute and disperse’ landfills.

11.8.40 As such, the magnitude of impact is conservatively considered to be high in the absence of appropriate mitigation measures due to the potential long-term impacts that may occur as a result of the disturbance and mobilisation of pre-existing contamination and/or the introduction of new sources of contamination. This is in addition to the impact that is already demonstrated to be occurring as a consequence of the historical ‘dilute and disperse’ landfill.

11.8.41 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4, including the undertaking hydrogeological risk assessments, remediation works within the WRP site (see Table 11-5) and adherence to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), the magnitude of impact is reduced to negligible.

Significance of effect

11.8.42 With the implementation of primary and tertiary mitigation measures described in section 11.4 and Table 11-43, the significance of effect on surface water quality and the ecological habitats they support during the construction of the WRP site is considered to be minor adverse which is not significant.

11.8.43 Additional impacts relating to surface water quality and ecological habitats are provided in sections 8.8 and 19.8 of ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6) and ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6), respectively.

Impact 4: Potential impacts on the built environment

11.8.44 In the absence of appropriate mitigation measures, the construction of the WRP site has the potential to impact on the existing built environment. This may be through the creation of new preferential pathways for contaminants or ground gases to migrate. The creation of new preferential pathways has the potential to result in degradation of both utilities and concrete from aggressive attack. This could potentially compromise the integrity of buildings or utilities or lead to the migration and accumulation of ground gases in buildings resulting in explosions.

Sensitivity of receptor

11.8.45 There are currently no commercial or residential properties located within the WRP site. The WRP site is bound to the north, south and west by highways. Commercial properties are located within 250m of the WRP site to the east of Hermitage Stream (located within the footprint of the Pipelines between Budds Farm WTW and WRP site).

11.8.46 Due to the presence of highways and an absence of commercial or residential properties, the sensitivity of the built environment within the WRP site is considered to be low.

Magnitude of impact

11.8.47 As the WRP site is bound by highways and there are no commercial or residential properties located within the area of the WRP site, the magnitude of impact is considered to be negligible.

Significance of effect

11.8.48 The significance of effect to the built environment during the construction of the WRP site is considered negligible adverse which is not significant.

Impact 5: Impacts on agricultural land

11.8.49 As mentioned in paragraph 11.7.29, it has been proven that the land within the WRP site is non-agricultural in nature. Due to the absence of agricultural soils within the WRP site, an assessment of the impacts on agricultural land in relation to contamination is not considered necessary for this area of the Proposed Development.

Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Proposed construction methodology

11.8.50 The Pipelines would be located under the Hermitage Stream and would be constructed using trenchless construction methods. To facilitate trenchless construction works, a temporary construction compounds would be located at the Budds Farm WTW. The launch shaft for trenchless construction works would be located at the WRP site temporary construction compounds, and the reception shaft would be located at the Budds Farm WTW temporary construction compounds. The launch shaft at the WRP site would have a diameter of approximately 9.00m and a depth of 32.50m bgl. The reception shaft at Budds Farm WTW would have a diameter of approximately 5.50m and a depth of 19.00m bgl. The Pipelines (each of which are approximately 700m in length) would both be located on the same route within a single casing. The temporary construction compounds assessed within the 'Water Recycling Plant site' section is also of relevance to the Pipelines, to avoid duplication it has not been included within the assessment of the Pipelines.

Summary of contaminant linkages requiring risk management

11.8.51 Following the completion of Proposed Development specific ground investigations, a refined source-pathway-receptor model has been developed and presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 1 of 18 documents). A summary of the refined model is provided in Table 11-44.

11.8.52 Although the Order Limits have been refined following the completion of Proposed Development specific ground investigations, the assessments presented below include areas where no risks have been identified in light of the potential for unforeseen contamination to be present.

Table 11-44 Refined source-pathway-receptor model for the Pipelines between Budds Farm Wastewater Treatment Works and the Water Recycling Plant site

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
• Harts Farm Way landfill • Land south of Budds Farm WTW • Budds Farm WTW with lagoons	• Human health	• Ingestion and inhalation of soil/dust • Inhalation of gases and vapours • Dermal absorption via direct contact with soil	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to a MMP • Development of remediation strategies for areas deemed to represent a potentially inacceptable risk to land quality and ground conditions receptors
	• Groundwater	• Migration of mobile contamination leached from contaminated soils • Groundwater migrating via anthropogenic routes		
	• Surface water	• Runoff or discharges to surface water via existing drainage network • Recharge of surface water via contaminated groundwater • Deposition of wind-blown soil/dust		
	• Ecological sensitive sites			
	• Built environment	• Direct contact – sulphate attack on concrete, hydrocarbon corrosion of/permeation into plastic pipes • Migration of gases/vapours through permeable natural strata/backfill materials,		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
		buried service corridors and shaft/tunnel linings		• Foundations Works Risk Assessment

Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts

11.8.53 Excavation activities associated with the construction of the Pipelines between Budds Farm WTW and the WRP site, as well as the movement and storage of soils, have the potential to mobilise existing ground contamination (where present). This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

11.8.54 As mentioned in section 11.7, a Proposed Development specific ground investigation has been undertaken within the area of the Pipelines. Analysis of soil samples collected during the ground investigation did not identify the presence of contaminants in excess of their respective GAC or asbestos within the samples screened. However, cyanide was reported at a notable concentration within a sample of Made Ground. Groundwater samples collected from both within landfill waste/Made Ground and superficial deposits recorded exceedances of EQS values for several metals, TPH and PAH (see section 11.7).

11.8.55 The presence of these contaminants could represent a risk to construction workers, landowners, land users and neighbouring land users if exposed during construction activities. Construction activities, particularly earthworks, could disturb and expose construction workers and other site users to contamination associated with historical land uses. Construction activities could create pollutant linkages through ingestion, inhalation and direct dermal contact pathways (see Table 11-44).

11.8.56 In the event of exposing soils and storage of construction waste (including excavated soils), dust could be generated during dry and windy conditions. Under these conditions, construction workers, landowners, land users and neighbouring land users could be temporarily exposed to contamination via the inhalation of potentially contaminated dusts.

11.8.57 Additionally, earthworks and trenchless construction activities have the potential to change or create new preferential pathways allowing for ground gases to migrate and accumulate in confined spaces. The potential risk from ground gas could represent a risk to the health of construction workers through asphyxiation and explosion should they be required to enter confined spaces during the construction phase.

Sensitivity of receptor

11.8.58 Construction workers are considered to be the most sensitive receptors as the activities in which they are engaged constitute more direct exposure routes over longer periods of time.

11.8.59 The sensitivity of construction workers, landowners, land users and neighbouring land users is considered to be high.

Magnitude of impact

11.8.60 Excavation and movement of materials would be required during the construction phase of the Pipelines. On a conservative basis, the impacts associated with the construction of the Pipelines could be present across the whole construction

footprint for the duration of the works. Potential impacts are; however, considered to be of short-term duration (occurring only during the works). Therefore, the magnitude of impact is considered to be low.

11.8.61 In relation to risks associated with the migration of ground gas, the impacts could, on a conservative basis, be present across the whole construction footprint of the Pipelines for the duration of the works. This could therefore represent both acute and chronic health risks. Prior to the implementation of mitigation, the magnitude of impact in relation to ground gas is considered to be high.

11.8.62 However, with the implementation of the tertiary mitigation measures described in section 11.4 and Table 11-44, which includes adherence to risk assessments and method statements and adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), the magnitude of impact is considered to be negligible for both risks associated with the excavation and movement of materials and ground gas.

Significance of effect

11.8.63 With the implementation of tertiary mitigation measures the significance of effect on human health receptors during the construction phase is considered minor adverse which is not significant.

Impact 2: Direct and indirect impacts on groundwater quality and groundwater resources

11.8.64 As mentioned previously in section 11.7, groundwater samples collected from within landfill waste/Made Ground and superficial deposits recorded exceedances of EQS values for several metals, TPH and PAH. Earthwork and trenchless construction activities, inclusive of the reception shaft, associated with the Pipelines between Budds Farm WTW and the WRP site have the potential to result in direct impacts to the underlying Principal Aquifer of the Lewes Nodular Chalk Formation in the absence of appropriate mitigation measures. These activities have the potential to create preferential pathways which may allow for the migration of pre-existing or new sources of contamination and thereby impacting upon groundwater quality. There is also the potential for drilling mud/other contaminants to leak along the drill path, which could also result in a reduction in groundwater quality within the underlying Principal Aquifer.

11.8.65 Direct impacts to the Secondary A and Secondary Undifferentiated Aquifers within the superficial deposits may also occur in the absence of appropriate mitigation measures due to the intrusive nature of trenchless construction methods of the Pipelines and associated earthworks to facilitate the installation of the Pipelines. The significance of disturbance would be dependent on the depth of the aquifer units in relation to the proposed depths of trenchless construction works and earthworks, with superficial aquifers present at the surface at a greater risk of direct impacts.

11.8.66 During construction, surface layers would be excavated at the reception shaft which may allow for a localised increase in the infiltration of rainwater and surface run-off to the subsurface. This could, in the absence of appropriate mitigation measures, potentially mobilise residual contamination already present within the overlying unsaturated strata which could potentially migrate into the underlying

superficial aquifers. Due to the location of the Pipelines it would not be possible to avoid areas of residual contamination.

11.8.67 Should groundwater within the aquifers underlying the Pipelines be impacted by the mobilisation of pre-existing sources of contamination or through the introduction of new sources of contamination there is the potential for impacted groundwater to be released into the Hermitage Stream. This in turn has the potential to impact on sensitive ecological receptors (see Impact 3).

11.8.68 If required, dewatering of perched water or groundwater within excavations could also affect groundwater flow and water quality resulting in impacts to the base flow of local watercourses and waterbodies.

11.8.69 In addition, there is also the potential for the introduction of new sources of contamination through, for example, the accidental release of lubricants, fuels and oils from construction machinery. This can occur as a result of spillages, leakage or storage. These can enter into the ground and subsequently into groundwater affecting the quality of the resource.

Sensitivity of receptor

11.8.70 Due to the potential for groundwater within the superficial aquifers to discharge into surface water features that support ecologically important sites, the sensitivity of the Secondary A and Secondary Undifferentiated Aquifers is considered to be high.

11.8.71 The sensitivity of the Principal Aquifer associated with the Lewes Nodular Chalk Formation is considered to be high. This is due to the presence of potable groundwater abstractions from the chalk adjacent to this area of the Proposed Development.

Magnitude of impact

11.8.72 Direct and indirect effects on superficial aquifers associated with excavation works (and any other associated construction activities, e.g. accidental spillages), changes to infiltration rates, surface water run-off and dewatering that may occur within the footprint of the Pipelines are predicted to be of local spatial extent within each aquifer unit. Should any such direct or indirect effects occur, the magnitude of impact for each aquifer is considered to be medium as there is the potential for impacts to affect the local area.

11.8.73 Trenchless construction works have the potential to create preferential pathways between previously identified sources of contamination and the Principal Aquifer. Dependent on the depth and thickness of the superficial aquifer units, there is also the potential for them to be affected by trenchless construction activities. Should a pathway be created, the magnitude of impact is considered to be high in the absence of appropriate mitigation measures as there is the potential for large scale, long-term impacts on groundwater quality and its suitability for potable abstractions.

11.8.74 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4 and Table 11-44, which includes undertaking hydrogeological risk assessments, adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) and the

adoption of a detailed CEMP, the magnitude of impacts on groundwater quality and groundwater resources are reduced to negligible.

Significance of effect

11.8.75 With the implementation of primary and tertiary mitigation measures, the significance of effect associated with the construction of the Pipelines on groundwater quality and groundwater resources is considered minor adverse which is not significant.

Impact 3: Impacts on surface water quality and the ecological habitats they support from contamination

11.8.76 Construction of the Pipelines between Budds Farm WTW and the WRP site would require the use of trenchless construction techniques beneath the Hermitage Stream. As described previously in section 11.7, landfill waste has been identified within both the area of overlap between the Pipelines and WRP site (including the launch shaft to be located within the WRP site and reception shaft located at Budds Farm WTW) and the southern extent of the Pipelines.

11.8.77 As discussed in section 11.7, groundwater samples collected from within landfill waste/Made Ground and superficial deposits recorded exceedances of EQS values for several metals, TPH and PAH. The earthworks and trenchless construction techniques required to enable the installation of the Pipelines have the potential to disturb pre-existing contamination and/or introduce new sources of contamination which could migrate and be released into surface water features via the following pathways:

1. Mobilisation and migration of soil contaminants or dissolved phase contaminants in groundwater by construction activities with subsequent release into surface waters.
2. Surface water run-off from contaminated Made Ground soils brought to the surface during construction.
3. Run-off from storage of potentially contaminated soils.
4. Migration of soil or groundwater contaminants into surface water drains during construction activities which then enter surface water.
5. Accidental spillage whilst handling, storing or treating contaminated water, fuel or other chemicals used during construction.
6. Alteration of the hydraulic regime of the local area as a result of the construction works.

Sensitivity of receptor

11.8.78 Any migration and discharge of contamination into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats that they support. The Pipelines cross the Hermitage Stream which discharges into three designated sites (Chichester and Langstone Harbours Ramsar Site and SPA, Langstone Harbour SSSI and Solent Maritime SAC). Therefore, the sensitivity of surface water receptors is considered to be high.

Magnitude of impact

11.8.79 As discussed in section 11.7, surface water samples were collected from the Hermitage Stream as part of the previous phases of ground investigation conducted within the WRP site. Analysis of the surface water samples indicated that the surface water body continues to be impacted by on and off-site historical 'dilute and disperse' landfills (see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)).

11.8.80 The magnitude of impact is conservatively considered to be high in the absence of appropriate mitigation measures due to the potential long-term impacts that may occur as a result of the disturbance and mobilisation of pre-existing contamination and/or the introduction of new sources of contamination. This is in addition to the impact that is already demonstrated to be occurring as a consequence of the historical 'dilute and disperse' landfill.

11.8.81 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4, which includes undertaking hydrogeological risk assessments, adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) and adoption of a detailed CEMP, the magnitude of impact is reduced to negligible.

Significance of effect

11.8.82 With the implementation of primary and tertiary mitigation measures described in section 11.4 and Table 11-44, the significance of effect on surface water quality and the ecological habitats they support during the construction of the Pipelines is considered to be minor adverse which is not significant.

11.8.83 Additional impacts relating to surface water quality and ecological habitats are provided in sections 8.8 and 19.8 of ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6) and ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) respectively.

Impact 4: Potential impacts on the built environment

11.8.84 In the absence of appropriate mitigation measures, the construction of the Pipelines between Budds Farm WTW and the WRP site has the potential to impact the existing built environment. This could be due to the creation of new preferential pathways for contaminants or ground gases to migrate. The creation of new preferential pathways has the potential to result in degradation of both utilities and concrete from aggressive attack. This could potentially compromise the integrity of buildings or utilities or lead to the migration and accumulation of ground gases in buildings resulting in explosions.

Sensitivity of receptor

11.8.85 The Pipelines cross Harts Farm Way and footpaths before connecting to the existing Budds Farm WTW. Additional commercial properties are located within 250m of the Pipelines.

11.8.86 Due to the presence of a highway and commercial buildings on or within 250m of the Pipelines, the sensitivity of the built environment is considered to be medium.

Magnitude of impact

11.8.87 Potential impacts to these identified receptors are considered to be localised to work areas and areas of potential contamination. Therefore, the magnitude of impact is considered to be low.

Significance of effect

11.8.88 The significance of effect to the built environment during the construction of the Pipelines is considered minor adverse which is not significant.

Impact 5: Impacts on agricultural land

11.8.89 As mentioned in paragraph 11.7.65, land within the area of the Pipelines between Budds Farm WTW and the WRP site has been proven to be non-agricultural in nature. As such, an assessment on the impacts on agricultural land in relation to contamination is not considered necessary for this area of the Proposed Development.

Pipelines between the Water Recycling Plant site and Bedhampton Springs

Proposed construction methodology

11.8.90 The Pipelines between the WRP site and Bedhampton Springs would each be approximately 750m in length. The Pipelines would commence at the WRP site and pass underneath the A27 and Mill Lane. From the boundary of the Bedhampton Springs site, the Pipelines would either be located above ground or below ground depending on the proximity to groundwater abstraction at Bedhampton Springs which is located within a SPZ 1 and depending on operational access requirements.

11.8.91 Two sections of trenchless construction works are required to account for the change in direction of the route of the pipelines. The first section of trenchless construction works would be from the WRP site to temporary construction compounds B1-1 located west of Mill Lane and south of the West Coastway Line railway (see ES Figure 1.1 Location of the Proposed Development and Order Limits, Volume III (Document reference 6.3, DCO Volume 6) for location of temporary construction compounds).

11.8.92 The shaft for trenchless construction works at the WRP site would have a minimum depth of approximately 17.00m below-ground level and a diameter of approximately 12.50m. The shaft within temporary construction compounds B1-1 would have a minimum depth of approximately 8m below-ground level and a diameter of approximately 10.50m. To avoid duplication, an assessment of the shaft for trenchless construction works at the WRP site has not been included within the assessment of the Pipelines. Instead, please refer to the 'Water Recycling Plant site' section for a discussion on potential impacts within this section of the Proposed Development.

11.8.93 The second section of trenchless construction works would be from temporary construction compounds B1-1 to temporary construction compounds B1-2 located east of Mill Lane and south of the West Coastway Line railway. The same shaft at temporary construction compounds B1-1 would be used for the first and second section of trenchless construction works. The shaft within temporary construction compounds B1-2 would have a minimum depth of approximately 7.00m below-ground level and a diameter of approximately 8.20m.

Summary of contaminant linkages requiring risk management

11.8.94 Following the completion of Proposed Development specific ground investigations, a refined source-pathway-receptor model has been developed and presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents). A summary of the refined model is provided in Table 11-45.

11.8.95 Although the Order Limits have been refined following the completion of Proposed Development specific ground investigations, the assessments presented below include areas where no risks have been identified have been included in light of the potential for unforeseen contamination to be present.

Table 11-45 Refined source-pathway-receptor model for the Pipelines between the Water Recycling Plant site and Bedhampton Springs

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
• Former corn mill and Bedhampton Mill • Railway • Open land (grass covered field) • Former sewage treatment works	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts and groundwater • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to an MMP • Development of remediation strategies for areas deemed to represent a potentially inacceptable risk to land quality and ground conditions receptors • Foundation Works Risk Assessment
	• Groundwater*	• Leaching through unsaturated and saturated soils		
	• Surface water	• Surface water runoff • Migration through groundwater and underground utilities		
	• Ecological sensitive sites	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases and vapours by animals		
	• Built environment	• Direct contact** • Migration of gases/vapours		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures

*Although not noted within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), the assessment presented within this chapter has considered the migration of contaminants via anthropogenic routes. **Although not noted within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), within this assessment direct contact relates to sulphate attack on concrete, hydrocarbon corrosion/permeation of plastic pipes. In addition, the assessment presented within this chapter considers both the future and existing built environment which differs from that presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) which considers the future built environment only.

Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts

11.8.96 Earthwork activities associated with the construction of the Pipelines between the WRP site and Bedhampton Springs, as well as the movement and storage of soils, have the potential to mobilise existing contamination. This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

11.8.97 As mentioned in section 11.7, both previous and Proposed Development specific phases of ground investigations have been undertaken within the area of the Pipelines. Analysis of soil samples collected during each phase of ground investigation did not identify the presence of contaminants in excess of their respective GAC values. Asbestos was also not identified within samples screened and no notable concentrations of contaminants were reported (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)).

11.8.98 Groundwater samples collected from within the area of the Pipelines all recorded concentrations of petroleum hydrocarbons in excess of the withdrawn WQS. Additionally, concentrations of metals (copper, manganese, nickel and zinc) were identified as being in excess of their respective GAC within superficial deposits (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 12 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)).

11.8.99 The presence of contaminated groundwaters could represent a risk to construction workers, landowners, land users and neighbouring land users if exposed during construction activities. Construction activities could create pollutant linkages through ingestion and direct dermal contact pathways (see Table 11-45).

11.8.100 In the event of exposing soils and storage of construction waste (including excavated soils), dust could be generated during dry and windy conditions. Under these conditions, and in the absence of appropriate mitigation measures, construction workers, landowners, land users and neighbouring land users could be temporarily exposed to contamination via the inhalation of potentially contaminated dusts.

11.8.101 Additionally, earthworks and trenchless construction works have the potential to change or create new preferential pathways allowing for any ground gases to migrate and accumulate in confined spaces. The potential risk from ground gas could represent a risk to the health of construction workers through asphyxiation and explosion should they be required to enter confined spaces during the construction phase.

Sensitivity of receptor

11.8.102 The sensitivity of construction workers, landowners, land users and neighbouring land users is considered to be high.

Magnitude of impact

11.8.103 Excavation and movement of materials would be required during the construction of the Pipelines. On a conservative basis, the impacts associated with the construction of the Pipelines could be present across the footprint of the Pipelines for the duration of the works. Potential impacts are; however, considered to be of short-term duration (occurring only during the works). Therefore, the magnitude of impact is considered to be low.

11.8.104 In relation to risks associated with the migration of ground gas, the impacts could, on a conservative basis, be present across the whole construction footprint of the Pipelines for the duration of the works. This could therefore represent both acute and chronic health risks. Prior to the implementation of mitigation, the magnitude of impact in relation to ground gas is considered to be high.

11.8.105 However, with the implementation of the tertiary mitigation measures described in section 11.4 and Table 11-45, which includes development of risk assessments and method statements and adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), the magnitude of impact is considered to be negligible for both risks associated with the excavation and movement of materials and ground gas.

Significance of effect

11.8.106 With the implementation of the tertiary mitigation measures, as described in section 11.4 and Table 11-45, the significance of effect on human health receptors during the construction of the Pipelines is considered minor adverse which is not significant.

Impact 2: Direct and indirect impacts on groundwater quality and groundwater resources

11.8.107 As mentioned previously in section 11.7, groundwater samples collected from within the area of the Pipelines between the WRP site and Bedhampton Springs all recorded concentrations of petroleum hydrocarbons in excess of the withdrawn WQS. Additionally, concentrations of metals (copper, manganese, nickel and zinc) were identified as being in excess of their respective GAC within superficial deposits.

11.8.108 In the absence of appropriate mitigation measures, direct impacts to the Principal Aquifer may occur from deep ground workings associated with trenchless construction works for the installation of the Pipelines beneath the A27 and Mill Lane. There is the potential for creating preferential pathways which may allow migration of pre-existing or new sources of contamination. There is also the potential for drilling mud/other contaminants to leak along the drill path, which could also result in contamination of groundwater.

11.8.109 Direct impacts to the Secondary A and Secondary Undifferentiated Aquifers within the superficial deposits may occur in the absence of appropriate mitigation measures due to the intrusive nature of the required earthworks for the launch and reception shafts for pipework installation. The significance of disturbance would be dependent on the depth of the aquifer unit in relation to the proposed depth of the

excavations, with superficial deposits at the surface at greater risk of direct impacts.

11.8.110 During construction, surface layers would be excavated at the launch and reception shafts for trenchless construction works, this may allow for a localised increase in infiltration of rainwater and surface run-off to the subsurface. This could, in the absence of appropriate mitigation measures, potentially mobilise residual contamination (if present) in the overlying unsaturated strata which could potentially migrate into the underlying superficial aquifers and bedrock aquifers (dependent of depth of aquifer units relative to depth of excavations).

11.8.111 Should groundwater within the aquifers underlying the Pipelines be impacted by the mobilisation of pre-existing sources of contamination or through the introduction of new sources of contamination, there is the potential for the impacted groundwater to be discharged into the Hermitage Stream. This in turn has the potential to impact sensitive ecological receptors (see Impact 3).

11.8.112 If required, dewatering of perched water or groundwater within excavations could also affect groundwater flow and water quality, resulting in impacts to the base flow of local watercourses/waterbodies.

11.8.113 There is also the potential for the introduction of new sources of contamination through, for example, the accidental release of lubricants, fuels and oils from construction machinery. This can occur as a result of spillages, leakage or storage. These can enter into the ground and subsequently into groundwater affecting groundwater quality.

Sensitivity of receptor

11.8.114 Due to the potential for groundwater within the superficial aquifers to discharge into surface water features that support ecologically important sites, the sensitivity of the Secondary A and Secondary Undifferentiated Aquifers is considered to be high.

11.8.115 The Principal Aquifers associated with the chalk bedrock are considered to be of high sensitivity, this is due to the presence of potable groundwater abstractions taken from the chalk. The SPZ 1 in the north-eastern part of the Pipelines is also considered to be of high sensitivity.

Magnitude of impact

11.8.116 Direct and indirect effects on superficial aquifers associated with excavation works (and any other associated construction activities, e.g. accidental spillages), changes to infiltration rates, surface water run-off and dewatering that may occur within the footprint of the Pipelines are predicted to be of local spatial extent within each aquifer unit. Should any such direct or indirect effects occur, the magnitude of impact for each aquifer is considered to be medium in the absence of appropriate mitigation measures as there is the potential for impacts to affect the local area.

11.8.117 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4 and Table 11-45, which includes adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1,

DCO Volume 7) and the adoption of a detailed CEMP, the magnitude of impact is reduced to negligible.

11.8.118 In the absence of appropriate mitigation, trenchless construction works has the potential to create a preferential pathway between PSCs, Principal Aquifers and SPZ 1. Dependent on the depth and thickness of the superficial aquifer units, there is also the potential for them to be affected by trenchless construction works.

11.8.119 Should a pathway be created, the magnitude of impact on the superficial aquifers (dependent of depth of aquifer units relative to depth of trenchless construction works), Principal Aquifers and SPZ 1 is considered to be high in the absence of appropriate mitigation measures as there is the potential for large scale and long-term impacts on groundwater quality and its suitability for potable abstractions.

11.8.120 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4, which includes undertaking hydrogeological risk assessments, adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) and the adoption of a detailed CEMP, the magnitude of impact is reduced to negligible.

Significance of effect

11.8.121 With the implementation of tertiary mitigation measures, as described in section 11.4 and Table 11-45, the significance of effect associated with construction of the Pipelines on water quality of the Principal, Secondary A and Secondary Undifferentiated Aquifers and SPZ 1 is considered to be minor adverse which is not significant.

Impact 3: Impacts on surface water quality and the ecological habitats they support from contamination

11.8.122 There are no Main Rivers located within the footprint of the Pipelines between the WRP site and Bedhampton Springs. However, there are tributaries of the Hermitage Stream present within the footprint of the Pipelines, with the Hermitage Stream itself present immediately east of the Pipelines.

11.8.123 As discussed in section 11.7, groundwater samples collected from within the area of the Pipelines all recorded concentrations of petroleum hydrocarbons in excess of the withdrawn WQS. Additionally, concentrations of metals (copper, manganese, nickel and zinc) were identified as being in excess of their respective GAC within superficial deposits (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)).

11.8.124 The earthworks and trenchless construction techniques required to enable the installation of the Pipelines have the potential to disturb pre-existing contamination (if present) and/or introduce new sources of contamination which could migrate and be released into surface water features via the following pathways:

1. Mobilisation and migration of soil contaminants or dissolved phase contaminants in groundwater by construction activities with subsequent release into surface waters.
2. Surface water run-off from contaminated Made Ground soils brought to the surface during construction.

3. Run-off from storage of potentially contaminated soils.
4. Migration of soil or groundwater contaminants into surface water drains during construction activities which then enter surface water.
5. Accidental spillage whilst handling, storing or treating contaminated water, fuel or other chemicals used during construction.
6. Alteration of the hydraulic regime of the local area as a result of the construction works.

Sensitivity of receptor

11.8.125 Any migration and discharge of contamination into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats that they support. The Pipelines cross tributaries of Main Rivers, including the Hermitage Stream to the immediate east of the Pipelines. As mentioned previously, the Hermitage Stream discharges into three designated sites (Chichester and Langstone Harbours Ramsar Site and SPA, Langstone Harbour SSSI and Solent Maritime SAC). Therefore, the sensitivity of surface water receptors is considered to be high.

Magnitude of impact

11.8.126 As discussed in section 11.7, surface water samples were collected from the Hermitage Stream as part of the previous phases of ground investigation conducted within the WRP site. Analysis of the surface water samples indicated that the surface water body continues to be impacted by on and off-site historical 'dilute and disperse' landfills (see ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)).

11.8.127 The magnitude of impact is conservatively considered to be high in the absences of appropriate mitigation measures due to the potential long-term impacts that may occur as a result of the disturbance and mobilisation of pre-existing contamination and/or the introduction of new sources of contamination. This is in addition to the impact that is already demonstrated to be occurring as a consequence of the historical 'dilute and disperse' landfill.

11.8.128 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4 and Table 11-45, which includes undertaking hydrogeological risk assessments, adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) and adoption of a detailed CEMP, the magnitude of impact is reduced to negligible.

Significance of effect

11.8.129 With the implementation of primary and tertiary mitigation measures described in section 11.4 and Table 11-45, the significance of effect on surface water quality and the ecological habitats they support during the construction of the Pipelines is considered to be minor adverse which is not significant.

11.8.130 Additional impacts relating to surface water quality and ecological habitats are provided in sections 8.8 and 19.8 of ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6) and ES Chapter

19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) respectively.

Impact 4: Potential impacts on the built environment

11.8.131 In the absence of appropriate mitigation measures, the construction of the Pipelines between the WRP site and Bedhampton Springs has the potential to impact the existing built environment. This could be due to the creation of new preferential pathways for contaminants or ground gases to migrate. The creation of new preferential pathways has the potential to result in degradation of both utilities and concrete from aggressive attack. This could potentially compromise the integrity of buildings or utilities or lead to the migration and accumulation of ground gases in buildings resulting in explosions.

Sensitivity of receptor

11.8.132 The route of the Pipelines crosses highways, public open spaces and footpaths as well as commercial areas. Additional commercial areas and residential properties are also present within 250m of the Pipelines.

11.8.133 Due to the presence of transport infrastructure, commercial and residential properties on or within 250m of the Pipelines, the sensitivity of the built environment is considered to be medium.

Magnitude of impact

11.8.134 Potential impacts to these identified receptors are considered to be localised to work areas and areas of potential contamination. Therefore, the magnitude of impact is considered to be low.

Significance of effect

11.8.135 The significance of effect to the built environment during the construction of the Pipelines is considered minor adverse which is not significant.

Impact 5: Impacts on agricultural land

11.8.136 As mentioned in paragraph 11.7.102, land within the area of the Pipelines between the WRP site and Bedhampton Springs has been proven to be non-agricultural in nature. Due to the absence of agricultural soils within the area of the Pipelines, an assessment of the impacts on agricultural land in relation to contamination is not considered necessary for this area of the Proposed Development.

Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Proposed construction methodology

11.8.137 During the testing of the installed Pipeline between the WRP site and Otterbourne WSW, water storage lagoons would be required. Testing of the installed Pipeline involves filling and pressurising sections of the Pipeline to check for leaks or other operational issues prior to final commissioning of the section of Pipeline. The water storage lagoons would be used to contain the potable water used for the testing of

the Pipeline and the cleaning of this water using a silt buster. They would comprise a lined shallow bunded area of land with a volume that would vary depending on commissioning requirements. The maximum dimensions for the water storage lagoons would be 60m x 60m and constructed to a maximum depth of 1m (see ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6)).

11.8.138 As mentioned previously, the assessment for constructing the Pipeline also covers the construction of AGP. The locations of AGP with respect to each component section of the Pipeline are described below.

Section D: The Water Recycling Plant Site to Portsdown Hill

11.8.139 Section D of the Pipeline comprises the section between the WRP site and Portsdown Hill. Section D would be constructed using tunnelling construction. The tunnel launch shaft would be located at the temporary construction compounds at the WRP site. The shaft at the WRP site would have a minimum depth of approximately 21.00m bgl and a diameter of approximately 15.00m. The tunnel reception shaft would be located within Section E (see below).

11.8.140 An intermediate tunnel shaft would be located within temporary construction compounds D-1 located south of Portsdown Hill Road (B2177) and west of Gillman Road which would be accessed directly from Gillman Road. The shaft within temporary construction compounds D-1 would have a minimum depth of approximately 65.00m bgl and a diameter of approximately 12.50m. This shaft would be backfilled, capped and reinstated to its existing condition following the completion of construction works.

Section E: Portsdown Hill to Boarhunt

11.8.141 Section E of the Pipeline comprises the section between Portsdown Hill and Boarhunt. This section of the Pipeline is anticipated to be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of eight temporary construction compounds and two water storage lagoons would be required within Section E.

11.8.142 Section E also includes the reception shaft of the tunnelled section described in Section D at temporary construction compounds E-1 located north of Portsdown Hill Road (B2177) which would be accessed directly from New Down Lane. The shaft within temporary construction compounds E-1 would have a minimum depth of approximately 11.00m bgl and a diameter of approximately 12.50m.

11.8.143 BPT/IPS-E would be located within Section E. The site for BPT/IPS-E is located on a hillside, and it would be cut into the sloping ground to reduce visual and landscape impacts. It is expected that a retaining wall of approximately 8.00m would be installed to support this. A cut and fill process would be implemented where any site won material from the cut exercise would balance the fill. Due to the scale of the cut undertaken for BPT/IPS-E, it is expected that the volume of excavated material will be greater than the fill material.

11.8.144 BPT/IPS-E would include a main building housing pumps and associated infrastructure, and a covered tank. The main building is expected to be constructed as a steel portal frame with insulated cladding and the tank is expected to be

constructed using reinforced concrete. The remaining elements of BPT/IPS-E would either be housed in a glass reinforced plastic (GRP) kiosk or be located outside any structures. It is expected that the main building and tank would have piled foundations, and that pad foundations would be used for the remaining areas of the site.

Section F: Boarhunt to Crockerhill

11.8.145 Section F of the Pipeline comprises the section between Boarhunt and Crockerhill. Where Section F intersects the River Wallington, trenchless construction methods would be utilised. temporary construction compounds F-1 and temporary construction compounds F-2 would be used to undertake the trenchless construction works.

11.8.146 The remaining parts of Section F would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of three temporary construction compounds and one water storage lagoon would be required within section F.

11.8.147 Construction works for IPS-F would be undertaken within temporary construction compounds F-3, which would be accessed from Chalk Lane.

11.8.148 Due to the existing topography of the site for IPS-F, the ground level would be levelled, and a retaining wall would be installed on the eastern side of the site. A cut and fill process would be implemented where any site won material from the cut exercise would balance the fill.

11.8.149 IPS-F would include a main building housing pumps and associated infrastructure. This building is expected to be constructed as a steel portal frame with insulated cladding. The remaining elements of IPS-F would either be housed in a GRP kiosk or be located outside any structures. It is expected that the main building would have piled foundations, and that pad foundations would be used for the remaining areas of the site.

Section G: Crockerhill to Wickham

11.8.150 Section G of the Pipeline comprises the section between Crockerhill to Wickham. Trenchless construction works would be utilised where the Pipeline crosses the River Meon, Hoad's Hill and Winchester Road. The remaining parts of Section G would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at other environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of seven temporary construction compounds and one water storage lagoon would be required within Section G.

11.8.151 Construction works for IPS-G would be undertaken within temporary construction compounds G-6, which would be accessed from Titchfield Lane. Minor levelling at the site of IPS-G may be required to provide a level surface for the site, and a retaining wall may be required to support this. A cut and fill process would be implemented where any site won material from the cut exercise would balance the fill.

11.8.152 IPS-G would include a main building housing pumps and associated infrastructure. This building is expected to be constructed as a steel portal frame with insulated cladding. The remaining elements of IPS-G would either be housed in a GRP kiosk or be located outside any structures. It is expected that the main building would have piled foundations, and that pad foundations would be used for the remaining areas of the site.

Section H: Wickham to Shedfield

11.8.153 Section H of the Pipeline comprises the section between Wickham and Shedfield. Section H intersects with high Street and Winchester Road (B2177). The intersection with high Street would be constructed using trenchless construction works between temporary construction compounds H-3 and temporary construction compounds H-4.

11.8.154 The intersection with Winchester Road (B2177) would be constructed using trenchless construction works between temporary construction compounds H-5 and temporary construction compounds J-1 (located in Section J).

11.8.155 The remaining parts of Section H would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of five temporary construction compounds would be required in Section H.

Section J: Shedfield to the River Hamble

11.8.156 Section J of the Pipeline comprises the section between Shedfield to the River Hamble. Section J intersects with St Anne's Lane and Botley Road (B3035). The intersection with St Anne's Lane would also be constructed in-combination with the trenchless construction works that would be used at the intersection with Winchester Road (B2177) as described in Section H.

11.8.157 The intersection with Botley Road (B3035) would be constructed using trenchless construction works between temporary construction compounds J-3 and temporary construction compounds K-1 (located in Section K).

11.8.158 The remaining parts of Section J would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of three temporary construction compounds would be required in Section J.

Section K: The River Hamble to Lower Upham

11.8.159 Section K of the Pipeline comprises the section between the River Hamble and Lower Upham. Section K intersects the River Hamble and Winters Hill. The intersection with the River Hamble would be constructed in-combination with the trenchless construction works that would be used at the intersection with Botley Road (B3035) as described in Section J.

11.8.160 The intersection with Winters Hill would be constructed using trenchless construction works between temporary construction compounds K-4 and temporary construction compounds K-5.

11.8.161 The remaining parts of Section K would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at other environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of six temporary construction compounds would be required for Section K.

11.8.162 Construction works for BPT-K would be undertaken within temporary construction compounds K-6, which would be accessed from Winchester Road (B2177). The site for BPT-K is located on a hillside and would be partially buried within the hillside which would require levelling or terracing of the site. A retaining wall would be required to support this. A cut and fill process would be implemented where any site won material from the cut exercise would balance the fill.

11.8.163 BPT-K would include a tank and a valve building. These buildings are expected to be constructed using reinforced concrete or brick. The remaining elements of BPT-K would either be housed in a GRP kiosk or be located outside any structures. It is expected that the tank would have piled foundations, and that pad foundations would be used for the remaining areas of the site.

Section L: Lower Upham to Brambridge

11.8.164 Section L of the Pipeline comprises the section between Lower Upham and Brambridge. Section L intersects with Winchester Road (B3354), Bow Lake and an upstream tributary of the River Itchen. The intersection with a watercourse and woodland at Store House Gully would be constructed using trenchless construction works between temporary construction compounds L-2 and temporary construction compounds L-3.

11.8.165 The intersection with Winchester Road (B3354) would be constructed using trenchless construction works between temporary construction compounds L-5 and temporary construction compounds L-6.

11.8.166 The intersection with Bow Lake would be constructed using trenchless construction works between temporary construction compounds L-7 and temporary construction compounds L-8.

11.8.167 The intersection with an upstream tributary of the River Itchen would be constructed using trenchless construction works between temporary construction compounds L-9 and temporary construction compounds L-10.

11.8.168 The remaining parts of Section L would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at other environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of ten temporary construction compounds and two water storage lagoons would be required within Section L.

Section M: Brambridge to Otterbourne Water Supply Works

11.8.169 Section M of the Pipeline comprises the section between Highbridge Road and Otterbourne Water Supply Works. Section M intersects with the River Itchen and an upstream tributary of the River Itchen.

11.8.170 The intersection with the River Itchen would be constructed using trenchless construction works between temporary construction compounds L-10 (located in Section L) and temporary construction compounds M-1. The trenchless

construction works at the intersection of the River Itchen would be at a depth of approximately 15.00m bgl. The launch shaft for the trenchless construction works would be at temporary construction compounds L-10, and would have a minimum depth of approximately 13.00m bgl and a diameter of approximately 10.50m. The reception shaft within temporary construction compounds M-1 would have a minimum depth of approximately 8.00m bgl and a diameter of approximately 9.00m.

11.8.171 The intersection with an upstream tributary of the River Itchen would be constructed using trenchless construction works between temporary construction compounds M-2 and temporary construction compounds M-3.

11.8.172 The remaining parts of Section M would be constructed using trenched open-cut construction; however, trenchless construction works may be utilised at other environmentally sensitive locations (see Outline CEMP (Document reference 7.1, DCO Volume 7)). A total of three temporary construction compounds would be required within Section M.

11.8.173 Section M will also comprise a works area for Invasive Non-Native Species (INNS) Treatment within the footprint of Otterbourne WSW to avoid introducing pathways for the spread of INNS into the surrounding environment. The INNS Treatment would comprise repurposing an existing tank and development of a treatment plant. The existing tank can be repurposed as this area of the site will become redundant as part of the upgrades to Otterbourne WSW. The treatment plant would either be housed within an existing redundant building, or a new building would be developed.

Summary of contaminant linkages requiring risk management

11.8.174 Following the completion of Proposed Development specific ground investigations, a refined source-pathway-receptor model has been developed and presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 to 5 and 7 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents). A summary of the refined model is provided in Table 11-46.

11.8.175 Although the Order Limits have been refined following the completion of Proposed Development specific ground investigations, the assessments presented below include areas where no risks have been identified have been included in light of the potential for unforeseen contamination to be present.

Table 11-46 Refined source-pathway-receptor model for the Pipeline between the Water Recycling Plant site and Otterbourne Water Supply Works

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
Section D – ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 2 of 18 documents)				
• Open land (grass covered field) • Former corn mill • Railway	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts, contaminated groundwater and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to an MMP • Development of remediation strategies for areas deemed
	• Groundwater	• Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Runoff or discharges to surface water via existing drainage network, recharge of surface water via contaminated groundwater and deposition of wind-blown dust		
	• Ecological sensitive sites**	• Runoff or discharges to surface water via existing drainage network, recharge of surface water via contaminated groundwater and deposition of wind-blown dust		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
				to represent a potentially inacceptable risk to land quality and ground conditions receptors • Foundations Works Risk Assessment
Section E - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 3 of 18 documents)				
• Pits (unspecified and chalk) • Water works (including reservoir) • Kilns • Made Ground/infilled ground • Parchow Groundworks • Landfill	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment
	• Groundwater	• Leaching through unsaturated and saturated soils • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles to surface watercourses and migration through groundwater and underground utilities		
	• Ecological sensitive sites**	• Plant uptake, direct contact, ingestion and inhalation of soils/dusts, gases, and vapours by animals		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
	• Built environment* (BPT/IPS-E)	• Gas and vapour migration and accumulation • Direct contact with materials		• Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to an MMP
Section F - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 4 of 18 documents)				
• Crockerhill Former Brickworks • Albany Farm Historical Landfill • Pits – clay, sand and chalk	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of
	• Groundwater	• Leaching through unsaturated and saturated soils • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater and underground utilities		
	• Built environment* (IPS-F)	• Gas and vapour migration and accumulation including via anthropogenic routes i.e. pipe bedding*** • Direct contact with materials		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
				Practice to manage the re-use of excavated soils • Development and adherence to an MMP
Section G - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 5 of 18 documents)				
• Pits – various • Motorhome repair/vehicle maintenance garage • Wickham WTW	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of
	• Groundwater	• Leaching through unsaturated and saturated soil • Leaching/permeation of granular soils and migration via anthropogenic routes*** • Trenchless construction works beneath the River Meon may create a preferential pathway for contamination to impact groundwater		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater and underground utilities		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
	• Built environment* (IPS-G)	• Gas and vapour migration and accumulation including via anthropogenic routes i.e. pipe bedding*** • Direct contact with materials		Practice to manage the re-use of excavated soils • Development and adherence to an MMP
Section H - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 6 of 18 documents)				
• Shirrell Heath Sand Pit Landfill • Pit – gravel, sand • Worked ground • Former Pig Farm (potential)	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of
	• Groundwater	• Leaching through unsaturated and saturated soil • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater and underground utilities		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
				Practice to manage the re-use of excavated soils • Development and adherence to an MMP
Section J - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for document 7 of 18 documents)				
• Industrial Estate - Woodmans Farm • Ash House Farm Landfill • Rossgarth Landfill • Pit – Sand	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils
	• Groundwater	• Leaching through unsaturated and saturated soil • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater and underground utilities		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
				• Development and adherence to an MMP
Section K - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 8 of 18 documents)				
• Infilled channels • Former pond • Made Ground/ worked ground • Wintershill Hall (military/civilian base)	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts (and asbestos fibres) • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to an MMP
	• Groundwater	• Leaching through unsaturated and saturated soil • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater and underground utilities		
	• Built environment* (BPT-K)	• Direct contact and gas migration/accumulation including via anthropogenic routes i.e. pipe bedding***		

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
Section L - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 9 of 18 documents)				
• Crowd Hill Landfill • Embankment (located adjacent to Winchester Road)	• Human health	• Direct dermal contact (soil and groundwater), ingestion and inhalation of soils/dusts (and asbestos fibres) • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to an MMP
	• Groundwater	• Leaching through unsaturated and saturated soil • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater and underground utilities		
	• Built environment	• Gas and vapour migration and accumulation including via anthropogenic routes i.e. pipe bedding***		
Section M - ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for document 10 of 18 documents)				

Source	Receptor	Pathway	Proposed Development phase	Risk Reduction Measures
• Open field (agricultural)	• Human health	• Direct dermal contact, ingestion and inhalation of soils/dusts • Inhalation of gases and vapours	• Construction • Operation • Decommissioning	Measures included within the Outline CEMP (Document reference 7.1, DCO Volume 7), for example: • Development and adherence to risk assessments and method statements protective of human health, the environment and controlled waters • Development of a plan for dealing with unforeseen contamination, including a watching brief and discovery strategy during groundworks • Appropriate storage of contaminated soils, e.g. placement on impermeable surfaces • Foundations Works Risk Assessment • Adoption of CL:AIRE Definition of Waste: Code of Practice to manage the re-use of excavated soils • Development and adherence to an MMP
	• Groundwater	• Leaching through unsaturated and saturated soil • Leaching/permeation of granular soils and migration via anthropogenic routes***		
	• Surface water	• Surface water runoff from stockpiles • Migration through groundwater		
	• Ecological sensitive sites**	• Plant uptake, direct contact, ingestion and inhalation of dusts, gases, and vapours by animals		

In all instances only relevant pathways have been considered in the assessment, for example windblown dust will not be an issue where tunnelling is being undertaken. This means that not all pathways are applicable for all Sections of the Pipeline, ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) should be referred to for a detailed assessment as this assessment in this ES chapter is intended to be a high level overview and not an exhaustive detailed assessment. *Although not noted within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0

– for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents), within this assessment direct contact relates to sulphate attack on concrete and hydrocarbon corrosion/permeation of plastic pipes. In addition, the assessment presented within this chapter considers both the future and existing built environment which differs from that presented within ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) which considers the future built environment only. Where there are no proposed buildings with each section of the Pipeline, built environment receptors have not been included within the above table. **Only applicable where designated ecological sites have been identified within 250m of the Pipelines, where it is not included within the table no designated sites (e.g. SSSI) have been identified within the land quality and ground conditions study area. ***Although not noted within ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents) , the assessment presented within this chapter has considered the migration of contaminants via anthropogenic routes including via groundwater and ground gas as applicable.

Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts

11.8.176 Earthworks and piling activities associated with the construction of the Pipeline between the WRP site and Otterbourne WSW, as well as the movement and storage of soils, have the potential to mobilise existing ground contamination (where present, for example where the Pipeline interacts with historical pits, landfills and infilled ground – see section 11.7). This could result in impacts to human health through dermal contact, inhalation and ingestion of contaminants.

11.8.177 As mentioned in section 11.7, a series of ground investigations (inclusive of previous phases and Proposed Development specific ground investigations) have been undertaken along the route of the Pipeline. Analysis of soil samples collected during each of the phases of ground investigation identified the presence of asbestos in Section G, K and L (noting that screening was not undertaken on all scheduled samples). An exceedance of the GAC for lead was recorded in one sample of Made Ground collected from Section J, which crosses the Rossgarth and Ash House Farm landfills. Notable concentrations of TPH, sulphate, creosols, cadmium, copper, lead, iron, total PAH, trimethylphenol and 1,2,4-trimethylbenzene were recorded in soil samples collected from both the Made Ground and natural soils within the Order Limits for the Pipeline.

11.8.178 In addition to the contaminants identified within soil samples, groundwater samples recorded exceedances of GAC for metals, cyanide, E.Coli, phenol, sulphate, chloride, TPH, PAH, ammonium (NH_4), nitrite (NO_2) and total ammonia (N) (see section 11.7). Faecal coliforms, faecal streptococci and total coliforms (which do not have GACs) were also identified within a groundwater sample collected from the Whitecliff Sand Member (located below a WTW in Section G).

11.8.179 The presence of these contaminants could represent a risk to construction workers, landowners, land users and neighbouring land users if exposed during construction activities. Construction activities, particularly earthworks during shaft construction, could disturb and expose construction workers, landowners, land users and neighbouring land users to contamination associated with historical and current land uses. Construction activities could create pollutant linkages through ingestion, inhalation and direct dermal contact pathways (see Table 11-46).

11.8.180 In the event of exposing soils and storage of construction waste (including excavated soils), dust could be generated during dry and windy conditions. Under these conditions, and in the absence of appropriate mitigation measures, construction workers, landowners, land users and neighbouring land users could be temporarily exposed to contamination via the inhalation of potentially contaminated dusts.

11.8.181 Additionally, excavation, trenchless construction works and tunnelling activities for the Pipeline have the potential to create a preferential pathway for ground gases to migrate and accumulate in confined spaces. An assessment of ground gas monitoring results within the interpretative reports which support this chapter (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)) highlighted the need for ground gas data to be considered at the preconstruction phase in

terms of risks to groundworkers, specifically those working within the temporary deep excavations associated with the planned trenchless construction works. The potential risks from ground gas could represent a risk to human health through asphyxiation and explosion.

Sensitivity of receptor

11.8.182 Construction workers are considered to be the most sensitive receptors as the activities that they are engaged in constitute more direct exposure routes over a longer period of time.

11.8.183 The sensitivity of construction workers, landowners, land users and neighbouring land users is considered to be high.

Magnitude of impact

11.8.184 During the construction phase of the Pipeline, excavation and movement of materials would be required. On a conservative basis, the impacts associated with the construction of the Pipeline could be present across the whole construction footprint for the duration of the works. Potential impacts are; however, considered to be of short-term duration (occurring only during the works). The magnitude of impact is therefore considered to be low.

11.8.185 In relation to risks associated with the migration of ground gas, the impacts could, on a conservative basis, be present across the whole construction footprint of the Pipelines for the duration of the works. This could therefore represent both acute and chronic health risks. Prior to the implementation of mitigation measures, the magnitude of impact in relation to ground gas is considered to be high.

11.8.186 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4 and Table 11-46, which includes developing and adhering to risk assessments and method statements, incorporating ground gas protection measures (see Design Principles Document (Document reference 5.11, DCO Volume 5)) and adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), the magnitude of impact is considered to be negligible for both risks associated with the excavation and movement of materials and ground gas.

Significance of effect

11.8.187 With the implementation of primary and tertiary mitigation measures included in section 11.4 and Table 11-46, the significance of effect on human health receptors during the construction of all sections is considered minor adverse which is not considered to be significant.

Impact 2: Direct and indirect impacts on groundwater quality and groundwater resources

11.8.188 As mentioned previously in section 11.7, groundwater samples collected from both Made Ground and natural deposits recorded concentrations of contaminants in excess of their respective GAC.

11.8.189 Direct impacts to the Secondary A and Secondary Undifferentiated Aquifers within the superficial deposits may occur in the absence of appropriate mitigation

measures due to the intrusive nature of the earthworks required to install the Pipeline between the WRP site and Otterbourne WSW. The significance of disturbance would be dependent on the depth of the aquifer unit in relation to the proposed depth of excavations.

11.8.190 As mentioned previously, water storage lagoons would be created within Sections E, F, G and L. The water storage lagoons would hold the water required for cleaning and hydro-testing of the Pipeline prior to operation. As with the potential impacts to superficial aquifers from earthwork activities associated with the installation of the Pipeline, the significance of disturbance during construction of the water storage lagoons would be dependent on the depth of the water storage lagoons (maximum of 1m) relative to the depth of the aquifer units, with superficial aquifers present at the surface at greater risk of direct impacts. Once constructed, the water storage lagoons would be bunded and lined (see ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6) for additional details).

11.8.191 During construction, surface layers would be excavated which may allow for increased infiltration of rainwater and surface run-off to the subsurface. This could, in the absence of appropriate mitigation measures, potentially mobilise residual contamination already present in the overlying unsaturated strata which could potentially migrate into the underlying shallow superficial aquifers impacting upon groundwater quality.

11.8.192 Direct impacts to the Principal Aquifers, Secondary A Aquifers (bedrock aquifers) and SPZs could occur from the deep ground workings related to trenchless construction operations and tunnelling. In the absence of appropriate mitigation, trenchless construction works and tunnelling required as part of the construction of the Pipeline have the potential to create preferential pathways and for drilling mud/other contaminants to leak along the drill path, which could cause contamination of groundwater. The volume of drilling fluids that could be released during trenchless construction/tunnelling works is dependent upon a number of factors, including the size of the fracture, the permeability of the geological material, the viscosity of the drilling fluid and the pressure of the drilling system.

11.8.193 There is the potential for groundwater within the underlying aquifers to be impacted by the mobilisation of pre-existing sources of contamination as a result of construction activities, inclusive of open-cut, trenchless construction and tunnelling methods of installation. There is also the potential for new sources of contamination to be introduced to the aquifers as a result of construction works. Should the groundwater be impacted, there is a potential for it to be discharged into surface water features, some of which discharge into or form part of designated environmentally sensitive sites including the River Itchen SSSI and SAC. This in turn has the potential to impact sensitive ecological receptors within the designated sites (see Impact 3 below).

11.8.194 If required, dewatering of perched water or groundwater within excavations could also affect groundwater flow and water quality. This may result in impacts to base flow of local water courses/waterbodies or impacts to groundwater abstractions.

11.8.195 In addition, during construction there is the potential for accidental release of lubricants, fuels and oils from construction machinery, including tunnel boring machines. This may occur as a result of leakages from the machines themselves or through spillages at storage locations (e.g. temporary construction compounds,

launch and reception shafts and tunnel shaft locations). These can enter into the ground and subsequently into groundwater, resulting in potentially adverse effects on groundwater quality.

Sensitivity of receptor

11.8.196 Due to the potential for groundwater within the superficial aquifers to discharge into surface water features that support ecologically important sites, the sensitivity of the Secondary A and Secondary Undifferentiated Aquifers is considered to be high.

11.8.197 The Principal and Secondary A Aquifers related to the underlying bedrock and associated SPZ, are considered to be of high sensitivity. It should however be noted that should the superficial aquifers be brackish or saline in nature (with particular reference to Section D), the potential for potable abstractions is considered unlikely.

Magnitude of impact

11.8.198 Direct and indirect effects on superficial aquifers associated with excavation works (and any other associated construction activities, e.g. accidental spillages), changes to infiltration rates, surface water run-off and dewatering that may occur within the footprint of the Pipelines during the construction phase are predicted to be of local spatial extent within each aquifer unit. Should any such direct or indirect effects occur, the magnitude of impact for each aquifer unit is considered to be medium as there is the potential for impacts to affect the local area.

11.8.199 Trenchless construction works, piling and tunnelling have the potential to create a preferential pathway between sources of contamination and the Principal Aquifers, Secondary A Aquifers (bedrock) and SPZs. Dependent on the depth and thickness of the superficial aquifer units, there is also the potential for them to be affected by trenchless construction techniques, piling and tunnelling activities. Should a pathway be created, the magnitude of impact on Principal Aquifers, Secondary A and Secondary Undifferentiated Aquifers and SPZs is considered to be high in the absence of appropriate mitigation measures as there is the potential for large scale, long-term impacts on groundwater quality.

11.8.200 However, with the implementation of the primary and tertiary mitigation measures described in section 11.4 and Table 11-46, which includes adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7) undertaking hydrogeological risk assessments and the adoption of a detailed CEMP, the magnitude of impact is reduced to negligible for each of the elements discussed above.

Significance of effect

11.8.201 With the implementation of primary and tertiary mitigation measures described in section 11.4 and Table 11-46, the significance of effect associated with construction of the Pipelines on groundwater quality and groundwater resources is considered minor adverse which is not significant.

Impact 3: Impacts on surface water quality and the ecological habitats they support from contamination

11.8.202 Construction of the Pipeline between the WRP site and Otterbourne WSW would require the use of trenchless construction works and tunnelling beneath existing infrastructure, Main Rivers and other surface water features. As discussed in section 11.7, groundwater samples collected from both Made Ground and natural deposits recorded concentrations of contaminants in excess of their respective GAC which may represent a risk to surface waterbodies and the ecological habitats they support (see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents)).

11.8.203 Installation of the Pipeline would require substantial earthworks in addition to the need for trenchless construction works and tunnelling. These activities have the potential to disturb potential pre-existing and/or introduce new sources contamination which could migrate and be released into surface waters via the following pathways:

1. Mobilisation and migration of soil contaminants or dissolved phase contaminants in groundwater by construction activities with subsequent release into surface waters.
2. Surface water run-off from contaminated Made Ground soils brought to the surface during construction.
3. Run-off from storage of potentially contaminated soils.
4. Migration of soil or groundwater contaminants into surface water drains during construction activities which then enter surface water.
5. Accidental spillage whilst handling, storing or treating contaminated water, fuel or other chemicals used during construction.
6. Alteration of the hydraulic regime of the local area as a result of the construction works.

Sensitivity of receptor

11.8.204 Any migration and discharge of contamination into surface waters could lead to a reduction in surface water quality and impact on the ecological habitats that they support. The Pipeline crosses several Main Rivers, some of which discharge into or form part of designated environmentally sensitive sites (see section 11.7). Therefore, the sensitivity of surface waters is considered to be high. It should, however, be noted that not all surface water features within the footprint of the Pipeline are associated with designated environmentally sensitive sites and so may have a lower sensitivity.

11.8.205 Additional impacts related to ecological habitats and surface water quality are provided in sections 8.8 and 19.8 of ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6) and ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) respectively.

Magnitude of impact

11.8.206 Proposed Development specific ground investigations recorded the presence of Made Ground associated with both historical landfills and other PSCs (see section 11.7). Should the historical landfills have operated under a 'dilute and disperse' approach, there is the potential for the magnitude of impact to be high in the absence of appropriate mitigation measures due to the potential long-term impacts that may occur as a result of the disturbance and mobilisation of pre-existing contamination. There is also the potential for new sources of contamination to be introduced as a result of construction activities. However, with the implementation of the primary and tertiary mitigation measures described in section 11.4 and Table 11-46, including the undertaking hydrogeological risk assessments and adherence to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), the magnitude of impact is reduced to negligible.

Significance of effect

11.8.207 With the implementation of primary and tertiary mitigation measures described in section 11.4 and Table 11-46, the significance of effect on surface water quality and the ecological habitats they support during the construction of the Pipeline is considered to be minor adverse which is not significant.

11.8.208 Additional impacts relating to surface water quality and ecological habitats are provided in sections 8.8 and 19.8 of ES Chapter 8 Terrestrial and freshwater biodiversity, Volume I (Document reference 6.1, DCO Volume 6) and ES Chapter 19 Water environment, Volume I (Document reference 6.1, DCO Volume 6) respectively.

Impact 4: Potential impacts on the built environment

11.8.209 In the absence of appropriate mitigation measures, the construction of the Pipeline between the WRP site and Otterbourne WSW has the potential to impact on the existing built environment. This may be through creating new preferential pathways for contaminants or ground gases to migrate that may lead to the degradation of utilities and concrete from aggressive attack. This could potentially compromise the integrity of buildings, utilities or facilitate the migration of ground gases into buildings resulting in explosions.

Sensitivity of receptor

11.8.210 The route of the Pipeline crosses multiple residential areas, commercial areas, highways, railway lines, parks and leisure facilities. These features are also present within the 250m buffer zone. In relation to Sections D, L and M of the Pipeline, the route is located within 250m of scheduled monuments.

11.8.211 With reference to Table 11-9, due to the presence of commercial and residential properties both within the area of the Pipeline and the 250m buffer zone, the sensitivity of the built environment is considered to be medium.

11.8.212 For Sections D, L and M of the Pipeline, which have scheduled monuments located within 250m, the sensitivity is considered to be high.

Magnitude of impact

11.8.213 As mentioned previously, Section D of the Pipeline would be constructed as a tunnel due to the developed nature of the route. The launch and reception shafts would be at minimum depths of between 11.00m and 21.00m bgl. An intermediate tunnel shaft would be at a minimum depth of 65.00m bgl within Section D of the Pipeline. Where tunnelling is required, the magnitude of impact is considered to be negligible due to the depth of the tunnel and shafts relative to built environment receptors (inclusive of scheduled monuments).

11.8.214 Where shallow earthworks, open-cut, piling and trenchless construction methods are to be used as part of the construction of the Pipeline, these would be located within 250m of the previously identified built environment receptors. Potential impacts to the built environment in these areas are considered to be localised to the work area and areas of contamination. Therefore, the magnitude of impact is considered to be low.

11.8.215 In relation to shallow earthworks, open-cut, piling and trenchless construction methods employed in areas adjacent to scheduled monuments, the magnitude of impact is considered to be negligible. This is due to the scheduled monuments within the vicinity of where these construction methods would be employed comprising of a former field boundary and moat (Sections L and M) which have limited potential for structural and/or cosmetic damage to occur as a result of construction works.

Significance of effect

11.8.216 The significance of effect on the built environment during the construction of the Pipelines is considered minor adverse, which is not significant.

Impact 5: Impacts on agricultural land

11.8.217 As mentioned in section 11.7, Proposed Development specific ground investigations and surveys have identified the presence of ALC Grades 1 – 4 agricultural land and areas of non-agricultural land along the route of the Pipeline between the WRP site and Otterbourne WSW.

11.8.218 Due to the nature of the land use along the route of the Pipeline, it would not be possible to avoid agricultural land. As mentioned in section 11.7, localised areas along the route of the Pipeline with a history of potentially contaminative uses have been identified. These areas have the potential to represent a contamination risk to agricultural land. Where Proposed Development specific ground investigations have been undertaken, exceedances of GAC protective of human health and controlled waters have been identified within soil, soil-leachate and groundwater samples analysed (see ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II (Document reference 6.2, DCO Volume 6, Version 0 – for documents 1 to 5, 7 and 11 to 14 of 18 documents) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 6, 8 to 10 and 15 to 18 of 18 documents).

11.8.219 Construction activities therefore have the potential to mobilise pre-existing sources of contamination in identified areas, or, due to the intrusive nature of construction activities create new preferential pathways. There is also the potential for new

sources of contamination to be introduced which may have adverse impacts on agricultural land.

11.8.220 Discussions in relation to potential impacts associated with construction on agricultural land beyond the impacts related to contaminated land can be found in ES Chapter 12 Land use and agriculture, Volume I (Document reference 6.1, DCO Volume 6).

Sensitivity of receptor

11.8.221 With reference to Table 11-9, due to the presence of ALC Grade 1 - 3a land the sensitivity of the receptor is considered to be high.

Magnitude of impact

11.8.222 During the construction phase of the Pipeline, excavation and movement of materials would be required. On a conservative basis, the impacts associated with the construction of the Pipeline could be present across the whole construction footprint for the duration of the works. Potential impacts are, however, considered to be of short-term duration (occurring only during the works). Therefore, the magnitude of impact is considered to be low.

11.8.223 However, with the implementation of the tertiary mitigation measures described in section 11.4 and Table 11-46, which includes adhering to good construction practices as set out in the Outline CEMP (Document reference 7.1, DCO Volume 7), the magnitude of impact is considered to be negligible.

Significance of effect

11.8.224 With the implementation of tertiary mitigation measures included in section 11.4 and Table 11-46, the potential impacts associated with the construction works required for the Pipeline are negligible on a high sensitivity receptor. Therefore, the significance of effect is considered minor adverse which is not significant.

Above Ground Plant

11.8.225 The AGP which includes the BPT and IPS, would be located along the Pipeline between the WRP site and Otterbourne WSW. As such, a separate assessment of the potential impacts associated with the AGP has not been undertaken and reference should be made to the previous sections.

Invasive Non-Native Species Treatment at Otterbourne Water Supply Works

11.8.226 The INNS Treatment would be located within the Order Limits for the Otterbourne WSW. As such, a separate assessment of the potential impacts associated with the INNS treatment has not been undertaken and reference should be made to the previous Pipeline between the WRP site and Otterbourne WSW in previous sections.

Operational effects

Water Recycling Plant site

Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts

11.8.227 As described in ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6), maintenance works associated with the operation of the WRP site are anticipated to be undertaken during the operational life of the Proposed Development. Should there be a requirement to undertake unplanned works, for example replacement of infrastructure, during the operational phase there may be a requirement for soils to be excavated.

11.8.228 Should contaminated materials be brought to the surface through excavation during the operational phase, and no mitigation measures are implemented, these materials could be permanently exposed at the surface. This creates the potential for maintenance workers, workers required to run the WRP site, landowners, land users and neighbouring land users to come into direct contact with contaminated materials left in-situ through dermal contact, inhalation and ingestion of contaminants.

11.8.229 If materials with a differing porosity to that of the surrounding environment (for example, a more porous material such as coarse hardcore) are used to backfill excavations, there is the potential for ground gases to migrate from the area below the WRP site. This may lead to an accumulation of ground gases within the infrastructure associated with the WRP site accessed by maintenance workers and workers required to operate the plant. The risks associated with the accumulation of ground gases to these workers include asphyxiation and explosion.

11.8.230 Ground investigations undertaken within the WRP site have identified the presence of gassing materials within the historical landfill with a subsequent CS3 assigned to the WRP site following an assessment of ground gas monitoring results (see section 11.7 and ES Appendix 11.2 Geotechnical and geo-environmental reports, Volume II (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)).

Sensitivity of receptor

11.8.231 The sensitivity of operation and maintenance workers, landowners, land users and neighbouring land users is considered to be high.

Magnitude of impact

11.8.232 The impacts associated with the operational phase of the WRP site could be present across the whole operational footprint for the Proposed Development's lifetime (assumed to be a minimum of 100 years). Noting, however, that natural degradation of contaminants and a reduction in ground gas and leachate production would occur over this time period. The WRP site will be suitable for use following construction with the design taking account of required mitigation measures; such as designing for a Characteristic Situation 3 for landfill gas and the WRP itself forming a barrier to prevent exposure to the underlying waste. Should excavation works be required during the operational phase, the impacts

from this are predicted to be of local spatial extent (localised to areas where contamination may be present and to areas where excavation works may be required).

11.8.233 Any such work would be undertaken with knowledge of the underlying ground conditions, employing task specific risk assessment and method statements which would ensure that the appropriate mitigation measures protective of human health are implemented (for example, the use of appropriate PPE), as set out in the Operational Environmental Management Plan (Document reference 7.7, DCO Volume 7). Once completed, these excavation works would be completed by re-encapsulating the underlying waste in order to maintain the barrier to future exposure. Therefore, the magnitude of impact is considered to be negligible.

Significance of effect

11.8.234 With the implementation of both primary and tertiary mitigation measures described in section 11.4 and Table 11-43, the significance of effect on human health receptors during the operation of the WRP site is considered minor adverse which is not significant.

Impact 2: Impact on controlled waters (groundwater and surface waters)

11.8.235 Maintenance activities at the WRP site have the potential to mobilise pre-existing contamination or introduce new sources of contamination through the leakage or spillage of fuels, oils or other chemicals from machinery, vehicles or operational equipment. This could impact upon groundwater and water quality within the underlying Secondary A, Secondary Undifferentiated and Principal Aquifers and the Hermitage Stream respectively via, for example, downwards migration of contaminants or surface run-off into the Hermitage stream.

11.8.236 In addition, should excavation works be required there is the potential for direct impacts to the underlying Secondary A, Secondary Undifferentiated and Principal Aquifers to occur, which in turn could discharge into the neighbouring Hermitage Stream and lead to a reduction in both groundwater and surface water quality. This would be dependent on the depth of the required excavation relative to the depth of the underlying aquifers.

11.8.237 During the operational phase of the Proposed Development, the production of landfill leachate should decrease on the basis that infiltration from the surface would be vastly reduced through the presence of hardstanding. This would in turn result in a reduction in ammonium and the possibility for nitrate potential to occur and therefore betterment. It is considered that there would be minimal risk for an increase in nitrate potential to occur during the operation of the WRP site.

Sensitivity of receptor

11.8.238 Any migration and discharge of pre-existing or new sources of contamination into groundwater or surface water features through direct or indirect pathways (for example, infiltration, surface run-off or discharge of groundwater into surface water features) could lead to a reduction in groundwater and surface water quality. Should there be a reduction in either groundwater or surface water quality, there is the potential for impacts on the ecological habitats which they support.

11.8.239 Although there are no designated ecologically sensitive areas within the operational footprint of the WRP site, three designated sites are located within 250m (Chichester and Langstone Harbours Ramsar and SPA, Langstone Harbour SSSI and Solent Maritime SAC) which interact with the Hermitage Stream located to the east of the WRP site. Therefore, the sensitivity of controlled waters is considered to be high.

Magnitude of impact

11.8.240 There may be the requirement for unplanned works to be undertaken (for example the replacement of infrastructure) which may require excavations. Should this be required, the pre-mitigation magnitude of impact on groundwater receptors is considered to be medium as there is the potential for impacts to affect the local area. With regards to surface water features, the pre-mitigation magnitude of impact is considered to be high due to the potential for long-term impacts to occur due to the mobilisation of pre-existing contamination as a result of the works.

11.8.241 The potential for long-term impacts on surface water features as a result of contamination is evident from the surface water samples collected during previous ground investigations. As discussed in section 11.7, surface water samples collected from Hermitage Stream were identified as containing concentrations of contaminants in excess of GAC. These exceedances have been attributed to historical 'dilute and disperse' landfills and therefore suggest that if pre-existing sources of contamination are mobilised, there is the potential for them to impact upon surface water receptors over a long-term basis.

11.8.242 The WRP site would consist of infrastructure from which new sources of contamination could impact upon groundwater and surface waters as a result of leakages or spillages of fuels, oils and other chemicals. Should a major accident occur within the WRP site, there is the potential for large scale, long-term impacts on groundwater and surface water quality. Therefore, the pre-mitigation magnitude of impact is considered to be high.

11.8.243 However, with the implementation of the tertiary mitigation measures described in section 11.4 and Table 11-43, including the undertaking of remediation works and development of an Emergency Response Plan as set out in the Operational Environmental Management Plan (Document reference 7.7, DCO Volume 7), the magnitude of impact is reduced to negligible.

Significance of effect

11.8.244 With the implementation of tertiary mitigation measures described in section 11.4 and Table 11-46, the significance of effect on controlled waters during the operation of the WRP site is considered to be minor adverse which is not significant.

11.8.245 Additional impacts relating to major accidents on groundwater and surface water receptors are provided in section 14.8 of ES Chapter 14 Major accidents and disasters, Volume I (Document reference 6.1, DCO Volume 6).

Impact 3: Potential impacts on the built environment

11.8.246 Materials such as concrete used in the infrastructure associated with the WRP site have the potential to undergo degradation, such as chemical attack, from aggressive ground conditions due to the presence of acids or sulphates. This has the potential to compromise the integrity of the structures located within the WRP site.

11.8.247 Buildings constructed on sources of ground gas (for example, historical landfill) could also be at risk from the accumulation of gases potentially resulting in explosion.

Sensitivity of receptor

11.8.248 Due to the presence of commercial infrastructure associated with the WRP site, the sensitivity of the built environment is considered medium.

Magnitude of impact

11.8.249 With regards to aggressive ground conditions, structures and water supply pipes located within the WRP site would be designed to mitigate the site-specific ground conditions as part of the primary mitigation measures outlined in section 11.4. As such, the magnitude of impact is considered to be negligible.

11.8.250 Interpretation of ground gas monitoring data has identified a CS3 classification for the WRP site (see section 11.4 and ES Appendix 11.2 Geotechnical and geo-environmental reports Volume II) (Document reference 6.2, DCO Volume 6, Version 1 – for documents 15 to 18 of 18 documents)). Appropriate ground gas protection measures would be incorporated into the design of structures located within the WRP site as part of the primary mitigation measures outlined in section 11.4. Therefore, with these measures in place, the magnitude of impact in relation to ground gas risks is considered to be negligible.

Significance of effect

11.8.251 The potential significance of effect to the built environment during the operation of the WRP site is considered to be minor adverse, which is not significant.

Decommissioning

11.8.252 Effects from decommissioning of the Proposed Development are considered to be no greater than those identified during the construction phase (see paragraphs 11.8.2 to 11.8.224), with the exception of the potential impacts associated with the buried pipeline infrastructure which would be left in situ following the end of the life cycle. Once all pipelines associated with the Proposed Development have been drained, it is anticipated that they would be capped and potentially filled with grout under major assets, such as roads and railways, depending on industry good practices at the time.

Impact 1: Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts

11.8.253 It is anticipated that large scale excavation works associated with the pipelines would not be required during the decommissioning works for the Proposed Development. Should excavation works be required to facilitate decommissioning, there is the potential for these activities to disturb and expose decommissioning workers, landowners, land users and neighbouring land users to contamination. Decommissioning activities could create pollutant linkages through ingestion, inhalation and direct dermal contact pathways. However, should excavation works be required, they are anticipated to be in localised areas and not along the entire length of the pipelines.

11.8.254 In the event of exposing soils and storge of decommissioning waste (including excavated soils), dust could be generated during dry and windy conditions. Under these conditions, decommissioning workers, landowners, land users and neighbouring land users could be temporarily exposed to contamination via the inhalation of potentially contaminated dusts.

11.8.255 Once the pipelines associated with the Proposed Development have been drained, there is the potential for ground gases and/or vapours to migrate and accumulate along the length of the pipelines.

11.8.256 Should there be the requirement for decommissioning workers to enter the tunnels that house the pipelines (and any associated tunnel shafts), there is the potential for them to be exposed to ground gas and/or vapours. The potential risks from ground gas and vapours could represent a risk to human health through asphyxiation and explosion.

Sensitivity of receptor

11.8.257 Decommissioning workers are considered to be the most sensitive receptors as the activities they would be engaged in constitute more direct exposure routes.

11.8.258 The sensitivity of decommissioning workers, landowners, land users and neighbouring land users is considered high.

Magnitude of impact

11.8.259 Should any excavation works be required, the impacts are predicted to be of local spatial extent (localised to areas where contamination may be present and to areas where excavation works are required), of short-term duration and high reversibility (occurring only during decommissioning works). The magnitude of impact is therefore considered to be low.

11.8.260 In relation to risks associated with the migration of ground gases and vapours along the route of the pipelines, the impacts could be present for the duration of the works and represent both acute and chronic health risks. The magnitude of impact is therefore conservatively considered to be high in relation to ground gas and vapours on the basis that historical landfills located within the land quality and ground conditions study area would be nearing the end of their lifecycles, so ground gas production would be vastly reduced.

11.8.261 Decommissioning activities are expected to follow good industry practice in place at the time, which are anticipated to be similar in nature to measures contained in the Outline CEMP (Document reference 7.1, DCO Volume 7). Based on this assumption, mitigation measures protective of human health would be in place during the decommissioning works and therefore would reduce the magnitude of impacts to negligible.

Significance of effect

11.8.262 With the assumed implementation of tertiary mitigation measures, the significance of effect on human health receptors during the decommissioning of the Proposed Development is considered to be minor adverse which is not significant.

Impact 2: Impact on controlled waters (groundwater and surface waters)

11.8.263 There is the potential for activities related to the decommissioning of the pipelines associated with the Proposed Development to introduce new sources of contamination through leakage or spillage of fuels, oils or other chemicals from machinery and vehicles. There is also the potential for the pipelines to act as a conduit for the migration of contaminated perched water and/or groundwater. This could affect the groundwater quality within the aquifers underlying the pipelines associated with the Proposed Development as well as surface water receptors.

Sensitivity of receptor

11.8.264 Any migration and discharge of new sources of contamination into controlled waters through direct or indirect pathways (e.g. surface run-off, discharge of groundwater into surface water bodies) could lead to a reduction in groundwater or surface water quality and impact on the ecological habitats that they support. Due to the presence of environmentally designated sites which interact with surface water features along the route of the pipelines, the sensitivity of controlled waters is considered to be high.

Magnitude of impact

11.8.265 Should any excavation works be required as part of the decommissioning works for the pipelines, the magnitude of impact on groundwater receptors is considered to be medium in the absence of appropriate mitigation measures as there is the potential for impacts to affect the local area. With regards to surface water features, the magnitude of impact is considered to be high due to the potential for long-term impacts to occur due to the mobilisation of pre-existing contamination as a result of the works. However, decommissioning activities are expected to follow good industry practice in place at the time, which are anticipated to be similar in nature to measures contained in the Outline CEMP (Document reference 7.1, DCO Volume 7). Based on this assumption, mitigation measures protective of controlled waters would be in place during the decommissioning works and therefore would reduce the magnitude of impacts to negligible

11.8.266 In relation to migration of contaminated perched water and/or groundwater along the route of the pipelines, the potential impacts would be mitigated via the grouting and/or capping of the decommissioned pipelines. This would serve to break potential pathways and thereby reduce the magnitude of impact to negligible.

11.8.267 Should a major accident occur in relation to leakage or spillage of fuels, oils or other chemicals during decommissioning works, the pre-mitigation magnitude of impact is considered to be high due to the potential for large scale, long-term impacts on groundwater and surface water quality. However, mitigation measures are protective of controlled waters, which are anticipated to be similar in nature to those included within the Outline CEMP (Document reference 7.1, DCO Volume 7). This would thereby reduce the magnitude of impact to negligible.

Significance of effect

11.8.268 With the assumed implementation of tertiary mitigation measures, the significance of effect on controlled waters during the decommissioning of the Proposed Development is considered to be minor adverse which is not significant.

Impact 3: Potential impacts on the built environment

11.8.269 Should, following decommissioning, the pipelines associated with the Proposed Development be left open (i.e. the pipelines have not been capped following the cessation of the Proposed Development) there would be the potential for them to act as a migration pathway for ground gas and vapours. There would be the potential for the ground gas and vapours to accumulate in confined spaces and result in explosions. However, this is a conservative view as the historical landfills located within the land quality and ground conditions study area would be at the end of their lifecycles and therefore ground gas production would have vastly reduced.

Sensitivity of receptor

11.8.270 Due to the presence of commercial and residential properties located both within the Order Limits and 250m buffer, the sensitivity of the built environment is considered to be medium.

Magnitude of impact

11.8.271 The potential impacts associated with the migration of ground gases and vapours along the route of the pipelines would be mitigated via the expected grouting and/or capping of the decommissioned pipelines. This would serve to break the source-pathway-receptor linkage. As previously discussed, by this point in time ground gas production associated with historical landfills would have vastly reduced. Therefore, the magnitude of impact is considered to be negligible.

Significance of effect

11.8.272 The potential significance of effect to the built environment during the decommissioning of the Proposed Development is considered to be minor adverse which is not significant.

11.9 Additional mitigation, monitoring and enhancement

11.9.1 Mitigation measures are defined in ES Chapter 5 EIA approach and methodology, Volume I, (Document reference 6.1, DCO Volume 6) with primary mitigation and

tertiary mitigation for land quality and ground conditions being presented in section 11.4 of this chapter.

Secondary mitigation

11.9.2 With regard to land quality and ground conditions, no secondary mitigation measures are proposed.

Monitoring

11.9.3 The requirement for groundwater and surface water monitoring is contained within the Outline CEMP (Document reference 7.1, DCO Volume 7) which is submitted as part of the DCO application. There may also be the requirement for ground gas monitoring to continue during the construction phase, in line with relevant health and safety legislation requirements for the protection of construction workers, this would be determined post consent and once the final design for the Proposed Development has been confirmed.

Enhancement

11.9.4 Opportunities to incorporate environmental enhancements for land quality and ground conditions have been identified through the design development process to date, including the remediation of areas located within the Order Limits where unacceptable risks to land quality and ground-conditions receptors have been identified.

11.10 Summary of residual effects

11.10.1 Table 11-47 provides a summary of the residual effects relating to the construction, operation and decommissioning of the Proposed Development with regard to land quality and ground conditions receptors.

Table 11-47 Summary of residual effects

Impact	Receptor	Residual effects		
		Construction	Operation	Decommissioning
Exposure of workforce, landowners, land users and neighbouring land users to contaminated soils and groundwater and associated health impacts	Human health – construction and maintenance workers, landowners, land users and neighbouring land users.	Minor adverse (not significant)	Minor adverse (not significant)	Minor adverse (not significant)
Direct and indirect impacts on groundwater quality and	Principal and Secondary Aquifers, SPZs	Minor adverse (not significant)	Minor adverse (not significant)	Minor adverse (not significant)

Impact	Receptor	Residual effects		
		Construction	Operation	Decommissioning
groundwater resources	and groundwater abstractions.			
Impacts on surface water quality and the ecological habitats they support from contamination	Surface water and ecological habitats e.g. River Itchen SSSI	Minor adverse (not significant)	Minor adverse (not significant)	Minor adverse (not significant)
Potential impacts on the built environment	Commercial and residential properties, transport infrastructure, public open space and recreational routes/facilities.	Negligible adverse to minor adverse (not significant)	Minor adverse (not significant)	Minor adverse (not significant)
Impacts on agricultural land	Agricultural land	Minor adverse (not significant)	Scoped out	
*Note that operational and decommissioning impacts on groundwater and surface water are under the heading of impact on controlled waters (groundwater and surface waters) in section 11.8.				

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